Quick REFERENCE

GENERAL KNOWLEDGE

Edgar Thorpe
Showick Thorpe

ALWAYS LEARNING

PEARSON

Copyright © 2014 Dorling Kindersley (India) Pvt. Ltd.
Licensees of Pearson Education in South Asia

No part of this eBook may be used or reproduced in any manner whatsoever without the publisher's prior written consent

This eBook may or may not include all assets that were part of the print version. The publisher reserves the right to remove any material in this eBook at any time.

ISBN 978-93-325-3031-7
eISBN 978-93-325-3839-9

Head Office: A-8(A), Sector 62, Knowledge Boulevard, 7th Floor, NOIDA 201 309, India
Registered Office:11 Local Shopping Centre, Panchsheel Park, New Delhi 110 017, India

CONTENTS

Preface *v*

PART A

Chapter 1: Indian History 1
Chapter 2: Constitution of India and Indian Polity 32
Chapter 3: Indian Geography 54
Chapter 4: Indian Economy 80
Chapter 5: Indian Miscellanea 118

PART B

Chapter 6: Physical and World Geography 153
Chapter 7: International Organizations 184

PART C

Chapter 8: Everyday Science 199
Chapter 9: Physics 211
Chapter 10: Chemistry 234
Chapter 11: Life Science 256
Chapter 12: Computers and Information Technology 287

PART D

Chapter 13: Books and Authors 307
Chapter 14: Awards and Honours 319
Chapter 15: Sports and Games 323
Chapter 16: Miscellaneous Topics 333

PREFACE

Quick Reference General Knowledge is a good revisionary tool that students will find handy for brushing up various important aspects of general knowledge prevalent in most of competitive examinations. This product owes its existence to the need where students need dense, focused and well-structured material which is quick and comprehensively covers their preparation during the last days before the test.

Mostly students will find that facts provided in the book allows them to answer a potential question they might encounter in the actual test. It not only gives a focused route to score high marks in a GK test but also very effective start-up material at the start of preparation journey for an examination.

I have tried to bring up as many examinations where GK is a vital component as I believe, someone with little time to prepare for general knowledge can use it and score higher. To add to its crisp structure for quick results, it is important to keep in mind that the material for various sections of this book has been modelled based on the type of questions generally asked in the examinations. The book equips candidates with basic general awareness required for their success in these examinations.

As I always say, any work of this nature could not have been attempted without reference to the works of others. In the preparation of this book, I have had to constantly consult numerous encyclopedias, dictionaries, yearbooks, atlases and textbooks on a variety of subjects. I hereby acknowledge my indebtedness to all of them.

I would also like to express my heartfelt thanks to my late father Edgar Thorpe and my late mother Asha Thorpe without whose wholehearted support and inspiration, this book would have never seen the light of the day. I am thankful to Pearson for allowing me to keep my father's name on the cover of this book. Besides I am especially grateful to my brothers, Sunil Thorpe and Sanjay Thorpe, who have supported me in carrying forward our father's work. Last but not the least, my wife Vandana has been the most encouraging and helpful in this exercise.

As the world changes at a very rapid pace, so do facts and figures. It would be an endeavour to constantly revise each edition of this book in order to keep it as up-to-date as possible. I hope students will appreciate the book and any comments/suggestions for the development of the text would be most welcome.

Showick Thorpe

PART A

Chapter

1 INDIAN HISTORY

MAJOR PERIODS OF INDIAN HISTORY

- Indian archaeology has divided Indian history into the following major periods:
  Lower palaeolithic: 2 million years before present
  Middle palaeolithic: 80,000 years approx.
  Upper palaeolithic: 35,000 years approx.
  Mesolothic: 12,000 years approx.
  Neolithic, early agriculturists and pastoralists: 10,000 years approx.
  Chalcolithic, first use of copper: 6000 years approx.
  Harappan civilization: 2600 BC
  Megalithic burials, early iron: 1000 BC
  Early historic: 600 BC to 400 CE
- There are wide variations in development in different parts of the subcontinent.

ANCIENT INDIA

Indus Valley Civilization (2600–1900 BC)

- One of the first great civilizations, with a writing system, urban centres and a diversified social and economic system, appeared approximately 2600 BC along the Indus River Valley in Punjab and Sindh.
- The important sites connected with the Indus Valley civilization are Lothal near Ahmedabad (Gujarat); Kalibangan (Rajasthan); Banwali (in district Hissar, in Haryana); Ropar (Chandigarh, in Punjab); Mohenjodaro in Larkana district of Sind (now in Pakistan) and Harappa in Montgomery district of Punjab (now in Pakistan).
- It covered more than 12,99,600 km^2 from the borders of Baluchistan to the deserts of Rajasthan, from the Himalayan foothills to the southern tip of Gujarat.
- Different historians have proposed inclusive dates for the Indus Valley Civilization (IVC) as Marshal (3250 to 2750 BC); Mackay (2800 to 2500 BC); DP Aggarwal (2300 to 1750 BC, used C-14 determination); Wheeler (2500–1700 BC); Dales (2900–1900 BC) and MS Vats (3500 to 200 BC). (Publication division documents and NCERT estimates it to be 2600 to 1900 BC.)
- Meluha was the ancient name given to the Indus region by the Mesopotamians.
- The dating system in various history books and documents is BC (Before Present or Before Christ); BCE (Before Common Era); CE (Common Era; for example, 2014 CE is the year 2014 in present) and *c*. (*circa* meaning approximate).

- The region prior to the mature Harappan period had many archaeological cultures with distinctive pottery, evidence of agriculture, some crafts and pastoralism; most being small settlements with no large city.
- Harappans ate a wide range of plant and animal products including fish.
- Grains found at Harappan sites include wheat, barley, lentil, chickpea and sesame. Millet was majorly found at Gujarat sites whereas rice is found rarely.
- Harappans had domesticated animals like cattle, sheep, goat, buffalo and pig. Bones of wild animals included boar, deer and *gharial*.
- Most Harappan inscriptions were recorded on seals.
- Harappans were the earliest people to produce cotton.
- Harappan seals were most probably used in connection with trade. Mesopotamian cylindrical seals and cuneiform inscriptions have been found in Mohenjo-Daro.
- Most Harappan sites are located in semi-arid lands where irrigation was probably required for agriculture.
- Traces of canals are found at the Shortughai, a Harappan site in Afghanistan but none in Sind or Punjab.
- Archaeological excavations at Indus valley sites show that houses had wells in Kalibangan.
- Water reservoirs found in Dholavira (Gujarat) may have been used to store water for agriculture.
- Stone implements were largely used by the Indus people but it is not known if they used stone blades set in wooden handles or metal tools.
- The civilization seemed to have flourished at the maximum 1800 BC. Afterwards each urban phase marked by systematic town planning, extensive brick work, art of writing, use of bronze tools and red ware pottery painted with black designs practically disappeared.

Harappan Archaeology Timelines

Report of Alexander Cunninghan on Harappan Sear—1875
M. S. Vats starts excavations at Harappa—1921
Mohenjodaro excavations begins—1925
R. E. M. Wheeler excavates at Harappa—1946
S. R. Rao begins excavations at Lothal—1955
B. B. Lal and B. K. Thapar start excavations at Kalibangan—1960
M. R. Mughal starts explorations at Bahawalpur—1974
Surface exploration at Mohenjodaro (German and Italian team)—1980
Excavations by the US team at Harappan—1986
Dholavira excavations by R. S. Bisht—1990

Vedic Period: The Aryans

Early Vedic Period (1500–1000 BC)

- 'Aryan', the word, is borrowed from the Sanskrit word 'Arya', meaning 'a good family'.

- The Aryans were semi-nomadic, partly pastoral and partly agricultural people, from the region around the Caspian Sea in Central Asia and came to India in around 1500 BC in search of pastures through the passes in the Hindu Kush Mountains.
- On their way to India, Aryans first appeared in Iran.
- They first settled in Punjab and later moved eastwards and spread all over the Gangetic plains.
- They are said to have been the originators of the Hindu civilization.
- Being lovers of nature, Aryans worshipped the sun, the water, the fire, etc.
- Different historians have proposed different regions of their origin: B. G. Tilak (Arctic region); Strzygovski (Greenland); T. J. Engelbrecht (Swedish Coastal region); Penka (Scavandia); G. Kossina and H. Hirt (Central Germany); P. Giles (Danube valley); J. De Morgan (Siberia); Adolf Pictet (Central Asia); Ganganath Jha, D. T. S. Trivedi, L. D. Kala and A. C. Das (India); H. Peake, Gordon Childe and B. K. Ghosh (South Russia).
- In the excavations at Boghazkoi in Asia Minor, which dates back to 1400 BC, inscriptions are found containing the names of deities like Indira, Varuna and Nasatya.
- There were six religious books of the Aryans which reveal their beliefs, customs and culture.
  1. *The Vedas*: There were four vedas, namely, (i) Rig Veda (1017 hymns in the form of prayers to gods); (ii) Sama Veda (music); (iii) Yajur Veda (sacrifices, rituals and formulae) and (iv) Atharva Veda (medicine)
  2. *The Upanishads*: Source of Indian philosophy and theology
  3. *The Brahamanas*: On the socio-political life of the Aryans
  4. *The Aranyakas*: Forest books, treatises on mysticism and philosophy
  5. *Manu Smriti*: Laws of inheritance, duties of the kings and his subjects
  6. *The Puranas*: Religious and historical details of discourses on legends, rituals, traditions and moral codes
- Concepts of Vedic Philosophy: (a) *Atma* (soul); (b) *Karma* (deeds); (c) *Pap and punya* (sins and merits) and (d) *Punarjanma* (rebirth)

Later Vedic Period (1000–600 BC)

- More developed than the early Vedic period, the tiny tribal settlements were replaced by strong kingdoms.
- There was a growth of big cities like Ayodhya, Indraprastha and Mathura.
- This was also called the Brahmanical age and came very close to the modern form of Hinduism.
- The society was divided into four castes: *Varnashrama* (occupational, that which later became hereditary)—(i) Brahmins (priestly class); (ii) Kshatriyas (military class); (iii) Vaishyas (business or trading class) and (iv) Shudras (labour class)
- The Dravadians did no initiate and practice a social theory like the Aryan theory of varnasharma. Social system of Dravidians (matriarchal) was in contradiction to that of Aryans (patriarchas).
- *The Epic Age*: It was in the epic age that the Aryan tribes established themselves in the whole of northern India. The Mahabharata and the Ramayana are the two great epics of this period.
- *The Rise of Brahmanism*: During the later Vedic period, the observance of religion was made very complicated with the addition of several rituals. Consequently, only Brahmins could perform religious ceremonies.

- *The Revolt Against Brahmanism*: As Brahmins monopolized religion, the other castes revolted against the Brahmanical exploitation.

Emergence of Kingdoms or Mahajanapadas

- From the sixth century BC, the widespread use of iron in eastern Uttar Pradesh and Western Bihar facilitated the formation of large territorial states.
- Buddhist texts list the following 16 Mahajanapadas or major-janapadas as having been in existence in the sixth century BC.

16 Mahajanapadas (C) → Capital

1. *Magadha Kingdom (South Bihar)* (C) Pataliputra
2. *Anga and Vanga Kingdoms (East Bihar)* (C) Champa
3. *Malla Kingdom (Gorakhpur region)* (C) Kushinagar
4. *Chedi Kingdom (Yamuna and Narmada belt)* (C) Tisvathirati
5. *Vatsa Kingdom (Allahabad)* (C) Kausambi
6. *Kashi Kingdom (Banaras)* (C) Varanasi
7. *Kosala Kingdom (Ayodhya)*—important town in Kosala
8. *Vajji Kingdom (North Bihar)* (C) Vajji; (R)
9. *Kuru (Thaneswar, Meerut and present day Delhi)* (C) Indraprastha; (R)
10. *Panchala Kingdom (Uttar Pradesh)* (C) Kampila; (R)
11. *Matsya Kingdom (Jaipur)* (C) Viratanagar; (R)
12. *Surasena Kingdom (Mathura)* (C) Mathura; (R)
13. *Assaka Kingdom (Godavari)* (C) Potali; (R)
14. *Gandharva Kingdom (Peshawar and Rawalpindi)* (C) Taxila; (R)
15. *Kamboj Kingdom (North-east Kashmir)* (C) Rajapure; (R)
16. *Awanti Kingdom (Malwa)* (C) Ujjain-north, Mahismati-south; (R)

- The Vedic philosophy lost its original purity as the Vedic religion became complex and degenerated into superstitions and futile rituals causing wastage of time and resources.

Growth of Buddhism and Jainism (Sixth Century BC)

Buddhism

- Founded by Gautama Siddhartha (Kshatriya prince of the Saka clan), who left his family at the age of 29 in search of truth and wandered for about 6 years.
- Gautama was born in 563 BC (or 576 BC as is believed by some historians) at Lumbini (near Kapilvastu, capital of Saka republic) in Nepal.
- Gautama attained enlightenment under a pipal tree at Bodh Gaya, delivered his first sermon at Sarnath, spread his message for about 45 years and attained *mahaparinirvana* at Kusinara (Kushinagar) in 483 BC (at age of 80).
- Five great events of Buddha's life—*Lotus and Bull* (Birth); Horse (the great renunciation); *Bodhi tree or Pipal tree* (Nirvana); *Dharmavhakra or wheel* (first sermon) and *Stupa* (Parinirvana or death).
- Buddhism received state patronage of kings such as Ashoka the Great and it spread to neighbouring countries.

- *Doctrine of Buddhism*
  1. The four great truths: (a) The world is full of sorrow and misery, (b) the cause of all pain and misery is desire, (c) pain and misery can be ended by killing or controlling desire and (d) desire can be controlled by following the eight-fold path.
  2. Belief in *Nirvana*: When desire ceases, rebirth ceases and *Nirvana* is attained, that is, freedom from the cycle of birth, death and rebirth is gained by following the eight-fold path.
  3. The eight-fold path consists of right faith, right thought, right action, right livelihood, right effort, right speech, right remembrance and right concentration.
  4. Belief in *ahimsa*.
  5. Law of *karma*.
  6. Existence of God.
- *Buddhist Scriptures*: The Vinaya Pitaka, The Sutta Pitaka, The Abhidhamma Pitaka, The Khandhakas, The Udana, Milansapanha, Dipavamsa, Mahavamsa, Digha Nikaya, Majjihima Mikaya and Samutta Mikaya.
- Three types of Buddhist architecture are—(i) Stupa (for preserving the relics of prominent monks); (ii) Chaitya (prayer halls) and (iii) Vihara (residence places).
- *Famous Bhikhus During Buddha Era*: Sariputta (possessed the profoundest insight into the dhamma); *Moggalana* (has the greatest super natural powers); Ananda (the devoted disciple and constant companion of Buddha); Mahakassapa (the President of the Buddhist Council at Rajagriha); *Anuruddha* (master of right mindfulness); *Uppali* (master of vinaya) and *Rahul* (the Buddha's son).
- *Buddhist Councils*
  1. First at *Sattapanni* cave near *Rajagrihain* 483 BC (compiled Dhamma Pitaka and Vinaya Pitaka)
  2. Second at *Vaisali* (383 BC) (split of the Buddhist into *Sthaviravadins* and *Mahasangikas*).
  3. Third at *Patliputra in* 326 BC (to revise the scriptures under Presidentship of Moggliputta Tissa)
  4. Fourth *at Tambapanni in* 29 BC (realization that majority of monks can no longer retain entire *Tripaka* in their memories)
  5. Fifth *at Kaniska in Kashmir in* 72 AD (resulted in division of Buddhists into *Mahayanists* and *Hinayanists*)
- There were two 4th Buddhist Councils held by two different sects.
- *Sacred Buddhist Shrines*: Eight *Ashtamahasthanas* (Lumbini, Bodhgaya, Sarnath, Kushinagar, Sarasvati, Pajgriha, Vaishali and Sankasya) and other main centres [in Andhra Pradesh (*Amravati*, *Nagarjuna-konda*); in Gujarat (*Junagarh* and *Valabhi*); in Madhya Pradesh (*Sanchi* and *Bharhut*); in Maharashtra (*Ajanta-Ellora*); in Orissa (*Dhaularigi*); in Uttar Pradesh (*Kannauj*, *Kausambi* and *Mathura*) and in West Bengal (*Somapuri* and *Jagadala*)].

Jainism

- Jainism became the major religion under Vardhamana Mahavira who was the 24th Tirthankara or prophet of Jainism.
- Vardhamana Mahavira was a great Kshatriya belonging to the royal family of Magadha.
- A non-Brahmanical religion like Buddhism founded by Rishabha, father of King Bharata the first Chakravartan of India.

- He was born in 540 BC at Kundagrama (Vaishali) in Bihar. At the age of 42, he attained perfect knowledge—Kaivalya.
- He died at the age of 72 in 468 BC.
- *Doctrine of Jainism*
  1. Attainment of *Nirvana* (release from rebirth) through *TriRatna* (three jewels) consisting of (i) right faith (ii) right knowledge and (iii) right conduct.
  2. Belief in *ahimsa* in word, thought or deed towards all living beings.
  3. Belief in *karma* through denying the existence of God and dismissal of rituals.
- *The two sects within Jainism are*: The *Swethambaras*, followers of the 23rd Tirthankara *Parasvanatha*, are flexible in their approach and clad themselves in white garments. The *Digambaras*, followers of the 24th Tirthankara *Mahavira*, are believers of rigid penance, which can be attained by punishment to self and body; stress on nudity and not allowed to use cloth to cover the body.
- Jain Councils the first at *Patliputra* third century BC; [lost 14 Purvas (former texts) were replaced by 12 new sections (Angas) but this was acceptable by Swethambaras only while virtually rejected by Digambaras]. Second at *Valabhi* in the fifth century AD (12 new Angas and Upangas were finally compiled.)
- *Jain Sacred Literature*: Written in the form of Patrika called *Arsha or Ardha Magadhi, classified into:* 12 *Angas,* 12 *Upangas,* 10 *Prakirnas,* 6 *Chhedasutras and* 4 *Mulsutras.* These are not confined to religious matters but also include poetics, *Arthashastra and Kamasastra, etc.*
- Both Buddhism and Jainism declined with the rise of the Rajputs as a military force. Muslim invasions in the eleventh and twelfth centuries also led to further disintegration.
- Most important teachers of the time besides Buddha and Mahavira were: Nigantha Nataputta, Pakudha Kacchayana, Purana Kassapa, Sanjaya Belatthaputta Makkhali Gosala, Ajita Kesakambali, etc.
- Among the important sects existing during that era were: Ajivika, Tedandikas, Jatilaka, Munda savaka, Parivrajakas, Mangandikas, Gotamakas, etc.

Magadh Empire (Sixth Century—Fourth Century BC)

- By end of the sixth century BC, India's north-west was integrated into the *Persian Achaemenid Empire* and became one of its satrapies.
- This favourable geographical location enabled it to control the whole Gangetic plain.
- From a small kingdom with capital *Patliputra*, it became a major power in north India, embracing districts of Patna and Gaya in Bihar.
- Favourable geographical location, rich alluvial soil, close vicinity and control over copper and iron ore deposits helped *Bimbisara*, its first ruler, to acquire great wealth and strength, who later built a new capital *Rajagriha* (near Patna).
- *Notable Rulers of Magadha*: Bimbisara (545–493 BC); Ajatshatru (492–460 BC); Udayan (460–444 BC); Haryanka Kings (462–430/413 BC); Shishunaga Dynasty (430/413–364 BC) and The Nanda (364/345–324 BC).
- The first phase of expansion and consolidation of the Magdh empire was over by the reign of Mahapadma Nanda.
- Bhadrasala Nanda, the last Nanda ruler was defeated by Chandragupta Maurya.

Alexander's Invasion (Greek Invasion 326 BC)

- Alexander, the son of Phillip of Macedonia (Greece), invaded India in 326 BC.
- Ambhi, the king of Taxila, surrendered and offered no resistance.
- His major battle, *Ballet of Hydaspes*, was on the banks of river Jhelum with Porus, the king of Punjab. Impressed with *Porus's* courage Alexandra made him his ally and restored his kingdom.
- Alexander marched forward uphill Beas where his generals advised him to turn back fearing mutiny in the troops.
- Alexander remained in India for 19 months (326–325 BC) and died in 323 BC in Babylon.
- It was the result of Alexander's invasion that the link between India and the West was initiated.

Mauryan Empire (321–289 BC)

- Founded by Chandragupta Maurya (321–297 BC) when he overthrew the Nandas.
- It is known from the Mahavamsatika that after completing his education, Chandragupta (son of Mura, a non-royal woman and had become wife of a Nanda king), together with Chanakya, began to build up an army to overthrow the Nandas. He had failed in his first attempt but later succeeded.
- His son *Bindusara* (298–273 BC) succeeded him and annexed the south up to Mysore.
- *Kautilya* (*Chanakya*) a minister of Chandragupta, wrote the *Arthashastra*, a treatise on statecraft.
- Megasthenes was a Greek Ambassador to Chandragupta's court who wrote the *Indica* detailing the Mauryan dynasty.
- *Important Rulers*: Chandragupta (24 years; 321 BC to 297 BC); Bindusara (25 years; 298 BC to 273 BC); Ashoka (36 years; 273 BC to 231 BC); Dasaratha (8 years); Samprati (9 years); Salisuka (13 years); Devadharman (7 years); Satadhanvan (8 years) and Brihadrath (7 years).

Ashoka The Great (273–231 BC)

- Ashoka was the grandson of Chandragupta and son of Bindusara and is regarded as one of the greatest kings of all times.
- He was the first ruler to maintain direct contact with the people and he ruled for over 40 years.
- He acceded to the throne in 273 BC but the formal consecration took place 4 years later in 268 BC. Therefore, there is a controversy regarding the first four years of his rule.
- During his first 13 years, he carried on the traditional policy of expansion within India and friendly relations with foreign powers. In the 13th year of his reign, he conquered Kalinga.
- *The Kalinga War*: In 265 BC Ashoka invaded Kalinga (Orissa) and occupied it after widespread destruction and bloodshed. This lead to the conversion of Ashoka and he became a Buddhist.
- Ashoka had *three brothers*—Sumana, Tisya and Vitasoka; *five wives* (Devi Vedisa; Karuvaki; Asandhimitra; Padmavati and Tisyaraksita; *four sons*—Mahendra, Tivara, Kunala, Jalauka; *two daughters*—Sanghamitra (married to Agnibrahma) and Charumati (married to Devapala Kshtriya); *three grandsons* (Dashratha, Samprati and Sumana (son of Sanghamitra)).
- His occupation with Buddhism weakened his administration and led to the decline of the Mauryan empire.

- Chronological order of Ashoka's edicts/inscriptions arranged in eight groups in:
  1. Two minor rock edicts (258 to 257 BC)
  2. Babru edicts (257 BC)
  3. Fourteen rock edicts (257 to 256 BC)
  4. Kalinga inscriptions (256 BC)
  5. Barabar rock edicts in caves near Gaya (250 BC)
  6. Tarai's two minor pillar edicts (249 BC)
  7. Seven pillar edicts (243 BC)
  8. Four minor pillar edicts (232 BC)
- *Literary Sources*
  1. *Arthasastra* (Kautilya)
  2. *Indica* (Megasthense)
  3. *Chadragupta Katha* (Chanya)
  4. *Mudra Rakshasha* (Visakhadatta)
  5. *Puranaa*
  6. *Vamsathapakasini, Digha Nikaya and Jatakas* (Buddhist literature)
  7. *Dipavamsa* and *Mahavamsa* (Ceylonese chronicles)
  8. *Divyavadana* (Tibetan sources)
  9. *Parisistaparvan* (Jaina works)
- *Archaeological Excavations*: B. B. Lal (*Hastinapur*); Hohn Marshall (*Taxila*); G. R. Sharma (*Ghositearam Monastery*) and A. S. Altekar (*Kumrahar Pillered Hall*). Other excavations were also carried out at *Rajagriha* and *Pataliputra*.

Pre-Gupta Period

- *Sungas Dynasty*: Pushyamitra Sunga assassinated Brihadrata, the last Mauryan ruler and founded the Sunga dynasty. The stupa constructed by Ashoka at Sanchi was enlarged to nearby twice its size during the Sunga period.
- *Kanvas Suserman*: Vasudeva, a minister to the last Sunga ruler assassinated his king and founded kanvas Suserman
- *Satavahanas Dynasty*: Pulamayi III killed the last Kanvas ruler and founded Satavahanas dynasty. During the Satavahana period, the stupa were also constructed in southern India. The most important of these were at Amravati, Bhattiprolu, Gantasala and Nagarjunkonda.
- By 220 AD, Satavahanas diluted its power to local governors who were supported by Saka rulers of western regions. Feudal practices began during this period in India.
- Hellenistoc art features in north-western India during this period.
- Indo-Greeks were the first foreign rulers of north-western India in the post-Mauryan period. Menander was the most famous of all the Indo-Greek rulers.
- Gold coins were issued for the first time in India during this period.
- Saka rulers, main rulers in western India came into prominence under kings Moga (first Saka king) and Rudradaman I. Mahapana, Ushavadatta, Ghamatika and Ghastana were other important Saka rulers.
- Parthians, who had roots in Iran, defeated the Sakas. Gondophernes was their important ruler.
- Kushans defeated Parthians and Kanishka was their most prominent ruler. Kushans belonged to one of the five Yenchi clans of Central Asia.
- Kanishka started the Saka era in 78 AD.
- Vasudeva I, the last Kushan ruler, was defeated by Nagas rulers.

Gupta Dynasty (AD 320–550)

- The Gupta dynasty is called the Golden Age or the Classical Age of ancient India.
- During this period foreign rule was completely reversed and peace and prosperity prevailed.
- The following were the important rulers of the Gupta Dynasty:
  Chandragupta I (320–335 AD)
  Samudragupta (335–380 AD)
  Chandragupta II (380–415 AD)
  Kumaragupta I (415–455 AD)
  Skandagupta (455–467 AD)
  Purugupta (467–469 AD)
  Buddha Gupta (477–500 approx.)
- The Gupta Dynasty is called the Golden Age of Sanskrit language and the Classical Age of ancient India because of the following:
  1. There was political unity, foreign rule was completely removed and peace and prosperity prevailed.
  2. The enlightened character of government, that is, taxes were light, punishment was mild, etc.
  3. The revival of Hinduism, while there was tolerance of all other religions.
  4. Use of Sanskrit developed and art and literature flourished during the period.
  5. Fa-hien, a Chinese pilgrim who visited India (AD 399–414) during Vikramaditya's reign and gave an excellent account of the Gupta Dynasty and prosperity of the country.

Table 1.1 Nine Gems in the Court of Chandragupta II

S. No.	*Name of Person*	*Contribution in the Field of*	*Works that Made them Famous*
1.	Kshapanaka	Astrology	*Jyothisyashastra*
2.	Dhanvantri	Medicine	*Ayurveda* (Book of Medicine)
3.	Kalidasa	Drama and poetry	*Shakuntala*, *Meghaduta*, etc.
4.	Amarasimha	Lexicography	*Amarakosha* (Glossary)
5.	Varahamihira	Astrology	*Brihadsamhita*
6.	Vararuchi	Grammar	*Vyakarana* (Sanskrit)
7.	Sanku	Architecture	*Shilpashastra*
8.	Vetalabhatta	Magic	*Mantrashastra*
9.	Harisen	Poet	—

- The reunification of North India under the Imperial Guptas in 320 AD and the reign of Harshavardhana of Kanauj comprised India's classical age.
- The Guptas established their base of imperial power in Magadha, where they controlled rich veins of iron from the Barabar Hills.
- The peak of Gupta power and cultural glory was attained during the reign of Chandragupta II (Table 1.1).
- Numismatic evidence attests to the final defeat of the Shakas by the Guptas after which the Gupta Empire had direct control over the ports of the Arabian Sea and the riches of Western trade.
- Kalidasa's Abhijnana Sakuntalam was a major literary work of this period.

- During the Gupta era, Hindu, Buddhist and Jain faiths received royal support.
- The Gupta era also marked the apogee of cave art and sculpture.
- Commerce and Buddhism stimulated Indian intercourse with China and south-east Asia at this time.
- The Gupta Empire was supported primarily by the land revenue 'share' (tax) provided by India's peasant villages from every harvest.
- For half a century after the collapse of the Gupta Empire, North India reverted to the political fragmentation before the Guptas.
- Yoga, one of the six schools of classical Hindu philosophy that emerged in this era, continues to be studied to this day.
- The political system of South India should not be thought of as a group of competing, centrally developed bureaucratic states, as was the case in the North.

Harshavardhana (AD 606–647)

- The Gupta empire disintegrated, the kingdom of Sthaneswar emerged as a set of power from the region of Kanauj (Thaneswar) under king Pushpabhuti.
- Harshavardhana was the last Hindu king of northern India. He came to power in 606 AD after restoring Kanauj, his brother-in-law's kingdom from Devagupta, king of Malwa.
- He established a strong empire conquering Bengal, Malwa, eastern Rajasthan and the entire Gangetic plain up to Assam.
- Hieun Tsang was a Chinese traveller who stayed in India during this period (between AD 635 and 643) and wrote a detailed account of India.
- Banabhatta, one of the court poets of Harshavardhana, wrote Harshacharita, a biography of the king.

Rajputs (AD 650–1200)

- After Harshavardhana, the Rajputs emerged as a powerful force in Western and Central India.
- Out of the political disarray prevalent in North India, the Rajputs chalked out the small kingdoms of Gujarat and Malwa.
- From the eighth to twelfth century they struggled to keep themselves independent.
- But as they grew bigger the infighting made them brittle, they fell prey to the rising domination of the Muslim invaders.
- Among them the Gujara of Pratihara, the Gahadwals of Kanauj, the Kalachuris of Chedi, the Chauhans of Ajmer, the Solankis of Gujarat and the Guhilotas of Mewar are important.
- Prithviraj Chauhan was a brave ruler who ruled over Delhi and Agra. Jai Chand Rathor was the last Rajput king who was defeated and killed by Muhammad Ghori. The kingdom of Delhi fell to Ghori.

OTHER IMPORTANT DYNASTIES

Gujara-Partiharas

- A branch of Partiharas founded by Brahmana Harichandra of Jodhpur State, Rajasthan, which belonged to Gujaratra or Gurjara.

- *Important Rulers*: Nagabhatta I, Vatsaraja (783 AD), Nagabhatta II, Ramabhadra, Bhoja (836–885 AD), Mahendrapala (885–995AD).

Rashtrakutas

- Dantidurga of the Rashtrakuta family, a Mahasamanta under Chalukya Vikramaditya II, had succeeded to capture greater portion of Deccan before 753 AD from Chalukya Vikramaditya II and his successor Kirtiverman II.
- Dhruva (779–793) was an important king in this linage who led successful campaigns in north India against Palas and Parthiharas.
- *Other Important Rulers Include*: Govinda III (793–814), Amoghavarsha (814–979) and Krishna II (878–914).

Palas

- Gopala, founder of Pala dynasty, reigned in the third quarter of eighth century comprising regions of Gauda, Vanga, Radha and Magadha.
- *Important Rulers Include*: Dharampapa (770–810), Devapala (810–850), Vigrahapala (850–854) and Narayanapala (854–908).
- The rule of Pala dynasty came to an end about the middle to the twelfth century.

Senas of Bengal

- Originally inhabitants of Dakshinapatha and came into prominence in 1095 AD when Vijayasena ascended the throne after wresting Ganda from the last Pala king Mandanpala.
- *Other Important Rulers*: Ballasena (1158–1187), Lakshmanasena (1187–1205) and Visvarupasena.
- Muhammad-bin-Bhakhtyal-Khalji defeated Lakshhmanasena and captured Nadia and later conquered north Bengal to establish Muslim rule in Radha and Ganda.
- By mid-thirteenth century, the Senas were overthrown by the Deva dynasty reigning in Samantata to the east of the Brahmaputra.

Andhras

- Also known as the Shathavahanas, they are considered to be among the earliest rulers of the Deccan. They gained independence after the death of Ashoka.
- *Simukha*: Founder of this dynasty has a mention in Jain texts. Shathakarni I (ruled 184–130 BC), Pulumayi II (AD 130–145) and last king Yagnashathakarni (AD 175–225) are its important rulers. 'Krishna' was among their earliest rulers who was a contemporary of Ashoka.

Chalukyas (Sixth century AD to Twelfth century AD)

- History of Chalukyas, the Karnataka rulers, can be classified into three eras:
  1. Early Western Era—known as Chalukya of Badami
  2. Later Western Era—the Chalukyas of Kalyani
  3. Eastern Chalukya Era—the Chalukyas of Vengi; Pulakesin I (AD 543–567); Pulakesin II (AD 610–642); Vinyaditya (AD 681–696); Vikramaditya II (AD 733–745) are its important rulers

Chola Dynasty

- Founded by Rajaraja I (AD 985–1014) who ruled over Madras and parts of Karnataka with Tanjore as his capital.
- The last ruler of the Chola dynasty was Rajendra III (AD 1246–79). He was a weak ruler and surrendered to Pandyas.

MEDIEVAL INDIA

- Muhammad Ghori's conquests became the nucleus of a new political entity in India—the Sultanate of Delhi—and the beginning of Muslim rule in India.
- Iban Batuta, Marco Polo and Athanasius Nikitin visited India during the Sultanate period.
- Of the five dynasties of Delhi Sultanate, the first three were of Turkish origin and the Lodhis were Afghans.

Delhi Sultanate (1206–1526)

This can be divided into five distinct periods, they are as follows:

1. The Ilbari or Slave Dynasty (1206–1290)

- Founded by Qutub-ud-din Aibak (1206–1210), was succeeded by Aram Shah (for an insignificant tenure, was defeated and deposed by Iltutmish).
- Later rulers in this dynasty included:
  1. Shamas-ud-din Iltutmish (1210–1236)
  2. Razia Sultan (1236–1239), the only Muslim lady ruler of India
  3. Nasir-ud-din Mahmud (1246–1266)
  4. Balban (1266–1287)
- The first sultan who introduced a purely Arabic coinage and adopted standard coins, the silver Tanka was Iltutmish.
- Balban asserted 'kingship knows no kinship'.
- Amir Khusro (1253–1325), known as 'parrot of India', was in the court of Balban.

2. Khilji Dynasty (1290–1320)

- Founded by Sultan Jalal-ud-din Khilji (1290–1296) who brought under his sway all the Rajput kingdoms.
- Alaud-din Khilji (1296–1316) was the nephew of Sultan Jalal-ud-din, whom he killed and succeeded in 1296.
- Alaud-din Khilji resumed several types of land grants such as Inams, Waqfs, etc.
- Khusro Khan in 1320 killed Qutub-ud-din Mubarak Shah, the successor of Ala-ud-din Khilji and ended the Khilji dynasty.

3. Tughlak Dynasty (1320–1414)

- Founded by Ghiasuddin Tughlak (1320–1325).
- Other important rulers of the Tughlak Dynasty were:
  1. Mohammed-bin Tughlaq (1325–1351) who introduced token coins of brass and copper.

2. Firoz Shah Tughlak (1351–88). *Ibn Batuta* was an African traveller who visited India in 1333. He was appointed as the Chief Qazi of Delhi by the Sultan. Timur, a Turk, invaded India in 1398 and ended the Tughlak Dynasty.

- Commercial horticulture was popularized by Firuz Shah Tuglaq.

4. Sayyid Dynasty (1414–1451)

- Timur's nominee Khizr Khan (1414–1421) captured Delhi and was proclaimed the new Sultan who ruled for about 7 years.
- The last Sayyid King Alam Shah (1443–1451) abdicated in favour of Bahlol Lodhi.

5. Lodhi Dynasty (1451–1526)

- Founded by Bahlol Lodhi (1451–1488), one of the Afghan Sardars who established himself in Punjab after the invasion of Timur.
- Sikander Lodhi (1489–1517) and Ibrahim Lodhi (1517–1526) were the famous rulers of the Lodhi Dynasty.

First Battle of Panipat (1526)

- The first battle of Panipat was fought in 1526 between Ibrahim Lodhi—the ruler of Delhi—and Babur—the ruler of Kabul.
- Babur invaded India and established the Mughal dynasty.

Decline of Delhi Sultanate

- The main causes of the downfall of the Delhi sultanate were as follows:
  1. Despotic and military type of governments that did not have the confidence of the people.
  2. Degeneration of the Delhi Sultans.
  3. The sultanate became too vast and could not be controlled effectively.
  4. Financial instability.
  5. The number of slaves increased to 1,80,000 in Firoz Shah's time, which was a burden on the treasury.

Mughal Dynasty (1526–1540 and 1555–1857)

- *Babur* (1526–1530) is said to have founded the Mughal empire. He defeated Ibrahim Lodhi in the First Battle of Panipat in 1526 and became the emperor of Delhi in 1527 after defeating Afghans in the Battle of Gorge.
- *Humayun* (1530–1540) was the son of Babur and ascended the throne in 1530.
- *Sher Shah Suri* (1540–1545) an Afghan, who ruled the country for a brief period after defeating Humayun. He introduced a brilliant administration, land revenue policy and several other measures to improve the economy. He issued the coin called 'Rupia' and built the Grand Trunk Road (GT Road) linking Peshawar to Calcutta.
- *Akbar* (1556–1605) the eldest son of Humayun, is said to be the real founder of the Mughal empire because Babur and Humayun could not consolidate the empire as Akbar successfully did. He was the first ruler who divorced religion from politics and his attitude towards Hindus was very conciliatory.
- *Jehangir* (1605–1627) Salim, son of Akbar, ascended the throne after Akbar's death in 1605. He is known for his strict administration of justice. He married Mehr-un-nisa in 1611, who later on was given the title of 'Nur Jahan'.

- *Shahjahan* (1628–1658) son of Jehangir, ascended the throne after his father's death. Three years after his accession, his beloved wife Mumtaz Mahal died in 1631 and to perpetuate her memory he built the Taj Mahal at Agra. He is known for the promotion of art, culture and architeture. The Red Fort and Jama Masjid are some of the magnificent structures built by him. Shahjahan's failing health set off the war of succession among his four sons. His third son, Aurangzeb, crowned himself emperor in 1658 and Shahjahan was imprisoned by him till he died in captivity in 1666.
- *Aurangzeb* (1659–1707) the son of Shahjahan ruled for 50 years. He was a Muslim fanatic who demolished several Hindu Temples and banned all religious festivals. He executed Guru Teg Bahadur (the ninth Guru of Sikhs) when he refused to embrace Islam.

Second Battle of Panipat (1556)

- The second battle of Panipat fought between Hemu, the Hindu leader and Akbar's regent Bairam Khan.
- Hemu was defeated on 5 November, 1556, captured and slain by Bairam Khan.
- This ended the Mughal-Afghan contest for the throne of Delhi in favour of the Mughals and enabled Akbar to reoccupy Delhi and Agra.

Battle of Haldighati (1576)

- This battle was fought in 1576 near Gogundo (Haldighati) between Rana Pratap Singh of Mewar and the Mughal Army led by Man Singh of Amber.
- Rana Pratap Singh was defeated but he continued the struggle and did not submit.

Decline of Mughal Empire

- In 1739, during the reign of Mohammed Shah, a Persian king, Nadir Shah, invaded India and broke up the Mughal empire.
- He plundered Delhi and took the Kohinoor diamond with him to Afghanistan.

Vijayanagar Empire, Sikhs and Marathas

Vijayanagar Empire

- Founded in 1336 by Harihara I (1336–56) as a result of the political and cultural movement against the Tughlaq authority in south India.
- Genealogically the Vijayanagar empire is classified as:
  1. *Sangam Dynasty* (1336–1485 AD) [Harihara I (1336–56), Bukka I (1356–77), Harihara II (1377–1404), Bukka II (1404–06), Devaraya I (1406–22), Vira Vijaya (1422), Devaraya II (1422–46), Mallikarjuna (1446–65), Virupaksha (1465–85), Prauda Deva (1485)]
  2. *Saluva Dynasty* (1485–1505 AD) [Saluva Narasimha (1485–90), Timmaraya (1490–91), Immadi Narasimha (1491–1505)].
  3. *Tuluva Dynasty* (1505–70) [Vir Narasimha (1505–09), Krishnadeva Raya (1509–29), Achyta Raya (1529–42), Venkta I (1542–43), Sadasiva (1543–70).
  4. *Aravidu Dynasty* (1570–1652) [Tirumala (1570–72), Sri Ranga (1572–85), Venkata II (1585–1614), Sri ranga II (1614), Ramadeva (1614–30), Ventata III (1630–42), Sri Ranga III (1642–52).
- Vijayanagar-Bahamni conflict is one of the most important struggles for the Vijayanagar rulers. It started on a large scale in 1367 AD during the reign of Bukka-I.

The clash of interest had three points: (i) the Tungabhadra doab, (ii) Krishna-Godavari delta and (iii) in the Marathwada country.

- The Vijayanagar empire crumbled at the Battle of Talikota where the fist rulers of Bahamni sultanate combined forces and attacked Vijayanagar in 1565 AD. The later rulers that controlled the Vijayanagar empire belonged to Aravidy dynasty and asserted lesser impression on the history of the region.

Sikhs and Marathas

Sikhs

- In the fifteenth century, the Sikhs grew into a strong community.
- Aurangzeb captured Guru Teg Bahadur, the ninth guru of Sikhs, in 1675 and executed him when he refused to embrace Islam.
- The Sikhs resented the Mughals for their religious intolerance.
- Guru Gobind Singh, son of Guru Teg Bahadur, organized his followers into a military force called Khalsa to avenge the murder of his father.
- Guru Gobind Singh, however, was murdered in 1708 by an Afghan in the Deccan.
- Banda Bahadur, the militant successor of Guru Gobind Singh, continued the war against Mughals but he too was murdered.

Marathas

- Marathas became powerful after the departure of Nadir Shah.
- Shivaji played a pivotal role in liberating India from Muslim rule.
- It was he who initiated the strategy of guerilla warfare.

War with Shivaji

- Shivaji was the most powerful Maratha king and an arch enemy of Aurangzeb.
- When Aurangzeb could not eliminate him, he conspired with Jai Singh of Amber, a Rajput, to eliminate Shivaji.
- In 1665, on an assurance given by Jai Singh, Shivaji visited Aurangzeb's court. Shivaji was imprisoned by Aurangzeb but he managed to escape and in 1674 proclaimed himself as an independent monarch.
- He died in 1680 and was succeeded by his son Sambhaji who was executed by Aurangzeb.
- Sambhaji was succeeded by his brother Rajaram and after his death in 1700 his widow Tarabai carried on the movement.

MODERN INDIA

Rise of Autonomous States

- With the declining poser of the Mughal empire in the eighteenth century, there emerged various autonomous states in India.
- Some of the important ones are listed here:
  1. Bengal under Murshid Quli Khan
  2. Oudh (Awadh) under Sadat Khan Barhan-ul Mulk
  3. Hyderabad under Nizam-ul-mul Asaf Jah
  4. Carnatic under Saadatullah Khan

5. Mysore under Hyder Ali
6. Jats under Churaman and Surajmal
7. Sikhs under Ranjit Singh

Coming of the Europeans

- Portuguese traders were the first to discover a sea route to India free from Turkish threat in 1498.
- They were followed by the Dutch in 1595 and the English in 1600 and finally the French in 1664 who also came to India for trade.

Portuguese

- In 1498, it was Vasco-da Gama a Portuguese sailor who first discovered a sea route to India via the Cape of Good Hope. He arrived at Calicut on 27 May 1498.
- The Portuguese soon established political power along the west coast of India.
- He was succeeded by Captain General Alfonso de Albuquerque who conquered Goa in 1510.

Dutch

- The first fleet of the Dutch reached India in 1595 and Dutch East India Company was formed in 1602 but their influence soon vanished.
- In 1605 they established their first factory in Masulipattam, followed by more factories in Pulicat (1610), Surat (1616), Bimilpatam (1641), Karikal (1645), Chinsura (1653), Kasimbazar (1658), Baranagore (1658), Patna and Balasore (both 1658) and Cochin (1663).
- Till 1690, Pulicat was their chief trade centre and afterwards it shifted to Negapatnam.
- The Anglo-Dutch rivalry was at its peak during the late seventeenth and early eighteenth century till the Dutch collapsed with their defeat by the English in the battle of Bedera in 1759.

The English

- The English East India Company was formed in 1600 through a Charter signed by Queen Elizabeth I granting permission to trade with India. Captain Hawkins paid a visit to the court of Jehangir in 1608 but failed to secure trading rights.
- However in 1613, on Sir Thomas Roe's visit they were permitted to established their first factory at Surat.
- Gradually the Company established its trading centres at Bombay, Calcutta and Madras.
- The English established their settlements/factories in Masulipattam (1611), Agra, Ahmedabad, Baroda, Broach (all 1619), Armagaon near Pulicat (1626), Hariharpur and Balasore (1633), Patna, Dacca, Kasimbazar in Bengal and Bihar (1835), Madras (1639) to establish Fort St George, Hugli (1651), a network of settlements in Bihar, Bengal and Orissa (1658), Bombay (1668), Sutanuti (1690), Kalikota and Govindpur (1698).
- Sutanuti, Kalikota and Govindpur were later joined together into a new city 'Calcutta' and the factory at Sutanati was fortified in 1700 and named 'Fort William'.
- During 1686, the English declared war against Mughal Emperor Aurangzeb in which the English lost all control of its settlement and factories in India to Mughals in 1688–1689.

- In 1690, the surrendering British were pardoned by Mughal Emperor. In 1691, the English were granted 'farman' by Aurangzeb which exempted the British Company from payment of customs duties in Bengal.
- Faruk Siyar granted the British another 'farman' in 1717 and thus extended the privilege to the British in Gujarat and Deccan.

French

- The French came to India in 1664 and set up centres near Madras and Chandernagore on the Hooghly to trade with India.
- They also established naval bases in the islands of Bourbon and Mauritius in the Indian Ocean.
- Initially, they flourished till 1706 but afterwards decline occurred till 1720 and it was governors Lenoir and Dumas that after 1720 the French regrouped in India.
- However, during 1742 the French governor Dupleix started repulsing the English power which resulted in 'Carnatic Wars' and finally resulted in French defeat.

Danish

- In 1616, the East India Company, Denmark, reached Indian coasts and established settlements in Tranquebar in Tamil Nadu (1620) and Serampore in Bengal (1676).
- However, due to rising presence of the British they had to sell all their settlements to the British during 1845.

East India Company and British Rule

- On arriving in India the East India Company had to face Dutch and French opposition as they were the main contestants for political supremacy over India.
- But the British were successful in destabilizing them and soon the company's functions expanded into political ambition.

Robert Clive

- He led the English forces to capture Arcot and other regions. He was instrumental in laying the foundation of the British empire in India.
- In the Carnatic Wars between the French and the English, the latter finally defeated the French in the Battle of Wandiwash to gain control over South India.

English Conquest of Bengal

- Nawab Alivardi Khan was an independent ruler of Bengal between 1740 and 1756.
- He in fact extended protection to the European merchants in carrying on their trade.
- Alivardi Khan nominated his grandson (daughter's son) Siraj-ud-Daula as his heir since he had no son. He died in April 1756.
- In the meantime the company constructed fortifications at Calcutta and violated the terms under which they were allowed to trade.
- Siraj-ud-Daula took prompt action and occupied an English factory at Kasimbazar and later captured Calcutta in June 1756.

Black-Hole Tragedy

- English prisoners were said to have been crowded into a small chamber which had a single, tiny window on a hot summer night of 20 June 1756. As a result several English prisoners died of suffocation and wounds.

- In December 1756, Colonel Clive and Admiral Watson reached Bengal from Madras and captured Calcutta.
- Mir Jafar, brother-in-law of Alivardi Khan, had a secret pact with Clive who promised him the same state of Bengal.
- Mir Jafar nevertheless also assured his support to Siraj-ud-Daula against the English.

Battle of Plassey (1757)

- Robert Clive led the company's forces against Siraj-ud-Daula's army on 23 June 1757 and defeated them with the help of his conspiracy with Mir Jafar.
- This proved to be the first step towards territorial supremacy and paved the way for the British conquest of Bengal and eventually the whole country.
- The Nawab was captured and executed and Mir Jafar was installed as the Nawab of Bengal.
- He ceded Zamindari rights to 24 Parganas and got ₹1,67,00,000 as compensation. This was the first British acquisition of Indian territory.

Battle of Buxar (1764)

- At the instigation of Mir Qasim, successor of Mir Zafar, this battle was fought by Nawab Shuja-ud-Daula of Awadh and Shah Alam II (Mughal) on one side and the English forces led by Clive on the other side.
- Clive's forces were victorious resulting in the capture of Bihar and Bengal.

Carnatic Wars

First Carnatic War (1746–1748)

- The French and the British companies clashed at Carnatic. Dupleix was then the chief official of the French Company at Pondicherry.
- The French opened hostilities by sacking Fort St George and expelled all Englishmen.
- The Nawab of Carnatic sent an army but was defeated.

Second Carnatic War (1751–1754)

- The British were able to consolidate themselves by taking hold of Bengal, Bihar and Orissa.
- The second battle between the French and the British took place in 1760 in which the French were defeated.
- It ended with the Treaty of Paris in 1763 which foiled the dreams of the French to have an empire in India.

War with Marathas

- The First Anglo-Maratha war (1775–1782) took place during the governor-generalship of Warren Hastings.
- The war ended with the Treaty of Salbai, 1782 and status quo restored.

Mysore War

- Mysore was a powerful state under Haider Ali. In 1769 the first Anglo-Mysore war was fought in which the British forces were defeated.
- Haider Ali occupied almost the whole of Carnatic.

- However in 1781, Haider Ali was defeated at Porto Novo and saved Madras.
- After Haider Ali, the war was carried on by Tipu Sultan. A peace treaty was then signed.
- However in 1789 another war was launched and Tipu Sultan was defeated in 1792.

First Governor

- In 1758, Robert Clive was appointed the first governor of Bengal by the East India Company.
- Clive remained in England from 1760 to 1765 and on his return in 1765, the emperor ceded to the Company the Diwani of Bengal, Bihar and Orissa.

Notable Rules in India (1720–1949)

Saadat Khan Burhan-ul-Mulk (1722–1739)—Awadh
Safdar Jung (1739–1754)—Awadh
Shuja-ud-daulah (1754–1775)—Awadh
Asaf-ud-daulah (1775–1797)—Awadh
Wazir Ali (1797–1798)—Awadh
Nizam-ul-Mulk Asaf Jah (1724–1748)—Hyderabad
Nasir Jung (1748–1750)—Hyderabad
Muzaffar Jung (1750–1751)—Hyderabad
Salabat Jung (1751–1760)—Hyderabad
Nizam Ali (1760–1803)—Hyderabad
Sikandar Jah (1803–1829)—Hyderabad
Nasir-ud-daulah (1829–1857)—Hyderabad
Afjal-ud-daulah (1857–1869)—Hyderabad
Mahabat Ali Khan (1869–1911)—Hyderabad
Osman Ali Khan (1911–1949)—Hyderabad
Hyder Ali (1761–1782)—Mysore
Tipu Sultan (1782–1799)—Mysore
Ranjit Singh (1792–1839)—Punjab
The Nawabs of Bengal (1717–1772)
Murshid Quli Khan (1717–1727)
Suja-ud-din (1727–1739)
Sarfraz Khan (1739–1740)
Alivardi Khan (1740–1756)
Siraj-ud-daulah (1756–1757)
Mir Jafar (1757–1760)
Mir Qasim (1760–1763)
Mir Jafar (1763–1765)
Najm-ud-daulah (1765–1772)

BRITISH RULE

Governor-Generals of India and Reforms

Warren Hastings (1772–1785)

- Warren Hastings succeeded Clive in 1772 and became the first governor-general of India. He introduced several reforms, established civil and criminal courts and courts of appeal.

- He passed 'The Regulating Act, 1773' giving a legalized working constitution to the company's dominion in India. It envisaged a Council of Ministers headed by the governor-general.
- The Pitt's India Act of 1784 was passed by the British Parliament to put the company's affairs in permanent centralized control of the British Parliament.

Governors Between Clive and Hastings

- John Zephaniah Holwell succeed Robert Clive as governor of Bengal in 1760.
- He was replaced with Henry Vansittart in the same year.
- Vansittart officiated as governor till 1765, till the return of Robert Clive for his second term as governor.
- Clive's health deteriorated in 1765, he was succeeded by Harry Verelst (1767–1769) and then John Cartier (1769–1772) before Warren Hastings was sent to India in 1772.

Lord Cornwallis (1786–1793)

- Lord Cornwallis succeeded Hastings in 1787.
- He introduced a new revenue system under the Permanent Settlement of Bengal in 1793 with a view to stabilize land revenue and create a loyal contented class of zamindars.
- This abolished periodic auction of zamindari rights and established permanent zamindari rights to collect land revenue from the tenants and payment of a fixed amount to the government treasury every year.

Lord Wellesley (1798–1805)

- During the governor-generalship of Lord Wellesley, the Fourth Mysore War (1799) was fought. This was the last Mysore war.
- Tipu Sultan, after regaining lost strength, set out again on his plan to oust the British from India with the help of Napoleon and the Persian king.
- Lord Wellesley visualizing danger, sought an alliance with the Nizam and the Marathas and defeated Tipu Sultan in 1799 who died valiantly fighting the British.
- Besides war, Wellesley depended on a system of subsidiary alliances to expand British territories whereby the ruler of an aligning state was compelled to accept permanent stationing of a British force within his territory and pay subsidy for its maintenance. Sometimes a territory was added in lieu of payment.
- A ruler also had to accept a British resident. They were not allowed to employ any European without British approval nor negotiate with any Indian ruler without consulting the governor-general.
- Thus, subsidiary allied lost sovereignty in external matters, while the British resident interfered in internal administration, thus the rulers lost control over their territories.

Lord Hastings (1813–1823)

- Under the governorship of Lord Hastings Nepal was defeated in 1814, resulting in Nepal ceding Garhwal and Kumaon to the British.
- In 1818, the Marathas made a last attempt to regain their independence. This led to the third Anglo-Maratha war in which the Marathas were completely crushed.
- During Hastings' tenure, various reforms were initiated such as the Ryotwari settlement according to which direct settlement was made between the government and the Ryots (cultivators).

- The revenue was fixed for a period not exceeding 30 years on the basis of quality of soil. Half the net value of the crop was to be given to the government.
- During this period special attention was paid to education, building of roads, bridges and canals.

Lord William Bentinck (1828–1835)

- He was famous for the social reforms he introduced, such as abolition of Sati (1829), suppression of Thuggee, suppression of female infanticide and human sacrifices.
- English was introduced as a medium of higher education on the advice of his council member, Thomas Babington Macaulay.
- Lord Bentinck also made a pact with Maharaja Ranjit Singh, the ruler of Punjab.
- By the Charter Act 1833, the company ceased to be a trading company and became an administrative power.
- He also adopted some corrective measures in the civil services. However, it was Cornwallis who founded the British Civil Service in India.

Raja Rammohun Roy

- He lived during the period of Lord Bentinck.
- He was a religious and social reformer who helped Bentinck in the abolition of Sati.
- In 1829, a new society called Brahmo Samaj was started by Rammohun Roy which discarded idol worship, caste system and several complicated rites and rituals.

Sir Charles Metacalfe (1836–1844)

- He was notable for removing restrictions on the press and media.

Lord Hardinge (1844–1848)

- During his period, the First Sikh War (1845) was fought between the Sikhs and the British.
- The Sikhs were defeated and were brought under British control.

Lord Dalhousie (1848–1856)

- Lord Dalhousie succeeded Lord Hardinge in 1848. During his period, the Second Sikh War (1849) was fought in which the Sikhs were defeated again and the Dalhousie was successful in annexing the whole of Punjab to the British administration.
- The Doctrine of Lapse was introduced by Lord Dalhousie, whereby in the absence of a natural heir, the sovereignty of Indian states was to lapse to the British and such rulers were not permitted to adopt a son to inherit their kingdoms.

Reforms

- The first railway line between Bombay and Thane was opened in 1853 and in the same year Calcutta and Agra were connected by telegraph.
- Other reforms include setting up of P.W.D. and passing of the Widow Remarriage Act (1856).
- Keshav Chadra Sen founded the 'Indian Reform Association' in 1870.
- Debendranath Tagore published a Bengali monthly 'Tattvabodhini Patrika'.
- Dayanand Saraswati published pamphlet (with religious inclinations) Gaukarunanidhi in 1881.

- G. G. Agarkar started the Deccan Education Society and the journals Kesri and Mahratta along with B. G. Tilak. Gopal Krishan Gokhale was and active member of the Deccan Education Society.
- A Hindu Social Reform Association was started in Madras in 1892 by the 'Young Madras Party'.
- Shibli Numani founded the Nadwah-ul-ulama in 1894.

Ramakrishna and Vivekananda

- Ramakrishna Paramahansa (1836–1886) a priest at a temple in Dakshineshwar near Calcutta emphasized that there are many roads to god and salvation and that service to man was service to god.
- His great disciple, Swami Vivekananda (1863–1902) popularized his religious message and founded Ramakrishna Mission in 1896.

Arya Samaj

- The Arya Samaj was founded in 1875 by Swami Dayanand Saraswati in order to reform Hindu religion in north India.
- Swami Dayanand believed that there was only one god who was to be worshipped in spirit and not in the form of idols and images. He also wrote *Satyarth Prakash.*
- Great split in Arya Samaj occurred in 1892 over the question of the system of education to be followed.

INDIAN FREEDOM STRUGGLE

First War of Independence

- It is also known as the Sepoy Mutiny or the Revolt of 1857.
- On 29 March 1857 during the vice-royalty of Lord Canning, an Indian sepoy of the 34th regiment, Mangal Pandey, killed two British officers on parade at Barrackpore.
- The Indian soldiers present on parade refused to obey orders to arrest Mangal Pandey. However, he was later arrested, tried and hanged.
- The news spread like wild fire to all cantonments in the country and very soon a countrywide sepoy revolt broke out from Lucknow, Ambala, Burhanpur and Meerut.
- On 10 May 1857, soldiers at Meerut refused to touch the new Enfield rifle cartridges which were said to have a greased cover made of animal fat.
- The soldiers along with other groups of civilians went on a rampage, broke open jails, murdered Europeans and marched to Delhi.
- The appearance of the marching soldiers next morning in Delhi was a signal to the local soldiers, who in turn, also revolted, besieged the city and proclaimed the 80 year old Bahadur Shah Zafar as the Emperor of India.

Failure of the Revolt

- The rebels dealt with a powerful blow when the British captured Delhi on 20 September 1857 and imprisoned Emperor Bahadur Shah.
- The British military then dealt with the rebels in each centre by term. The Rani of Jhansi died fighting on 17 June, 1858.
- Nana Saheb refused to give in and finally escaped to Nepal in January 1859, hoping to renew the struggle.

- Kunwar Singh died in May 1858, trying to escape from the British.
- Tantia Tope, who successfully carried out guerrilla warfare against the British until April 1859, was betrayed by a fellow rebel and was captured and put to death by the British, thus reestablishing British authority over India.

Causes of Failure of the Mutiny

- Disunity of Indians and poor organization.
- *Lack of complete nationalism*: Scindia, Holkars, the Nizam and others actively helped the British.
- Lack of coordination between sepoys, peasants, zamindars and other classes.
- All participants had different motives for participating in the revolt.

British Rule After the Revolt

Government of India Act (1858)

- Queen Victoria issued a proclamation on 1 November 1858 placing India under the direct governance of the Crown.
- The proclamation was called the 'Magna Carta of Indian Liberty'.

Indian National Congress

- The Indian National Congress was formed in 1885 by A. O. Hume, an Englishman and a retired civil servant, in association with various national leaders.
- He called for a conference in Pune in December 1885.
- The conference received the unanimous support of all Indian leaders who decided to rename the Indian National Union as Indian National Congress (INC).
- The first session of the Congress was held in Bombay under the presidentship of W. C. Banerjee.
- With the foundation of the Indian National Congress, the struggle for India's independence was launched.

Moderate Period (1885–1906)

- At first, the Congress was a moderate, constitutional movement. In its early days, the party confined itself to an annual debate where political issues were discussed.
- It asked the government to remedy complaints but had no constitutional role.
- However, some Congress members were also members of the Legislative Assembly, which advised the viceroy and the executive committee on the drafting of new laws.
- The cause of the Indian National Congress spread rapidly among middle-class Indians.
- With the founding of the Indian National Congress, the struggle for India's independence was launched in a small, hesitant and mild but organized manner.
- The first two decades of the Indian National Congress are described in history as one with moderate demands and a sense of confidence in British justice and generosity.
- Its aim was not to be aggressive in attaining independence lest the British should suppress them.
- This resulted in the Indian Council Act in 1892 which allowed some members to be indirectly elected by Indians but kept the official majority intact.

Partition of Bengal

- To destroy the political influence of the educated middle class, the partition of Bengal came into effect on 16 October 1905 by a royal proclamation, reducing the province of Bengal in size by creating a new province of East Bengal which later became East Pakistan and the present day Bangladesh.

Swadeshi Movement (1905)

- On 7 August 1905, the Indian National Congress adopted a resolution to boycott British goods.
- Bonfires of foreign goods were conducted on a large scale in all the major cities.

Muslim League (1906)

- In 1906, an all India Muslim League was set up under the leadership of Aga Khan, Nawab Salimullah of Dacca and Nawab Mohsinul-Mulk. It supported the partition of Bengal.
- This led to communal differences between Hindus and Muslims.

Surat Session—Split in Congress (1907)

- *Confrontation at the Session*: The Indian National Congress split into two groups, the extremists and the moderates, at the Surat session in 1907 held on the banks of the Tapti river.
- The extremists were led by Lokmanya Tilak, Lajpat Rai and Bipin Chandra Pal and the moderates were led by Gopal Krishna Gokhale.
- At the Surat session, the moderate and extremist delegates of the Congress met in an atmosphere surcharged with excitement and anger.

Minto–Morley Reforms (1909)

- Minto–Morley reforms were introduced when Lord Minto was the governor-general of India.
- They envisaged a separate electorate for Muslims. The government thereby sought to create a rift between the Hindus and Muslims.

Indian National Congress Before World War I

- However, certain changes at the turn of the century resulted in changing the mood of the Congress.
- The most important among them was the change in the attitude of the British.
- Some of the repressive and oppressive measures of the British promoted the growth of extremism within the Congress.
- Extremist leaders such as Bipin Chandra Pal, Bal Gangadhar Tilak and Lala Lajpat Rai called on the people to show courage and self-reliance in the cause of India's nationalism.
- The partition of Bengal in 1905 raised the political temper of the country.
- The Congress started getting polarized into the moderates and the extremists.
- This era of militant nationalism prevailed within and without the Congress during 1906–1919.
- The 1906 session of Congress declared 'Dominion Status' to be the political goal of the Congress and four resolutions on boycott, swadeshi, swaraj and national education were adopted.

Home Rule Movement (1915–1916)

- Dr Annie Besant, inspired by the Irish rebellion, started a Home Rule Movement in India in September 1916.
- The movement spread rapidly and branches of the Home Rule League were established all over India.
- Bal Gangadhar Tilak wholeheartedly supported the movement.
- He joined forces with Dr Besant and persuaded the Muslim League to support the programme as well.

Indian National Congress During World War I

- The Congress reunited in support of the British during World War I but was disappointed soon after the war when Britain restricted political activity in India.
- Under the leadership of Mahatma Gandhi the Congress demanded *purna swaraj* ('complete independence') and waged periodic campaigns of non-violent civil disobedience.
- Although leaders of the organization were imprisoned several times, Britain made some concessions in the 1930s.

Lucknow Pact (1916)

- The Lucknow Pact of 1916 was an important step in achieving Hindu–Muslim unity.
- Both the Congress and Muslim League held sessions at Lucknow, where anti-British feelings were generated among the Muslims.
- This weakened the British attitude and in 1916 a British policy was announced whereby associations of Indians were increased and gradual development of local self-government introduced.

August Declaration of 1917

- During World War I, the British claimed that they stood for the protection of democracy around the world.
- Thus Indians, who fought for them in this war, demanded that democracy should also be introduced in their country.
- In his famous August Declaration presented before the House of Commons on 20 August 1917, Montague, the Secretary of State for Indian Affairs, said that in order to satisfy the local demands, his government was interested in giving more representation to the natives in India.
- New reforms would be introduced in the country to meet this objective. The control over the Indian government would be transferred gradually to the Indian people.
- This was the result of the Hindu–Muslim unity exhibited by the Lucknow Pact.

Gandhian Era (1918–1947)

- Mahatma Gandhi dominated the Indian political scene from 1918–1947.
- Mahatma Gandhi provided the leadership of the highest order and his philosophy of non-violent Satyagraha became the most potent weapon to drive out the British from the Indian soil.

Montague–Chelmsford Reforms

- Lord Montague came to India and stayed for 6 months.
- During this period, he held meetings with different government and non-government people. Finally, in cooperation with Governor-General Lord Chelmsford, Montague presented a report on the constitutional reforms for India in 1918.
- The report was discussed and approved by the British Parliament and then became the Government of India Act of 1919. This act is commonly known as the Montague–Chelmsford Reforms.

Rowlatt Act 1919

- During the vice-royalty of Lord Chelmsford, a sedition committee was appointed by the government.
- The Rowlatt Act, 1919, gave unbridled powers to the government to arrest and imprison suspects without trial. Gandhiji decided to fight against this act and he gave a call for Satyagraha.

Jallianwala Bagh Massacre (1919)

- Dr Kitchlu and Dr Satyapal were arrested on 10 April 1919 under the above act which caused serious unrest in Punjab.
- A public meeting was held on 13 April 1919 in Jallianwala Bagh in Amritsar where thousands of people including women and children assembled.
- Before the meeting could start General Dyre ordered indiscriminate heavy firing on the crowd and hundreds of people were killed and more than 1200 people wounded.
- It was a turning point in the Indo-British relations and gave strength to Gandhiji's mission.

Khilafat Movement (1920)

- During World War I the safety and welfare of Turkey was threatened by the British, weakening the Sultan of Turkey and Caliph's position.
- The Caliph was looked upon by the Muslims as their religious head.
- The two brothers Mohammed Ali and Shaukat Ali launched an Anti-British movement in 1920 calling it the Khilafat Movement.
- Maulana Abul Kalam Azad also led the movement and it was supported by Gandhi as well as Congress which paved the way for Hindu-Muslim unity.

Non-cooperation Movement (1920)

- Hindu-Muslim unity encouraged Gandhi to launch his non-violent, non-cooperation movement.
- The movement envisaged surrender of titles, resignation from nominated offices, refusal to attend government work, boycott of foreign goods, etc.

Significance of the Movement

- — This was the first truly nationalist movement of India which brought together almost all working strata of society such as peasants, teachers, students, women and merchants.
- — It acquired a real mass base as it gained momentum and spread across the length and breadth of the country.
- — The congress also got a facelift with this movement, it gained recognition as an organization for action instead of a mere deliberative assembly.

— The development of national unity and willingness of people to make sacrifices for the cause of national independence also emerged from this movement.

Phases of Movement

— Phase I (Jan–Mar 1921): Educational boycott and boycott of law courts were carried out.

— Phase II (Apr–Jun 1921): Operation Tilak Swaraj Fund was organized throughout India.

— Phase III (July–Sep 1921): Picketing of shops selling foreign cloth and boycott of foreign cloth.

— Phase IV (Nov 1921–Feb 1922): Kisan movement and many local movements were carried out during this phase.

Chauri Chaura Incident (1922)

- As the movement was going on successfully, suddenly a mob of countrymen at Chauri Chaura near Gorakhpur clashed with the police and burnt the police station, killing 22 policemen.
- This compelled Gandhi to call off the non-cooperation movement on 12 February 1922.

Swaraj Party (1922)

- Gandhiji's decision to call off the agitation caused frustration in the masses. Leaders like Motilal Nehru, C. R. Das and N. C. Kelkar organized the Swaraj Party.
- They emphasized the need for entering into legislative councils by contesting elections.

Simon Commission (1927)

- The British Government appointed the Simon Commission in November 1927 to review and report as to what extent a representative government could be introduced in India.
- As all members of this commission were Europeans, Indian leaders decided to boycott the commission and wherever the commission went, there were slogans 'Simon go back'.
- While leading a demonstration at Lahore, Lala Lajpat Rai was severely beaten in a police lathi charge and he succumbed to his injuries.

Lahore Session (1929)

- In December 1929 at Lahore, the Indian National Congress under the presidentship of Jawahar Lal Nehru declared *Poorna Swaraj* (Complete Independence) to be the goal of the national movement.
- It was Gandhi who was the decisive voice in investing Jawaharlal Nehru with the office of president in what was to be a critical year of mass struggle.

Dandi March (1930)

- Mahatma Gandhiji started his famous march, called the Dandi March or 'Salt Satyagraha', from Sabarmati Ashram on 12 March 1930.
- He headed towards the small village of Dandi to break the Salt Law. The movement became so powerful that it sparked off patriotism even among the Indian soldiers.
- Soon thereafter, repressive measures such as mass arrests, lathi-charge and other repressive measures followed and about 1,00,000 people went to jail.

Civil Disobedience Movement (1930)

- Gandhi launched another civil disobedience movement towards achieving the goal of complete independence.
- In the beginning, he served 11-point ultimatum to the authorities which was mainly about the common grievances of the people of India but did not include the demand for complete independence.
- The 11 demands had:
  1. Two demands of the peasant (abolition of salt tax to eradicate the government's salt monopoly and reduction in the land revenue by percent).
  2. Three demands of the middle class (coastal shipping to be reserved for Indians, adequate protection to the domestic textile industry of India and checking the deteriorating rupee-sterling exchange ratio).
  3. The rest were common grivances (modifications in the working of the Central Intelligence Departments, release of political prisoners, complete prohibition of intoxicants, 50% reduction in military expenditure, 50% cut in civil administration expenditure and changes in the Arms Act, thus allowing citizens to bear arms for self-protection).

Government of India Act 1935

- The Government of India Act, 1935, was passed on the basis of Simon Commission report. It provided for a federal type of government.

World War II and the Indian Political Situation

- Just before World War II broke out, the Congress declared its unwillingness to associate itself with the British government.
- It also clearly informed the government that India should not be pushed to war without the consent of the Indian people.
- The British government also made no clear statement concerning its war and peace aims as applicable to India.
- The British Prime Minister stated that the British were in the war to maintain the world safe for democracy and uphold the right of every nation to self-determination.
- On 3 September 1939, Britain declared war against Germany.
- The governor-general to India, Lord Linlithgow, began dispatching Indian troops to the battlefield, without consulting Indian leaders.
- The governor-general also declared emergency in India under Article 93 of the Act of 1935 to curb internal disorder.
- The Congress told the British government that if it is fighting Germany for the maintenance and extension of democracy, then it must first extend full democracy to India.
- On 10 October 1939, the Congress pressed the government to free India after the war.
- The Viceroy, on 17 October 1939, made an official statement, declaring the British government's promise to issue dominion status to India and to reconsider the Act of 1935 after the war.

Indian National Congress During World War II

- During World War II, the Congress was suppressed when it refused to support Britain.
- It had, however, proved the strength of its popular support and Britain granted (1947) independence to India following the war.
- The predominantly Hindu Congress reluctantly accepted the creation of Pakistan as a separate Muslim nation.

Demand for Pakistan (1940)

- In its Lahore session held in March 1940 and with Mr Jinnah as its leader, the Muslim League raised a demand for Pakistan as a separate country for Muslims.

Cripps Mission

- The important points made by the Cripps Mission were as follows:
  1. General elections in the provinces would be arranged as soon as the war ended.
  2. A new Indian dominion, associated with the United Kingdom, would be created.
  3. Those provinces not joining the dominion could form their own separate union.
  4. Minorities were to be protected.
- However, both the Congress and the Muslim League rejected these proposals. Jinnah opposed the plan, as it did not concede Pakistan.

Quit India Movement (1942–1945)

- On 8 August 1942, the Congress passed a resolution known as the 'Quit India' resolution.
- Gandhiji asked the British to quit India and gave a call for 'do or die' to his countrymen.

Gandhi's Fast

- Mahatma Gandhi undertook a 21-day fast in jail. His condition deteriorated after 13 days and all hopes of his survival were given up. However, he survived and completed the 21-day fast.
- This was his answer to the government which had been constantly exhorting him to condemn the violence of the people in the Quit India Movement.
- Gandhi not only refused to condemn people resorting to violence but unequivocally held the government responsible for it.
- The popular response to the news of the fast was immediate and overwhelming. All over the country, there were demonstrations and strikes.
- The fast had done exactly what it had intended to. Public morale was raised, the anti-British feeling heightened and an opportunity was provided for political activity.

Significance

- The Quit India Movement marked a new high in terms of popular participation in the national movement and sympathy with the national cause.
- As earlier, students were at the forefront of the struggle. Women, especially school girls, played a vital role. Aruna Asaf Ali, Sucheta Kripalani and Usha Mehta were among the important members of the small groups participating in the agitation.

- The great significance of this historic movement was that it placed the demand for independence on the immediate agenda of the national movement. After Quit India there could be no retreat.
- Any future negotiations with the British government could only be on the manner of transfer of power. Independence was no longer a matter of bargain now.

Azad Hind Fauj (Indian National Army, INA)

- *Origin and Purpose*: Subhash Chandra Bose, popularly known as 'Netaji' was not convinced by the policy of the Congress to acquire freedom. He was an extremist and felt that it was impossible to compel the British to leave India without force.
- In 1942, Netaji formed the Azad Hind Fauj (Indian National Army) in Singapore and gave his famous call 'Dilli chalo'.
- He started a military campaign for the independence of India. Indian residents of South-east Asia and Indian soldiers and officers captured by the Japanese forces in Malaysia, Singapore and Burma joined the INA in large numbers.
- *Rise and Decline*: Subhash Chandra Bose set up the headquarter of the INA in two places—Rangoon and in Singapore—Recruits were sought from civilians, funds were gathered and even a women's regiment called the Rani Jhansi regiment was formed.
- One INA battalion also accompanied the Japanese Army to the Indo-Burma front to participate in the Imphal campaign. But with the defeat of Japan in 1944–1945, the INA also died out. Bose is said to have been killed in an air crash on his way to Tokyo in August 1945.
- *Achievements of the INA*: The achievements of the INA fell much short of its targets but it acquired a great significance in the history of India.
- It created a design of communal harmony in India. India's freedom struggle which was till now a territorial struggle against the ruling government became an international issue.
- The Indian Army also started thinking of independent India and showed little will to fight for the British crown.
- It also gave Congress the knowledge that its non-violent methods to gain independence may not be adequate. Overall, the INA helped expedite the process of Indian independence.

Cabinet Mission Plan

- The struggle for freedom entered a decisive phase in 1945–1946. The Cabinet Mission visited India and met the representatives of different political parties.
- The mission envisaged the establishment of a constituent assembly to frame the constitution, as well as an interim government.

Formation of the Constituent Assembly

- The constituent assembly met in December 1946 and Dr Rajendra Prasad was elected its president. The Muslim League did not join the assembly.

Mountbatten Plan

- Lord Mountbatten announced his plan on 3 June 1947 to break the deadlock created by the refusal of the Muslim League to join the constituent assembly.

- He laid down detailed principles for the partition of the country. Both the Congress and the Muslim League accepted the plan which resulted in the birth of Pakistan.

Partition of India

- In accordance with the Indian Independence Act 1947, which was based on the Mountbatten Plan, India was partitioned on 15 August 1947 into India and Pakistan.
- Lord Mountbatten was appointed the governor-general of free India and M. A. Jinnah, the first governor-general of Pakistan.

India After Independence

- After Lord Mountbatten, Sir C. Rajagopalachari became the first and the only Indian governor-general of India in 1948.
- Pt Jawaharlal Nehru took over as the first prime minister.
- Mahatma Gandhi undertook a fast for the sake of Muslim rights. On 30 January 1948, he was assassinated by Nathuram Vinayak Godse in a Birla House prayer meeting in Delhi.
- Sardar Vallabhbhai Patel single-handedly dealt with the accession of all princely states. All states were merged into neighbouring provinces. The states of Kashmir, Hyderabad and Mysore merged later on.
- On 13 September 1948, the Indian Army marched into Hyderabad after the violent actions of the Tazakars and the state acceded to the Indian Union.
- On 26 November 1949, the constituent assembly passed the new constitution of India. On 26 January 1950 India was proclaimed a republic.
- Dr Rajendra Prasad took over as the first president, Dr S. Radhakrishnan as the vice-president and Pt Jawaharlal Nehru as the first prime minister of India.

CHAPTER

2 CONSTITUTION OF INDIA AND INDIAN POLITY

THE CONSTITUTION

- In democracy, the sovereignty vests in the people and ideally people govern themselves.
- A constitution is a living and organic thing, which of all instruments has the greatest claim to be construed broadly and liberally.
- Constitution represents the vision and values of its founding fathers.
- Constitution is based on the social, political and economic ethos as well as the faith and aspirations of people.
- Constitutional law would normally cover and connote the fundamental law of the land as contained in the provisions of the constitution.
- Constitution is not to be interpreted as a mere law but as the machinery by which laws are made.

Drafting of the Constitution

- The concept of a constituent assembly had always been linked with the growth of the national movement in India.
- The assembly appointed a number of committees to deal with different aspects of the problem of framing the constitution.
- The task of framing the Constitution of India was given to the Constituent Assembly formed under the Cabinet Mission Plan of 1946.
- The Constituent Assembly appointed a Drafting Committee under the Chairmanship of Dr B. R. Ambedkar then the Law Minister.
- The Constitution of India was enacted, signed and adopted by the Constituent Assembly on 26 November 1949.
- *Commencement of Constitution*: On 26 January 1950, the Constitution of India came into force and India became a republic.

Structure of the Indian Constitution

- The Constitution of India is a most comprehensive document, unique in its own way and cannot be fitted into any particular model or mould.
- The Constitution of India consists of the following:
  1. The preamble.
  2. Parts I to XXII, covering over 395 Articles.
  3. Schedules 1–12.

- An appendix.
- The constitution originally adopted had 22 parts, 395 articles and 8 schedules. Presently, as amended from time to time in the last 60 odd years, there have been 98 amendments.
- From 8 schedules it has grown to 12 schedules and the number of articles has increased from 395 to more than 448. However, following the standard practice in this regard and to facilitate referencing, the existing number of articles, parts or chapters have not been changed.
- The constitution of India is a blend of the rigid and the flexible federal and unitary and presidential and parliamentary.

THE PREAMBLE

- The preamble of a constitution embodies basic values and the philosophy on which it is based.
- The 42nd Amendment (1976) added the words 'secular' and 'socialist' and now the preamble reads as follows:

> We, the people of India, have solemnly resolved to constitute India into a Sovereign, Socialist, Secular, Democratic Republic and to secure to all its citizens:
> *Justice*, social economic and political;
> *Liberty* of thought, expression, belief, faith and worship;
> *Equality* of status and of opportunity and to promote among them all;
> *Fraternity* assuring the dignity of the individual and the unity and integrity of the Nation.

In our Constituent Assembly on this twenty-sixth day of November 1949, we do hereby Adopt, Enact and Give to Ourselves This Constitution.

Preamble as Part of the Indian Constitution

- The preamble is an integral part of the constitution but is not an essential part of the constitution.
- The Supreme Court in 1973 gave a landmark verdict (Kesavananda Bharti v/s State of Kerala) stating, 'Preamble is a part of the constitution and is subject to amending power of the Parliament, as any other provisions of the constitution provided the basic structure of the constitution found in the preamble is not destroyed'.
- So the preamble is a key to unravel the minds of the makers of the constitution.

Significance of the Preamble

- The Supreme Court of India has given many historic decision which highlight the importance and utility of the preamble.
- The preamble serves three purposes:
  1. It indicates the source from which the constitution derives its authority.
  2. It states the objects that the constitution seeks to establish and promote.
  3. It states the date of its adoption.
- The nation turns to the various expressions contained in the preamble for proper appreciation of the aims and aspirations embodied in the constitution.
- It also aids the legal interpretation of the constitution where the language is found to be ambiguous.

Interpretation of the Preamble

- The preamble may be invoked to determine the ambit of
  1. Fundamental Rights
  2. Directive Principles of State Policy
- It may be pressed into service to interpret constitutional provisions whereby the preamble declares India to be a sovereign, socialist, secular and democratic republic.

IMPORTANT CONSTITUTIONAL DOCTRINES

Doctrine of Double Jeopardy

- A person shall not be prosecuted and punished for the same offence more than once [Article 20(2)].

Doctrine of Eclipse

- The state is prohibited from making any law which contravenes any of the fundamental rights [Article 13(2)].

Doctrine of Basic Feature of the Constitution

- This is also known as Doctrine of Basic Structure or Basic Elements of the Constitution (propounded in 1973 as tabulated in the Kesavnanda case):
  1. Supremacy of the constitution
  2. Republican and democratic form of government
  3. Secular character of the constitution
  4. Separation of powers
  5. Federal character of the constitution
- In the Indira Gandhi v/s Raj Narain case in 1975, the Supreme Court founded the following elements as the basic structure of the constitution:
  1. India as a sovereign democratic republic
  2. Equality of status and opportunity
  3. Secularism and the freedom of conscience
  4. Rule of law
- Further, the 'amending power of the parliament', 'Judicial review' and 'balance between the fundamental rights and the directive principles' were added to the list of elements basic to the Indian Constitution.
- In a landmark ruling in January 2007, the Supreme Court of India confirmed that all laws (including those in Schedule 9) would be open to judicial review if they violate the basic structure of the constitution.

Doctrine of Bias

- According to this, a person should not be a judge in one's own case and justice should not only be done but should also be seen to be done for the legitimacy of judicial administration.

Doctrine of Harmonious Interpretation

- Where two provisions in the constitution appear to be in conflict, the meaning that gives effect to both the provisions and ensures their smooth and harmonious operation should be accepted.

Doctrine of Liberal Interpretation

- It provides for the liberal interpretation of the constitution.
- This has led to a great deal of creative jurisprudence in India.

Doctrine of Progressive Interpretation

- The constitution shall be interpreted progressively with due consideration to the dynamic nature of the socio-legal framework.

Doctrine of Ministerial Responsibility

- For every act of the state, the ministers are responsible to the people through their elected representative in the parliament [Article 75(3)].
- It is an essential indicator of the parliamentary system.

Doctrine of Pith and Substance

- If the laws made by the parliament (under Articles 249 and 250) are incoherent with the state laws, then the law made by the parliament shall remain effective (Article 251) and the state laws shall not be operative to the extent of repugnancy.

Doctrine of Pleasure

- The services of a government employee, in defence service or civil service, can be dispensed with/without assigning any reasons.
- However, there were special constitutional safeguards in the case of certain high functionaries such as Judges of Supreme Court and High Courts, the Chief Election Commissioner, Comptroller and Auditor-General, members of Public Service Commissions, etc., concerning their removal from their respective offices except in the manner laid down in relevant articles.

Doctrine of Prospective Overruling

- An interpretation of the constitution given by court or the law declared by it may not overrule the validity of the past acts if any.

Doctrine of Repugnancy

- Any jurisdictional conflict between the union and the states concerning their legislative competence can be settled by the court ascertaining the substance of the matter relating to an item in one list or the other.

Doctrine of Severability

- If a part of the constitutional provision is found to be invalid, then the validity of the remaining part need not be affected, provided the part can be separated from the impugned part and can stand on its own.

Doctrine of Territorial Nexus

- The state law may not be considered valid outside the state unless there is an establishment of a significant territorial nexus or connection between the state making law and the subject matter of the legislation.

- The doctrine can be applied in cases involving sales tax, sale of goods and lotteries, prize/competition money, etc.

Parts and Articles of the Constitution

- Part I/Articles 1–4 (Territory of India, admission, establishment or formation of new states)
- Part II/Articles 5–11 (Citizenship)
- Part III/Articles 12–35 (Fundamental rights)
- Part IV/Articles 36–51 (Directive principles of state policy)
- Part IV-A/Article 51 A (Duties of a citizen of India)
- Part V/Articles 52–151 (Government at the union level)
- Part VI/Articles 152–237 (Government at the state level)
- Part VII/Article 238 (Repealed by 7th Amendment, 1956)
- Part VIII/Articles 239–241 (Administration of union territories)
- Part IX/Articles 242–243 O (The Panchayats)
- Part IX-A/Articles 243P–243 ZG (The municipalities)
- Part X/Articles 244–244 A (Scheduled and tribal areas)
- Part XI/Articles 245–263 (Relations between the union and states)
- Part XII/Articles 264–300 A (Finance, property, contracts and suits)
- Part XIII/Articles 301–307 (Trade, commerce and travel within territory of India)
- Part XIV/Articles 308–323 (Services under the union and states)
- Part XIV-A/Articles 323A–323B (Deals with administrative tribunals)
- Part XV/Articles 324–329A (Election and election commission)
- Part XVI/Articles 330–342 (Special provision to certain classes SCs/STs, OBCs and Anglo Indians)
- Part XVII/Articles 343–351 (Official languages)
- Part XVIII/Articles 352–360 (Emergency provisions)
- Part XIX/Articles 361–367 (Miscellaneous provisions)
- Part XX/Article 368 (Amendment of constitution)
- Part XXI/Articles 369–392 (Temporary, transitional and special provisions)
- Part XXII/Articles 393–395 (Short title, commencement and repeal of the constitution)

SCHEDULES

- Schedules can be added to the constitution by amendment. The original constitution only had eight schedules.
- The Ninth Schedule was the first schedule added to the original constitution by the 1st Amendment of 1951 and the Twelfth Schedule is the latest schedule added by the 74th Amendment of 1992.
- The 12 schedules in force cover the designations of the states and union territories; the emoluments for high level officials; forms of oaths; allocation of the number of seats in the Rajya Sabha (Council of States, the upper house of parliament) per state or territory; provisions for the administration and control of scheduled areas and scheduled tribes; provisions for the administration of tribal areas in Assam; the union (meaning Central Government), state and concurrent (dual) lists of responsibilities; the official languages; land and tenure reforms and the association of Sikkim with India.

First Schedule (Articles 1 and 4)

- It deals with the territories of the 28 states and 7 union territories of the Indian Union.

Second Schedule (Articles 59, 65, 75, 97, 125, 148, 158, 164, 186 and 221)

- Deals with salaries, allowances, etc., payable to the President of India, Governors of States, Chief Justice of India, Judges of the Supreme Court and High Courts and the Comptroller and Auditor General of India.
- The revised salaries now are as follow:
  1. President of India: ₹1,50,000 per month (also, the government allots, for the upkeep of the president, an annual budget of ₹22.5 crore)
  2. Vice-President: ₹1,20,000 per month
  3. Governor of a state: ₹1,10,000 per month (varies from state to state)
  4. Chief Justice of the Supreme Court: ₹1,00,000 per month
  5. Judges of the Supreme Court: ₹90,000 per month
  6. Chief Justice of a High Court: ₹90,000 per month
  7. Judges of a High Court: ₹80,000 per month

Third Schedule (Articles 75, 99, 124, 148, 164, 188 and 219)

- It prescribes the various forms of oath or affirmation which various incumbents have to take before assuming a public office.

Fourth Schedule (Articles 4 and 80)

- It allocates seats to each state and union territory in the Rajya Sabha. It contains provisions as to the administration and control of scheduled areas.

Fifth Schedule (Article 244)

- It deals with the administration and control of schedules areas.

Sixth Schedule (Articles 244 and 275)

- It deals with provisions regarding administration of tribal areas in the states of Assam, Meghalaya and Mizoram.
- This schedule in the constitution, amended in 1988 by Act 67 of 1988, received the assent of the president on 16 December 1988 and was applied to the states of Tripura and Mizoram with effect from 16 December 1988.

Seventh Schedule (Article 246)

- It gives three lists of powers and subjects to be looked after by the union and the states as follows:
  1. *Union List*: It comprises subjects of all-India importance like Defence, International Affairs, Railways, Post and Telegraph, Income tax, etc. The parliament has the exclusive power to legislate on these subjects. It contains 97 subjects.
  2. *State List*: It contains subjects of local importance. Normally the state legislature alone legislates on these subjects. It contains 66 subjects.

3. *Concurrent List*: It contains subjects on which the parliament as well as the state legislature enjoy authority.

- According to the 88th amendment, service tax is to be levied, collected and appropriated by the union and the states.

Eighth Schedule (Articles 344 and 351)

- It gives a list of 22 regional languages recognized by the constitution.
- Originally there were only 14 languages in the schedule and the 15th language 'Sindhi' was added by the 21st amendment in 1967 and three languages: Konkani, Manipuri and Nepali were added by the 71st amendment in 1992.
- In 2003, the 92nd amendment added four more languages to the list: 'Bodo', 'Dogri', 'Maithali' and 'Santhali'.
- The languages are as follows:

1. Assamese
2. Bengali
3. Bodo
4. Dogri
5. Gujarati
6. Hindi
7. Kannada
8. Kashmiri
9. Malayalam
10. Maithali
11. Marathi
12. Odia
13. Punjabi
14. Sanskrit
15. Sindhi
16. Tamil
17. Telugu
18. Santhali
19. Urdu
20. Konkani
21. Manipuri
22. Nepali

Ninth Schedule (Article 31-B)

- It contains certain acts and regulations of the state legislature dealing with land reforms and abolition of the zamindari system.
- It contains 257 acts.
- This schedule was added to the constitution in 1951 by the First Constitution (Amendment) Act.

Tenth Schedule (Articles 102 and 191)

- It contains certain provisions regarding disqualification of members on grounds of defection.

Eleventh Schedule (Article 243-G)

- It lists 29 subjects on which the panchayats have been given administrative control. It was added to the constitution on 20 April 1992 by the 73rd Amendment in 1992.

Twelfth Schedule (Article 243-W)

- It lists 18 subjects on which the municipalities are given administrative control. It was added to the constitution on 20 April 1992 by the 74th Amendment in 1992.

CITIZENSHIP

- *Part II (Articles 5–11)*: The constitution provides for only single citizenship and there is no separate citizenship of states.
- Citizenship can be acquired (Citizenship Act, 1955) by birth, descent, registration, naturalization, or when India acquires new territories.
- Citizenship can be lost by renunciation, termination or deprivation.
- The parliament can, by law, deprive any person of his citizenship if it is satisfied that citizenship was acquired by fraud, false representation or concealment of material facts.

Dual Citizenship 2005

- Under the Citizenship Act 2003, those eligible to become citizens of India as on 26 January 1950 could apply for dual Indian citizenship.
- The government has extended dual citizenship to all those who were holding the Person of Indian Origin Card (PIOC) and who had migrated from India after the formation of the Indian Republic.
- Persons of Indian origin who were citizens of Australia, Canada, Finland, France, Greece, Ireland, Israel, Italy, the Netherlands, New Zealand, Portugal, Cyprus, Sweden, Switzerland, the United Kingdom and the United States of America were eligible to apply for dual citizenship.
- A person who has been at any time a citizen of Pakistan Bangladesh or any other country that the government may notify in future is not entitled to dual citizenship.

FUNDAMENTAL RIGHTS PART III (ARTICLES 12–35)

- The constitution of India attempts a balance between the fundamental rights of the individual on the one hand and the socio-economic interests of the people and security of the state on the other hand.
- Originally, seven fundamental rights were listed in the constitution. However, after the 44th Amendment 1978, there are now only six fundamental rights, they are as follows:
- Right of Equality (Articles 14–18)
- Right of Freedom (Article 19): It guarantees
  - — Freedom of speech and expression.
  - — Freedom to assemble peacefully and without arms.
  - — Freedom to form associations and unions.
  - — Freedom of movement throughout India.
  - — Freedom to reside and settle in any part of India.
  - — Freedom to practise any profession or to carry on any occupation, trade or business.
- Right Against Exploitation (Articles 23–24)

- Right to Freedom of Religion (Articles 25–28)
- Cultural and Educational Rights (Articles 29–30)
- Right to Constitutional Remedies (Article 32)
- *Right to Property*: Used to be a fundamental right but has now become only a legal right.
- The Janata Government on 20 June 1978 omitted the Right to Property by Constitution (44th) Amendment Act, 1978.
- No person shall be deprived of his property save by authority of law (Article 300A).

What Does Right to Information Mean?

- It includes the right to
  1. Inspect works, documents and records.
  2. Take notes, extracts or certified copies of documents or records.
  3. Take certified samples of material.
  4. Obtain information in form of printouts, diskettes, floppies, tapes, video cassettes or in any other electronic mode or through printouts.

DIRECTIVE PRINCIPLES PART IV (ARTICLES 36–51)

- Part IV of the constitution deals with the directive principles of state policy.
- The main directive principles are as follows:
  - — The act extends to the whole of India except the state of Jammu and Kashmir.
  - — Provision of adequate means of livelihood to all.
  - — Equitable distribution of wealth among all.
  - — Protection of children and youth.
  - — Equal pay for equal work to both men and women.
  - — Free and compulsory education for children up to the age of 14.
  - — Prevention of cow slaughter.
  - — The right to work, education, public assistance in case of unemployment, old age, sickness and disability.
  - — Prohibition of liquor.
  - — Establishment of village panchayats.
  - — Protection of historical and national monuments.
  - — Separation of the judiciary from the executive to secure for all citizens, a uniform civil code.
  - — Promotion of international cooperation and world security.
  - — Free legal aid from the state to the weaker sections of society.
  - — State to protect natural environment, forests and wildlife.

Difference Between Fundamental Rights and Directive Principles

- Fundamental rights constitute a limitation upon state actions whereas directive principles are instruments of instruction to the government to carry out certain responsibilities.
- Directive principles cannot be enforced in a court of law and do not create any justifiable right in favour of an individual.
- The 42nd Amendment Bill, 1976 had given the directive principles precedence over the fundamental rights.

- This amendment also added two more directive principles:
  1. Free legal aid from state to weaker sections
  2. State to protect natural environment, forests and wildlife.

DUTIES OF A CITIZEN OF INDIA PART IVA (ARTICLES 51A)

The 42nd Amendment Bill, 1976 had added 10 fundamental duties and later the 11th was added by the 86th Amendment Act, 2002 [Article 51 A(k)]. These are as follows:

1. To abide by the constitution and to respect its ideals and institutions, the national flag and the national anthem [Article 51 A(a)].
2. To cherish and follow the noble ideas which inspired our national freedom struggle [Article 51 A(b)].
3. To uphold and protect the sovereignty, unity and integrity of India [Article 51 A(c)].
4. To defend the country and render national service when called upon to do so [Article 51 A(d)].
5. To promote harmony and spirit of common brotherhood among all the people of India, transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women [Article 51 A(e)].
6. To value and preserve the rich heritage of our composite culture [Article 51 A(f)].
7. To protect and improve the natural environment [Article 51 A(g)].
8. To develop a scientific temper, humanism and the spirit of enquiry and reform [Article 51 A(h)].
9. To safeguard public property and abjure violence [Article 51 A(i)].
10. To strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement [Article 51 A(j)].
11. To provide opportunities for free and compulsory education to his child or ward between the age of 6 and 14 (added by the 86th Amendment Act, 2002) [Article 51 A(k)].

Important Constitutional Provisions for Minorities

Article 15	Prohibition of discrimination on grounds of religion.
Article 16	Equality of opportunity in matters of public employment.
Article 25	Freedom of conscience and free profession, practice and propagation of religion.
Article 26	Freedom to manage religious affairs.
Article 29	Right to conserve language, script and culture.
Article 30	Right to establish and administer educational institutions.
Article 347	Recognition of language.
Article 350	Redressal of grievances to any authority in the government in any of the languages used in the states/union territories.
Article 350 (A)	—
Article 350 (B)	—

UNION EXECUTIVE PART V (CHAPTER 1, ARTICLES 52–78)

The President

- The president of India is the constitutional head of a parliamentary system of government.
- He represents the nation but does not rule it.
- The real power vests with the council of ministers.
- The president is elected by an electoral college consisting of the following:
  — Elected members of the parliament (both houses).
  — Elected members of the state legislature.

Qualifications

- He must be a citizen of India.
- He must not be less than 35 years of age.
- He must be qualified to be an elected member of the Lok Sabha but shall not be a sitting member.
- He must not be holding any office of profit under the Government of India or any other governments.

Powers

- *Executive and Administrative Powers*: He appoints the senior officials of the state including the prime minister.
- All union territories are under the president of India.
- *Legislative Powers*: (a) Appoints 12 members to the Rajya Sabha and two Anglo-Indian members to the Lok Sabha; (b) dissolves the House of People; (c) assents or withholds his assent to any bill passed by the parliament and (d) issues ordinances.
- *Financial Powers*: (a) Causes the budget to be laid before the parliament; (b) sanctions introduction of money bills and (c) apportions revenue between the centre and the states.
- *Judicial Powers*: A president is Empowered to grant pardons, reprieve, remit the sentences or suspend, remit or commute punishments.
- *Emergency Powers*: Article 352 empowers the president to proclaim an emergency and take under his direct charge the administration of any state.
- The president cannot be questioned by any court for the action taken by him in the discharge of his duties.
- No criminal proceedings can be launched against him.
- He may be removed from office for violation of the constitution by impeachment (Article 61).

Vice President

- *Election*: The vice president is elected by members of an electoral college consisting of the members of both the Houses of Parliament.
- However, his election is different from that of the president as the state legislatures have no part in it.
- *Tenure*: Five years and is eligible for immediate re-election.

Functions

- Acts as ex-officio chairman of the Rajya Sabha.
- Officiates as president in case of death, resignation or removal of the latter.
- Functions as a president when the president is unable to discharge his functions due to illness, absence or any other cause.

Prime Minister

- The prime minister of India heads the council of ministers.
- He is the leader of the party that enjoys a majority in the Lok Sabha.
- He is appointed by the president.
- *Tenure*: Five years and holds the office with the consent of the president till a new Lok Sabha is formed.
- *Resignation*: If the government is defeated in the Lok Sabha (not in Rajya Sabha), the cabinet as well as the Prime Minister have to resign.

Council of Ministers

- The constitution provides for a council of ministers headed by the Prime Minister.
- It is a policy-making body and the government in the real sense.
- The prime minister is appointed by the president and the other ministers are appointed by the president on the advice of the prime minister.
- Any person who is not a member of the legislature can also be appointed as a minister but he cannot continue in that capacity for more than 6 months unless he secures a seat in either House of Parliament.

UNION LEGISLATURE (PART V, CHAPTER II–III, ARTICLES 79–123)

Parliament

- The parliament is the union legislature of India which comprises the following:
  — The president of India
  — The Council of States (Rajya Sabha)
  — The House of People (Lok Sabha)

Rajya Sabha

- It is the Council of States which is also known as the Upper House.
- It is made up of representatives from the states and members nominated by the president, who have distinguished themselves in literature, arts, science or social service.
- *Strength*: 250 members (238 members representing the states and union territories who come through election and 12 members who are nominated by the president).
- *Chairman of the Rajya Sabha*: The vice president of India is the ex officio chairman and the deputy chairman is elected from the members of the Rajya Sabha.
- *Tenure*: The Rajya Sabha is a permanent body not subject to dissolution.
- A third of its members retire after every 2 years.
- Thus, every member enjoys a 6 year tenure.

- *Functions*: Shares with the Lok Sabha the power of amending the constitution.
- It can originate any bill (except a money bill) and refer the charge of impeachment against the president.
- The elected members of the Rajya Sabha take part in the election of the president and the vice president.

Lok Sabha

- Also called the House of People or the Lower House of the parliament.
- It consists of members elected by direct election from territorial constituencies in various states and union territories and two members nominated (Anglo-Indian) by the president.
- *Strength*: 552 (530 represent states and 20 represent union territories and not more than two members of the Anglo-Indian community) to be nominated by the president, only if the president thinks this community is not adequately represented in the house.
- By amending Articles 75 and 164 the size of council of ministers was limited to 15% of the number of members in the Lower House.

Conduct of Business in Parliament

- *Sessions of Parliament*: Article 85(1) provides that 6 months must not intervene between two sessions of the house. However, it is for the president to summon each House of Parliament from time to time.
  - — Generally, there are 3 sessions of parliament annually
    1. Budget session (Feb–May)
    2. Monsoon session (July–Sep)
    3. Winder session (Nov–Dec)
- In the case of the Rajya Sabha, the budget session is split up into two sessions with 3–4 weeks break in between so that it has four sessions in a year.
- The schedule of sessions may vary during an election year or under other special circumstances.
- *Ordinary Bills*: All bills except money bills are introduced in either Houses of Parliament. A bill after debate is passed by a majority vote and sent to the other house.
- In case certain amendments are suggested in the other house, it is sent back to the house where the bill had originated for reconsideration. The bill is regarded as passed by both houses if the original house accepts the amendments of the other house.
  - — It is then presented to the president for his assent. If the president gives his assent to the bill, it then becomes an act. If the president withholds his assent, the bill is nullified.
- If the president neither gives his assent nor withholds his assent, he may return it to the parliament for reconsideration. If the houses pass the bill again after reconsideration, the president is bound to give his assent.
- *Money Bills*: A money bill can originate only in the Lok Sabha on the recommendation of the president. After it has been passed by the Lok Sabha, it is sent to the Rajya Sabha.
  - — The Rajya Sabha is given 14 days to make its recommendation. If it fails to do so within 14 days, the bill is considered as passed by both houses.
  - — If the Rajya Sabha returns the bill with its recommendation, it is up to the Lok Sabha to accept or reject the recommendations.
  - — Even if the Lok Sabha rejects the recommendations of the Rajya Sabha, the bill is considered to have been passed.

- *Joint Sitting of Parliament*: A joint session of both houses is ordered by the president to consider a particular bill in case
  — A bill is passed by one house and is rejected by the other.
  — The amendments made by the other house are not acceptable to the house where the bill originated.
  — A bill remains pending (unpassed) in a house for more than 6 months from the date of its receipt from the house where it originated.

Caretaker Government

- There is no provision in the constitution for anything like a caretaker government.
- The term has come to be used in common parlance to describe the status of a council of ministers that has resigned on having lost the confidence of the Lok Sabha or otherwise but is asked by the president to continue till alternative arrangements are made.
- At the levels of states, if the government cannot be carried on in accordance with the constitution there is provision for president's rule.

Anti-defection Law

- The anti-defection Law in the tenth schedule of the constitution which was supposed to prevent defections in effect, had become an enabling law for larger defections.
- The commission recommended that all defectors must resign and contest fresh elections.
- They should be debarred from holding any public office of a minister or any other remunerative political post without winning at a fresh election.
- Also votes cast by them to topple a government should be treated as invalid.

Supreme Court

- The Constitution of India presents a via media between the principles of parliamentary sovereignty and judicial supremacy.
- The Supreme Court stands at the apex of the judicial system of India.
- *Composition*: The Supreme Court consists of 1 Chief Justice and 25 other judges.
- The chief justice is appointed by the president and the other judges are appointed by the president in consultation with the chief justice.
- *Seat*: The Supreme Court normally sits in New Delhi.
- However it can hold its meetings anywhere in India.
- The decision in this regard is taken by the chief justice of india in consultation with the president.
- *Qualification*: Any citizen who has been a judge of a High Court for 5 years or an eminent jurist or who has been a practising advocate of High Court for a period of 10 years can be nominated as a Supreme Court judge.
- *Functions*
  1. It decides disputes between the union government and the states.
  2. It hears certain appeals in civil and criminal cases from the High Courts.
  3. The president can refer any question of law or fact of sufficient importance to the Supreme Court for its opinion.
  4. It can issue directions or writs for the enforcement of any of the fundamental rights referred by the constitution.

- *Tenure*: Judges of the Supreme Court can hold office up to the age of 65 years.
- After retirement, a judge of the Supreme Court shall not plead or act in any court before any authority in India.

State Executive

- The executive at the state level consists of
  — The governor
  — The chief minister
  — The council of ministers

Governor

- The governor is the nominal executive head of the state and is appointed by the president of India for a term of 5 years. He holds the office with the consent of the president.
- **Powers**
  — Executive powers
  — Legislative powers
  — Financial powers
  — Judicial powers
  — Discretionary powers

President vs. Governor

- The governor of a state cannot appoint the judges of the State High Courts but the president can (in consultation with the governor and the chief justice of India).
- Also the governor has no emergency powers but the President has.

State Council of Ministers

Chief Minister

- The leader of the party that commands a majority in the legislative assembly is invited by the governor to become the chief minister.
- A person who is not a member of the state legislature can be appointed as the chief minister, but the person concerned is required to get himself elected as a member within 6 months of his appointment.
- The chief minister recommends the names of ministers together with proposed portfolios for them to the governor who then appoints them.
- *Tenure*: 5 years

Council of Ministers

- *The Formation of Council of Ministers*: As per the constitution, every state must have a council of ministers to aid and advise the governor in exercising his executive functions (apart from those functions in which he shall act at his discretion).
- Once the governor appoints a chief minister as per the constitution, the chief minister finalizes the list of his ministers which is customarily permitted by the governor.
- Thus the ministry is created in the state and a formal council of minister takes precise shape.
- The council of ministers is permanently interconnected to the state legislature and functions as an executive arm of the state legislature.

- Constitutionally all ministers have to be members of either house of state legislature.
- *The Oath and the Emoluments*: Before a minister enters his office, the governor administers the oaths of office and of secrecy to him according to the forms set out for the purpose in the third schedule.
- The salaries and allowances of ministers are as the legislature of the state specifies.
- *Provisions as to the Council of Ministers*: The council of ministers are collectively responsible to the legislative assembly of the state.
- It means that the ministry can remain in office till it commands the confidence of the Lower House.
- A minister who for any period of 6 consecutive months is not a member of the legislature of the state shall at the expiration of that period cease to be a minister.

State Legislature

- The state legislature consists of the governor and one or two houses as the case may be.
- If the state has only one house, it is known as legislative assembly.
- The other is the legislative council.
- The states having one house are called unicameral and the states having two houses are called bicameral.

Bicameral States

- At present only five states have a bicameral legislature. They are as follows:
  1. Bihar, Jammu and Kashmir, Karnataka, Maharashtra and Uttar Pradesh.
  2. All other states have only one house.

Legislative Council (Vidhan Parishad)

- Also known as the Upper House.
- *Strength*: The total strength does not exceed one-third of the strength of the legislative assembly, subject to a minimum of 40 members.
- The strength varies as per population of the state concerned.
- *Tenure*: Six years with one-third of the members retiring every 2 years.
- *Election*: One-third of the members of a legislative council are elected by local bodies, one-third by the legislative assembly, one-twelfth by university graduates of at least 3 years standing, similar proportion by teachers and one-sixth are nominated by the governor.

Legislative Assembly (Vidhan Sabha)

- Also known as the Lower House.
- *Strength*: Legislative assembly consists of not more than 525 members and not less than 60 members.
- However, the legislative assembly of Sikkim has only 32 members.
- *Tenure*: 5 years.
- *Election*: Members are chosen by direct election from the territorial constituencies of the state.
- The council of ministers is collectively responsible to the assembly.
- The chief minister is the leader of the house.

State Judiciary

High Court

- Each state has a High Court which is the highest judicial organ of the state.
- However, there can be a common High Court for two or more states.
- For example, Punjab, Haryana and the union territory of Chandigarh have a common High Court.
- At present, there are 21 High Courts in the country.
- *Constitution*: The state judiciary consists of a chief justice and such other judges as the president of India may deem necessary to appoint.
- The strength of High Courts is not identical.
- For example, the Allahabad High Court has 37 judges against 5 in the Jammu and Kashmir High Court.
- *Term*: A judge of the High Court holds office till the age of 62 years.
- His term can be cut short due to resignation or removal by the president through the process of impeachment in the parliament.
- He vacates his office either on his appointment as judge of the Supreme Court or when he is transferred to another High Court.
- *Removal*: The president can remove a judge of the High Court only if the parliament passes a resolution by a two-third majority of its members present and voting in each house, requesting him to remove a judge.
- *Restriction on Legal Practice*: A person who has held office of a judge of the High Court is not allowed to practise law before the authority of the same court except the Supreme Court and a High Court other than the one in which he served as a judge.
- *High Court's Power of Superintendence*: Each High Court has power of superintendence over all courts within its jurisdiction.
- It can call for any returns from such courts, make and issue general rules and prescribe forms to regulate their practice and proceedings and determine the manner and form in which book entries and accounts shall be kept.

Functions of the High Courts

- *Judicial*: A High Court has original appellate and revisory jurisdiction with respect to revenue and its collection as also for enforcement of the fundamental rights.
- It is a 'Court of Record' and its decisions are referred to in all future cases.
- *Administrative*: It supervises the working of all subordinate courts and frames rules and regulations for the transaction of business.
- It can examine the records of subordinate courts.
- However, it does not have any power of superintendence over any court or tribunal constituted under any military law.

Appointment of Judges

- Every judge of a High Court including the chief justice is appointed by the president.
- The appointment of the chief justice is made after consultation with the chief justice of India and the governor of the state concerned.
- In case of appointment of a judge, the chief justice of the High Court concerned is also consulted in addition to the chief justice of India and the governor of the state concerned.

- Appointment of all judges is, however, done by the president only.
- On 6 October 1993, the constitution bench of the Supreme Court held that the opinion of the chief justice (of the concerned High Court and the Supreme Court) will have primacy on both the appointment as well as transfer of senior judges.
- *Qualification*: For appointment as a judge to the High Court, the person must be a citizen of India, should have been an advocate of a High Court or of two such courts in succession for at least 10 years, or should have held judicial office in Indian territory for a period of at least 10 years.

Panchayati Raj System in Independent India

Balwantrai Mehta Committee

- After the independence, a 'Community Development Programme' was started in 1952 but because it was not attached to the people, it did not prove to be a success story.
- People took it as a burden put on them by the government.
- A team, under the leadership of Balwantrai Mehta, tried to find out the cause for the failure of this programme and came up with the inference that there should be an organization at the village level which would select the true beneficiaries and implement various government programmes and schemes.
- This organization would act as the representative of all villagers and would ensure the development of the village as well as participation of villagers.
- In this way, Balwantrai Mehta tried to achieve local self-government through panchayats.
- This concept of local self-government was the right step towards a decentralized democracy.
- In this process, for the first time the state of Rajasthan adopted the three-levelled structure of panchayati rajvillage level, intermediate level and district level.

Ashok Mehta Committee

- In 1977, the Ashok Mehta Committee was set up to review the working of panchayats.
- The committee found out that the panchayati raj is the soul of democracy and therefore it should be empowered with more authority.
- The panchayats which were formed after 1977 are known as second-generation panchayats.
- In West Bengal, panchayats became more effective after accepting the suggestions made in this report.
- During the 1990s, it was realized that without constitutional power, self-government cannot be fruitful and therefore the Central Government passed the 73rd Constitutional Amendment Act in 1992, which became effective from 20 April 1993 (from the date of publication in the Gazette of India).

Basic Concepts of Panchayati Raj

- Panchayati Raj works on the underlying principle of enabling the masses in the rural set-up to think, decide and act as per their own socio-economic interests.
- Thus the Panchayati Raj Act is related to village self-governance, where the people in the form of an organization will think, decide and act for their collective interest.
- Self-government allows us to decide about ourselves without hampering others' interest.

- Whenever we talk about collective benefits, one point is clear that there is no conflict between the villagers' collective interest on one side and societal and national interest on the other rather they are complementary.
- Where panchayats end their activities, the state government takes them up.

Zonal Councils

- The five zonal councils are as follows:
  1. *Northern Zone*: It comprises the state of Haryana, Punjab, Rajasthan, Jammu and Kashmir, Himachal Pradesh and the National Capital Region of Delhi.
  2. *Eastern Zone*: It comprises Bihar, Jharkhand, West Bengal, Orissa, Assam, Manipur, Tripura, Nagaland, Arunachal Pradesh, Mizoram and Meghalaya.
  3. *Central Zone*: It comprises the states of Uttar Pradesh, Uttarakhand, Madhya Pradesh and Chhattisgarh.
  4. *Western Zone*: It comprises Gujarat, Maharashtra and Goa.
  5. *Southern Zone*: It comprises Andhra Pradesh, Tamil Nadu, Karnataka and Kerala.

Functions

- Zonal councils act as a consultative body to discuss matters of common interest of member states.
- It recommends the member states on the issues of (a) social planning; (b) inter-state transport; (c) economic planning; (d) border dispute and (e) matters concerning minorities, etc.

Attorney General of India

- The attorney general is the chief law officer of the government. He advised the government on legal matters and perform other duties of a legal nature as may be assigned.
- The constitution has a provision for the president to appoint a person qualified to be a Supreme Court judge as the attorney general of India.
- The attorney general of India has first right of audience in all courts of India.
- He holds office during the pleasure of the president. However in as much as he is appointed on the advice of the government, a convention has grown that with a change in government he submits his resignation.

Political Process in India

- India is a constitutional democracy with a parliamentary system of government and at the heart of the system is a commitment to hold regular, free and fair elections.
- These elections determine the composition of the government, the membership of the two Houses of Parliament, the state and union territory legislative assemblies and the presidency and vice presidency.
- The decline of the Congress (I) since the late 1980s has brought an end to the dominant single-party system that had long characterized India's politics.
- Under the old system, conflict within the Congress was often a more important political dynamic than conflict between the Congress and the opposition.
- The Congress had set the political agenda and the opposition responded.

- A new party system in which the Congress (I) is merely one of several major participants was in place by 1989.
- As often as not in the mid-1990s, the Congress (I) seems to respond to the initiatives of other parties rather than set its own political agenda.

General Elections in India

- At least once every 5 years, India's Election Commission supervises one of the largest, most complex exercises of collective action in the world.
- India's elections in the 1990s involved overseeing an electorate of about 521 million voters who travelled to nearly 6,00,000 polling stations to choose from nearly 8950 candidates representing roughly 162 parties.
- The elections reveal much about Indian society.
- Candidates span a wide spectrum of backgrounds, including former royalty, cinema superstars, religious holy men, war heroes and a growing number of farmers.
- Campaigns utilize communication technologies ranging from the latest video van with two-way screens to the traditional rumour travelling by word of mouth.
- Increasing violence also has come to characterize elections.
- In 1991, about 350 people including former Prime Minister Rajiv Gandhi, 4 other parliamentary candidates and 21 candidates running in state legislative assembly elections were killed in election-related violence.

Political Parties in India

- India's party system is in the throes of historic change.
- The 1989 general elections brought the era of Congress dominance to an end.
- Even though the Congress (I) regained power in 1991, it was no longer the pivot around which the party system revolved.
- Instead, it represented just one strategy for organizing a political majority and a declining one at that.
- While the Congress (I) was encountering growing difficulties in maintaining its coalition of upper-caste elites, muslims, scheduled castes and scheduled tribes, the BJP was endeavouring to organize a new majority around the appeal of Hindu nationalism.
- The Janata Dal and the BSP, among others, were attempting to fashion a new majority out of the increasingly assertive backward classes, Dalits, scheduled castes, scheduled tribes and religious minorities.
- AAP (Aam Aadmi Party) under the leadership of Arvind Kejriwal was launched in 2013 and in its first attempt at the Delhi Assembly polls 2013, it became the second largest party in state, thereon formed the government with support from the Congress party.

Indian Elections/Political System

- The word candidate comes from the Latin '*candidatus*' meaning 'one clad in white' and most, till this day, carry on with this white.
- 'Ballot' and 'bullet' are both derived from words for 'balls'.
- The Greeks dropped a white ball when they favoured a candidate and a black when they were against.
- The term 'blackballed' comes from this too.

- Designed by Electronics Corporation of India Ltd. and Bharat Electronics Ltd., electronic voting machines were first used in Kerala.
- The highest number of candidates that an electronic voting machine can support is 64.
- If the number exceeds this, the manual ballot is used.
- In the Modaurichi assembly constituency in Tamil Nadu, 1033 candidates fought for a single seat in 1996.
- The ballot paper was in the form of a booklet!
- The Congress in 1988 did not win a single seat in Uttar Pradesh.
- Mayawati's BSP and George W. Bush's Republican Party both have the same electoral symbol—the elephant.
- The lowest voter turnout in a polling station is three.
- It happened in Bomdila district in Arunachal Pradesh.
- Elections in the 1950s were carried out using different ballot boxes for each candidate rather than voting on ballot paper.
- Different coloured boxes represented different parties.
- Chhindwara in Madhya Pradesh is the only constituency in the Hindi belt which has always returned the Congress candidate during the general elections.
- Atal Bihari Vajpayee is the only politician who has won from six different constituencies: Balrampur (1957, 1967), Gwalior (1971), New Delhi (1977, 1980), Vidisha (1991) Gandhinagar (1956) and Lucknow (1991, 1996, 1998, 2004).
- He is also the only parliamentarian to be elected from four different states—Uttar Pradesh, Gujarat, Madhya Pradesh and Delhi.
- BJP won Lok Sabha seats for the first time in the states of Tamil Nadu and West Bengal in 1998.
- Rajnandagaon in Madhya Pradesh has a unique feature—father, mother and son have represented this constituency at different times.
- The highest voting percentage in any general election has been 62.2% in 1957, the lowest was in 1967 when only 33% citizens cast their vote.

OFFICIAL LANGUAGE: HINDI

- The makers of the Indian constitution faced a peculiar problem in selecting a national language as more than 1600 spoken languages were used by the vast population of India.
- The official language of the union was decided to be Hindi in Devanagari script [as per Article 343(1) of the constitution] but for a period of 15 years from the commencement of the constitution, the English language was allowed to be used for all official purposes of the union for which it was being used immediately before such commencement.
- Thus, English continued to be the official language of the union side by side with Hindi until 1965 and thereafter the use of English for any purpose depended on parliamentary legislation.
- The parliament made this law by passing the Official Languages Act, 1963.
- The act also lays down that both Hindi and English shall compulsorily be used for certain specified purposes such as resolutions, general orders, rules, notifications,

press communiques, administrative and other reports, licences, permits, contracts, agreements, etc.

- The official language(s) of any state shall be as the state legislature adopts (Article 345).
- The president, under Article 350B, appoints the special officers for linguistic minorities.
- The Supreme Court and High Court use the English language as per Article 348.

AMENDMENT OF THE CONSTITUTION: PROCEDURE (ARTICLE 368)

- The methods of amendment are three, according to the subject matter of the article concerned:
  1. Articles that may be amended by a simple majority.
  2. Articles that may be amended by a two-thirds majority of both Houses of Parliament—these are comparatively important matters.
  3. Articles that require not only a two-thirds majority of the parliament but also ratification by at least one-half of the state legislatures.
- It may be noted that provisions which affect the federal character of the constitution can be amended only with the approval of the states.
- Further, the initiative to amend the constitution rests only with the centre and the states cannot initiate any amendment.
- Following are the subjects of amendments: (a) fundamental rights, (b) territorial changes, (c) transitional provisions and (d) democratic reforms.
- The democratic reforms further include the following:
  1. Restrictions on imposition of an internal emergency.
  2. Creation of mechanisms for Panchayati Raj (local self-governance).
  3. Disqualification of members from changing party allegiance.
  4. Restrictions on the size of the cabinet.
  5. Creation of the National Commission for Scheduled Castes.
  6. Creation of the National Commission for Scheduled Tribes.

CHAPTER

3 INDIAN GEOGRAPHY

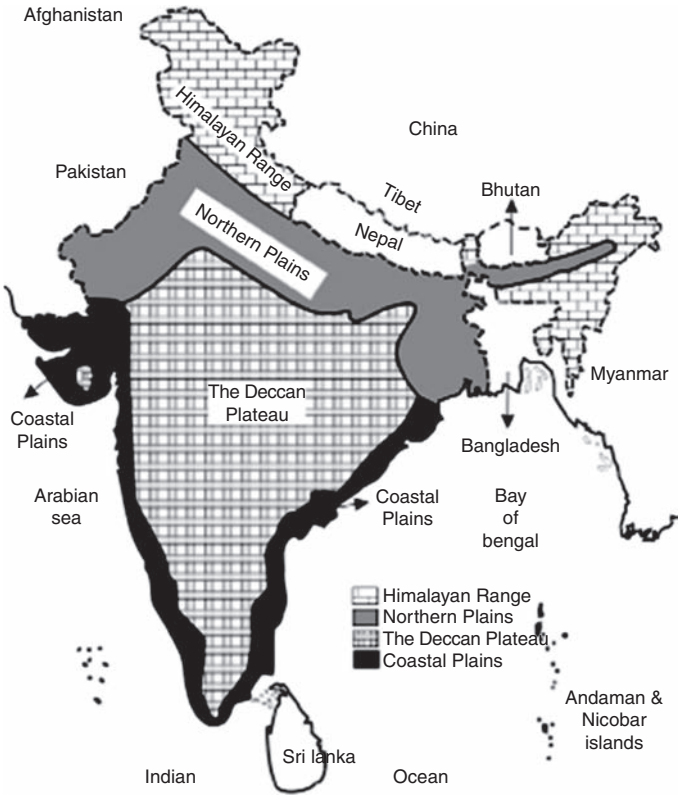
LOCATION, DIMENSIONS AND FRONTIERS

Location

- India occupies the south-central peninsula of Asia.
- India belongs to the northern hemisphere, since it is situated totally to the north of the equator.
- The southern tip of the Indian mainland misses the equator only by a few degrees.
- India lies in the northern hemisphere between 8°4′ N and 37°6′ N parallels of latitude and between 68°7′ E and 97°25′ E meridians of longitude and is part of the Asian continent.
- The country can be divided into six zones (i) north, (ii) south, (iii) east, (iv) west, (v) centre and (vi) north-east.
- It has 29* states and 7 union territories. These are as follows:
  1. *States*: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal.
  2. *Union Territories (UTs)*: Andaman and Nicobar Island, Chandigarh, Dadra and Nagar Haveli, Daman and Diu, Delhi (NCT), Lakshadweep and Puducherry.
- India stands apart from the rest of Asia, marked off by mountains and the sea which give her distinct geographical entity. Bounded by the great Himalayas in the north, it stretches southwards and at the Tropic of Cancer (23° 30′N) tapers off into the Indian Ocean between the Bay of Bengal on the east and the Arabian Sea on the west.
- It is a country in South Asia that lies entirely on the Indian Plate in the northern portion of the Indo–Australian Plate.
- India is the seventh largest country in the world in terms of area—accounting for about 2.4% of total world area—and also ranks second in terms of population.
- Six other countries larger than India are two to five times larger in area. These are Russia (1,71,24,442 km^2 and the largest country in the world); Canada (99,84,670 km^2); China (97,06,961 km^2); United States (96,29,091 km^2); Brazil (85,15,767 km^2) and Australia (76,92,924 km^2).

*On 4 March 2014, the Government of India notified in the official gazettee that the new state of Telangana will come into existence. 2 June 2014 onwards, Telegana has become the 29th state of India.

- Of the total area of India, land consists of 29,73,193 km^2 and water 3,14,070 km^2. This way about 9.55% of India's area consists of water.
- Area-wise it is 12 times larger than the United Kingdom and 8 times the size of Japan. The total area of European Unions (all its 28 member nations combined) is 43,81,376 km^2 which makes India to be about 3/4th of European Union area-wise.
- India consists of the mainland and two groups of islands, namely, Lakshadweep in the Arabian Sea (southeast of mainland) and Andaman and Nicobar in the Bay of Bengal (in the southwest of the mainland).
- Kanyakumari, the southernmost tip on the mainland, is situated on three seas and narrows before ending in the Indian Ocean. The southern-most point of the Indian Union is Indira Point located on the Andaman and Nicobar Island group not very far from Indonesian islands. Indira Point got submerged in 2004 during the tsunami.
- Lakshadweep Islands are comparatively less scattered and are nearer to the Indian coast.
- India has a very long coastline, approximating in length the radius of the earth.
- The latitudinal and longitudinal extent of the country are almost the same in degrees, that is, about 30° but in kilometres, the north–south distance (about 3200 km) is more than that of the east–west distance (approximately 3000 km).
- Time difference between the two extreme points in the east and west is of 2 h due to vast longitudinal extent.
- Time along the Standard Meridian of India (82°30′ E) passing through Allahabad is taken as the standard time for the whole country.
- The Tropic of Cancer (23°30′ N) divides India into almost two equal parts.
- The northern part is a broad region spreading from east to west, consisting of plains and the Himalayan mountains.
- The areas to the south of the Tropic of Cancer are triangular in shape having a base in the north and the land tapers towards the south. It mostly coincides with the peninsular plateau but also includes eastern and western coastal strips.
- From Gujarat to Arunachal Pradesh, there is a time lag of 2 hours. Hence, time along the Standard Meridian of India (82°30′E) passing through Mirzapur (in Uttar Pradesh) is taken as the standard time for the whole country. The latitudinal extent influences the duration of the day and night as one moves from south to north.
- The coastline of peninsular India is 5423 km and that of Andaman, Nicobar and Lakshadweep Islands is 2093.6 km. The mainland coast (Peninsular India) consists of 43% sandy beaches, 11% rocky coast including cliffs and 46% of marshy coast.
- India's highest point officially is K2 at 8611 m and it lies in Gilgit–Baltistan region (presently lie in the POK). Kangchenjunga in Sikkim at 8598 m is the highest point within India's current geographic boundaries.
- Thar desert is the world's ninth largest subtropical desert (area: more than 2,00,000 km^2).
- The soils in the Thar desert are of the Arid Zone and generally sandy to sandy-loam in texture.
- India is bounded by the Indian Ocean in the South, in the South-west by the Arabian Sea and in the South-east by the Bay of Bengal.
- The territorial waters of India extend into the sea to a distance of 12 nautical miles (22.2 km). The Maldives, Sri Lanka and Indonesia are island nations to the south of India.



This map is a sketch only, drawn not to scale, presented for reference and to aid understanding of the concept.

Dimensions

- Distance from north to south—3214 km
- Distance from east to west—2933 km
- Length of coastline—7516.6 km
- Length of land frontier—15,200 km
- Total geographic land area—32,87,263 km^2
- Percentage of earth's surface covered by India—2.4%
- Percentage of world's popu-lation living in India—17.5%
- India's territorial sea—12 nm (nautical miles)
- India's contiguous zone—24 nm (nautical miles)
- India's exclusive economic zone—200 nm (nautical miles)
- India's longest river—Ganga
- India's largest lake—Lake Chilka
- India's highest point—Mt. K-2 (8611 m)
- India's highest point of himalayas—Kangchenjunga (8598 m)
- India's lowest point—Kuttanad (–2.2 m)
- India's northernmost point—Siachin Glacier near Karakoram
- India's southernmost point—Indira Point, Great Nicobar, Andaman and Nicobar Islands
- India's westernmost point—West of Ghur Mota, Gujarat
- India's easternmost point—Kibithu, Arunachal Pradesh
- India's highest altitude—Kangchenjunga, Sikkim
- India's lowest altitude—Kuttanad, Kerala

Frontiers

- *North*: The Himalayan range, China (Border length: 4057 km), Bhutan (Border length: 699 km) and Nepal (Border length: 1751 km) separate India from Tibet.
  —The Siliguri Corridor, sandwiched between the borders of Bhutan, Nepal and Bangladesh, connects mainland India with the northeastern states.
  —The boundary line between India and China is called the McMahon Line.
  —The latitudinal and longitudinal extent of India is almost the same in degrees, that is, 30 degrees. But in kilometres, the north-south distance (approx. 3200 km) is more than that of the east-west distance.
- *East*: The Chin Hills and Kachin Hills, deeply forested mountains, separate India from Myanmar or Burma, to the far north-east. Bangladesh is separated from India (Border length: 4096 km) by watershed region of the Indo-Gangetic plan, the Khasi hills and the Mizo Hills.
- *West*: Pakistan lies on the Punjab Plain and the Thar desert (Border length: 3323 km). Afghanistan lies on the north west (Border length: 106 km).
- *South*: Indian Ocean and Sri Lanka, Gulf of Mannar and Palk Straits separate India from Sri Lanka.

International Boundaries Touching Indian States

- *Afghanistan*: 1 state [Jammu and Kashmir (Pakistan occupied area)]
- *Bangladesh*: 5 states (West Bengal, Mizoram, Meghalaya, Tripura, Assam)
- *Bhutan*: 4 states (West Bengal, Sikkim, Arunachal Pradesh, Assam)
- *China*: 5 states (Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh)
- *Nepal*: 5 states (Bihar, Uttarakhand, Uttar Pradesh, Sikkim, West Bengal)
- *Myanmar*: 4 states (Arunachal Pradesh, Nagaland, Manipur, Mizoram)
- *Pakistan*: 4 states (Jammu and Kshmir, Punjab, Rajasthan, Gujarat)

These include mainland frontiers only.

PHYSICAL FEATURES

- The subcontinent is divided into three fundamental segments or units:
  1. The Himalayas and their extensions to the east and the west
  2. The Indo-Gangetic plains to their south
  3. The peninsular India

  Yet, there is a fourth division though not so well marked and i.e., coastal plains, surrounding the peninsula together with the continental margins on the front.
- The stratigraphy, evolution and structure of these divisions are entirely unlike each other.

1. *The Himalayan Range*: The Himalayas, amongst the youngest fold mountains in the world, surround India on the north, north-west and north-east forming an arc.
   - The Himalayas and the mountain chains that extent beyond them are made up mainly of Proterozoic and Phanerozoic sediments largely marine and are tectonically highly distributed.
   - They are characterized by highly folded and faulted rocks and physically attain colossal heights.

- It is part of the great mountains of the north which run along the northern border of India and has two parts:
  1. The Karakoram
  2. The Himalayas
- The Karakoram has a number of ranges like Zaskar, Ladakh and Pirpanjal with mainly river Jhelum that flows in this region.
- The Himalayas has three important ranges:
  1. Himadri
  2. Himachal
  3. Siwalik
- They are about 2400 km in length and vary in width from 240–320 km.
  1. The Greater Himalayas (or northern range) average approx. 6000 m in height and contain three highest mountains on earth—Mount Everest (8848 m), K-2 or Mount Godwin Austin (8611 m) and Kanchenjunga (8598 m).
     —Such high altitudes admit travel to a few passes only, notably Shipki La [in Satluj valley—north east of Kalpa (Kinnaur)] and Jelep La and Nathu La (on the main Indo-Tibet trade route through the Chumbi valley, north-east of Darjeeling).
     —Greater Himalayas or Himadri, under perpetual snow, contains several glaciers which are sources of rivers like Ganges and Yamuna. The core of this part of the Himalayas is composed of granite.
  2. The lesser Himalayas (averaging 1500–5000 m in height) or Himachal (averaging 1500–5000 m in height) are situated south of the greater Himalayas. The average width is of 50 km.
     —While the Pir Panjal range forms the longest and the most important range, the Dhaula Dhar and the Mahabharat ranges are also prominent ones.
     —This range consists of the famous valley of Kashmir, the Kangra and Kullu Valley in Himachal Pradesh. Many health resorts are situated on the southern sole of the mountain range.
     —These ranges are mainly composed of highly compressed and altered rocks.
  3. The outer Himalayas (or the southern Himalayas) (averaging between 900 m and 1200 m in height lie between the lesser Himalayas and the Indo-Gangetic plains).
     —These discontinuous ranges join the lesser Himalayas in the extreme east. The longitudinal valley lying between the lesser Himalayas and the Shiwaliks are known as Duns. Dehra Dun, Kotli Dun and Patli Dun are some of the well-known Duns.
     —These ranges are composed of unconsolidated sediments brought down by rivers from the main Himalayan ranges located farther north. These valleys are covered with thick gravel and alluvium.

2. *The Northern Plains or the Indo-Gangetic Plains*: Formed by the valleys of the rivers Ganges and Brahmaputra, with a length of about 2400 km and width ranging between 240–320 km.
   - These plains occupy one-third of India's land surface and form the most fertile region. According to terrain characteristics this plain consists of two parts.
   - The Indo-Gangetic region is a very young feature formed only during the Quaternary Period.

- It has little to show by way of high relief and generally consists of undulating plains carved by highly developed river system.
- Its surface is covered by sediments of the Mid-late Pleistocene and Holocene or Recent Age.
- On the west it includes the vast stretch of the Thar Desert.
- The upland plains which lie above the flood level are made up of alluvial soil. It is one of the most fertile areas in the world.
- The low lands are liable to inundation during floods.
- The great plains comprises levelled land to the south of the great mountains of the north made up of fertile allvium soil.
- The great plains are confined by the northern mountains on the east, north and west and the peninsular plateaus on the south.
- The Assam plains comprises the Brahamputra valley; the eastern plains cover the Bengal basin and Bihar; the northern plains are spread over the Uttar Pradesh–Punjab doabs and the Indus plains cover the areas of the Punjab and Sind watered by the great river.
- So it consists of the lndus Basin, Ganga Basin and Brahmaputra Basin. River Indus and its tributaries—Jhelum, Chenab, Ravi, Beas and Sutlej—rise beyond the Himalayas.
- The tributaries of River Ganga either rise in the Himalayas or in the peninsular plateau. Yamuna, Ghaghara, Gandak, Kosi and Tista rise in the Himalayas. Chambal, Sindh, Betwa, Son, Ken and Damodar rise in the peninsular plateau. River Brahmaputra rises beyond the Himalayas.

3. *The Deccan Plateau*: Lying south of the northern plains, the plateau is flanked by mountain ranges called the eastern and western Ghats.
   - It is a comparatively stable mass of Precambrian rocks (except for the coastal tracts), some of which have been there since the formation of the earth.
   - It is geographically the oldest region of India, with rocks which are 3000–5000 million years old. The higher Deccan peaks reach over 2500 m which include the Nilgiri Hills.
   - The topography of the peninsula is also rugged but not in the way of the Himalayas. Barring Aravalli Range, most of the hills do not owe their origin to tectonics but to denudation of the pre-existing plateaus leaving relict chains they are mountains of circumdenudation.

4. *Coastal Plains*: The northern portion of the western coastal plain is called the Konkan and the southern portion is called the Malabar coast. The eastern coastal strip is known as the Coromandel coast.
   - The great plateau of peninsular lndia is located to the south of the great plains made up of hard igneous rocks. It has two parts:
     1. The Malwa plateau in the north which slopes towards the north
     2. Deccan plateau in the south
        —To the north-west of the Malwa plateau lies the Great Indian Desert, a region of inland made up of rocks and sand.
        —The Deccan plateau is located to the south of River Narmada. It is enclosed by western ghats and eastern ghats.

- They are old mountains and the western Ghats are formed by four major hills which run parallel to the Arabian Coast.
- The eastern ghats are low and discontinuous. They are near the Bay of Bengal coast. There are many rivers in the plateau which flow either into the Arabian Sea or the Bay of Bengal.
- The western coastal plains which is a narrow strip is divided into the Konkan coast and the Malabar coast. It has estuaris and lagoons.
- The eastern coastal plains is wider and is divided into northern circas and Coromandal Coast. It possesses fertile deltas.

Aravallis and Deccan Mountains

1. *The Aravallis*: The oldest mountain range in India. The highest peak in this range is Guru Shikhar at Mount Abu, rising to 1722 m lying near the border with Gujarat.
2. *The Vindhyas*: Separate the southern part of India from the northern part. Extending 1050 km the average elevation of these hills is 3000 m.
3. *The Satpuras*: Between the rivers Narmada and Tapti. It extends to 900 km with many peaks rising above 1000 m. It runs parallel to the Vindhya Range which lies to the north and these two east-west ranges divide the Indo-Gangetic plain from the Deccan plateau located north of River Narmada.
4. *Western Ghats*: Run along the western edge of India's Deccan plateau and separate it from a narrow coastal plain along the Arabian Sea. The range runs approximately 1600 km and average elevation is about 915–1220 m.
5. *Eastern Ghats*: Though not as tall as the western ghats some of its peaks are over 1000 m in height. Average elevation is about 610 m. The Nilgiri hills in Tamil Nadu lies at the junction of the eastern and western ghats.

ISLANDS

- There are two groups of islands:
  1. *Andaman and Nicobar Group*: The northern cluster of 204 small islands comprise the Andamans and the southern cluster of 19 small islands are the Nicobar islands.
  2. *Lakshadweep*: A group of 27 coral islands scattered in the Arabian Sea 300 km west of Kerala.
- The Andaman-Nicobar chain in the Bay of Bengal represents the elevated portions of submarine mountains while the Lakshadweep group in the Arabian Sea is entirely built by corals.

DESERTS

- The Thar desert also known as the Great Indian Desert is a large, arid region in the northwestern part of the Indian subcontinent and forms a natural boundary running along the border between India and Pakistan.
- Because the arid Thar desert is entirely different in charater from highly fertile plains of the Indus-Ganga-Brahamputra systems, it is regarded as a separate physiographic entity.

- It extends from the Sutlej river and has the Indus river on the west. The Aravalli forms the main landmark to the south-east of the Thar desert with the Rann of Kutch, the salt march sometimes included in Thar is on its south.
- It lies mostly in the Indian State of Rajasthan (touches the southern portion of Haryana and Punjab and northern Gujarat). The Cholistan desert adjoins the Thar desert spreading into Pakistani Punjab province.

SOILS IN INDIA

1. *Alluvial Soil*: Areas of the Indo-Gangetic plain covering almost a quarter of Indian soil and are very fertile. Found in Punjab, Haryana, Uttar Pradesh, Uttarakhand, Bihar, Jharkhand and West Bengal.
2. *Black Soil*: It is a rich mineral soil formed by deposition of lava ejected by volcanoes and is suitable for cotton cultivation. It is found in Maharashtra, Gujarat, Western Madhya Pradesh, Chattisgarh, Andhra Pradesh and Tamil Nadu. It is also known as regun soils.
3. *Red Soil*: Formed by the weathering of ancient metamorphic and crystalline rocks and having a high iron content. It is good for cultivation of pulses and coarse grains. Found in Madhya Pradesh, Chattisgarh, Orissa, Andhra Pradesh, Tamil Nadu, Karnataka and the North-eastern hill states.
4. *Laterite Soil*: Formed by the weathering of laterite rocks. It is found in areas occupied by the Deccan, Andhra Pradesh, Eastern Ghats, Karnataka, Tamil Nadu, Coast of Orissa, Meghalaya and Assam.

   Other types of soil found in India are saline and alkaline soils, peat and marshy soils, arid or desert soils and forest soil.

RIVER SYSTEMS OF INDIA

- The rivers of India are broadly classified into the following:
  1. *The Himalayan System*: These are perennial, snow-fed rivers. During the rainy season, they are generally flooded and carry 70% of the total discharge of river water into the sea. The three great Himalayan rivers are shown in Table 3.1.

Table 3.1 The Himalayan River System

Name	*Source*	*Length*	*Enters into*
Indus River System	*Mount Kailash in Tibet* (near Mansarovar Lake)	*2900 km*	*Arabian Sea*
Sutlej	Mansarovar Rakas Lakes	1050 km	Chenab
Beas	Near Rohtang Pass	470 km	Sutlej
Ravi	Near Rohtang Pass	720 km	Chenab
Chenab	Near Lahol Spiti Districts of H.P.	960 km	Indus
Jhelum	Verinag in Kashmir	725 km	Chenab

(*Continued*)

Name	*Source*	*Length*	*Enters into*
Ganges River System	*Gangotri Glacier in the Himalayas* Yamnotri	*2510 km*	*Bay of Bengal* Ganga
Yamuna	Gomat Taal (Fulhar Jheel)	1375 km	Ganga
Gomti	near Pilibhit	900 km	
	Matsatung Glacier		Ganga
Ghagra	Vidhyanchal	1080 km	Yamuna
Betwa	Ahirgawan (Kaimur Range)Jabalpur	480 km	Yamuna
Ken	district	427 km	
	Amarkantak		Ganga
Son	Near Gosain Dham Park	780 km	Ganga
Kosi	Chambal region in Madhya Pradesh	730 km	Yamuna
Chambal		1050 km	
Brahmaputra River System Originates in the Mansarovar Lake in Western Tibet and flows southwest of Tibet as Yarlung Tsangpo River, enters India in Arunachal Pradesh in rapid descent (where it is called Siang) and slows down in plains of Assam Valley (where it is called Dihang) and is joined by Dibang river and later by Lohit river and thereon gets the name 'Brahmaputra'. The principal tributaries of Brahamputra in India are the Subansiri, Jia Bhareli, Dhansiri, Puthimari, Pagladiya and the Manas.		*2900 km** (A Chinese researcher has confirmed its origination from Angsi Glacier and length as 3848 km. But it has not been notified by Indian authorities as yet)	*Bay of Bengal* (Flows southward through Bangladesh into the Ganges Delta and merges with the Padma, the main distributary of the Ganges, then the Meghna on the way to the Bay of Bengal)

*The holy Ganges is the longest river in the country. The 2900 km Brahmaputra is longer than the Ganges but only one-third of the river passes through India.

2. *The Deccan System*: These are seasonal rivers as their flow mainly depends on rainfall. They carry about 30% of total discharge of Indian rivers. Godavari is the largest river system in peninsular India. The Kaveri system is the southernmost in the country.
3. *Coastal River System*: These are numerous comparatively smaller coastal rivers. While there are more than 600 such rivers on the west coast, only a few of them drain into the sea near the delta on the east coast.

Table 3.2 The Third River System

Name	*Source*	*Length*	*Enters into*
1. Godavari	Western Ghats	1450 km	Bay of Bengal
Krishna		1290 km	
Kaveri		760 km	
Pennar		560 km	

(*Continued*)

Name	*Source*	*Length*	*Enters into*
2. Mahanadi	North-west of the Deccan	890 km	Bay of Bengal
Damodar	plateau	592 km	
3. Narmada	Northernmost portion of the Deccan	1290 km	Arabian Sea
Tapti	plateau	724 km	
4. Sharawathy	Western ghats	124 km	Arabian Sea
Netravati		—	
Bhartapuzha		250 km	
Periyar		300 km	
Pamba		176 km	

4. *The Rivers of the Inland Drainage Basin*: These are small rivers in sandy areas of Rajasthan called 'rivers of inland drainage basins', with no outlet in sea except Luni which drains into the Rann of Kutch. Other such prominent rivers are Machchu, Rupen, Saraswati, Banas and Ghaggar, etc.

This map is a sketch only, drawn not to scale, presented for reference and to aid understanding of the concept.

LAKES

- The Himalaya region is dotted with hundreds of lakes. Most lakes are found at altitudes of less than 5000 m with the size of the lakes diminishing with altitude.
- The largest lake is the Pangong Tso which is spread across the border between India and Tibet. It is situated at an altitude of 4600 m and is 8 km wide and nearly 134 km long. The highest lake is the Gurudogmar in North Sikkim, 5370 m.
- Lakes of India have different kinds of origins:
  —*Tectonic Lakes*: Old Pleistocene Lakes of Kashmir and Kumaon Himalayas.
  —*Crater Lakes*: They are due to volcanicity.
  —*Glacial Lakes*: They are in big mountains.
  —*Alluvial Lakes*: Oxbow lakes in the Ganga plains.
  —*Aeolian Lakes*: Caused due to small depressions of hollows.
  —*Lagoons*: These are formed due to depositions of sand bars along the seacoasts.

The best examples are Chilka lake (Orissa), Pulicat lake (Andhra Pradesh) and several Kayals on the Malabar coast of Kerala.

IMPORTANT LAKES OF INDIA

1. *Lakes of Kashmir*: Dal, Wular, Shesh Nag, Verinag, Manasbal, Nagin, etc.
2. *Lakes of Kumaon*: Nainital, Bhimtal, Khurpatal, Sattal, Punatal, etc.
3. *Lakes of Rajasthan*: Udaisagar, Fatehsagar, Jai Samand, Pichol and Sambhar Salt Lakes.
4. *Other Important Lakes*: Lake Lonar in Maharashtra, Chilka in Orissa, Lake Kolleru (Andhra Pradesh) and Nakkital (Mount Abu).

INDIAN STATES AND UNION TERRITORIES

Table 3.3 Facts for Quick Revision

	States	*Union Territories*
Largest population*	Uttar Pradesh (19,95,81,477)	NCT of Delhi (1,67,53,235); followed by Puducherry (12,44,464)
Smallest population*	Sikkim (6,07,688)	Lakshadweep (64,429)
Largest area**	Rajasthan (3,42,239 km^2)	Andaman and Nicobar Islands (8279 km^2)
Smallest area**	Goa (3702 km^2)	Lakshadweep (32 km^2)
Highest density of population	Bihar (1102 persons/km^2)	NCT of Delhi (11,297 persons/km^2) followed by Chandigarh (9252 persons/km^2)
Lowest density of population	Arunachal Pradesh (17 persons/km^2)	Andaman and Nicobar Islands (46 persons/km^2)
More females (highest sex ratio)	Kerala (1084 females per 1000 males)	Puducherry (1038 females per 1000 males)
More males (lowest sex ratio)	Haryana (877 females per 1000 males)	Daman and Diu (616 females per 1000 males)
Highest literacy rate	Kerala (93.91%)	Lakshadweep (92.28%)
Lowest literacy rate	Bihar (63.82%)	Dadar and Nagar Havali (77.65%)

(*Continued*)

	States	*Union Territories*
State touching maximum number of boundaries of other states	Uttar Pradesh (Haryana, Uttarakhand, Madhya Pradesh, Himachal Pradesh, Jharkhand, Bihar, Chhatisgarh, Rajasthan)—total eight states	
Largest Distrct	Kachchh (Gujarat) (45,652 km^2)	
Smallest District	Mahe (Puducherry) (9 km^2)	
Tropic of Cancer passes through eight states	Mizoram, Tripura, West Bengal, Jharkhand, Chhatisgarh, Madhya Pradesh, Rajasthan and Gujarat	
Indian Standard Meridian (82° 20′ E Meridian) passes through five states	Andhra Pradesh, Orissa, Chattisgarh, Madhya Pradesh, Uttar Pradesh	

*Area in ′000 km^2.
**Figures (2011 census estimates).
***Delhi is NCT (National Capital Territory).

This map is a sketch only, drawn not to scale, presented for reference and to aid understanding of the concept discussed. Telangana is carved out of Andhra Pradesh as 29th State of India. It is not being marked in above map.

CLIMATE AND FOREST RESOURCES

The Indian Meteorological Department recognizes four seasons, namely:

- Winter (December–March), summer (April–May), monsoon (June–September), season of retreating south-west monsoon (October–November).
- The climate of India is monsoon-type fed by two rain bearing winds, namely:
  1. *The South-West Monsoon (June–September)*: The south-west monsoons contribute 86% of the total rainfall in India. They open on the west coast around the beginning of June and continue till September with a declining trend as they move inland.
  2. *The North-East Monsoon (November–December)*: These are also called winter monsoons and are confined to a smaller area particularly the east coast. It is Tamil Nadu's major monsoon.

     Regions of heavy rainfall (above 200 cm)
     —Assam, Arunachal, Meghalaya, Sikkim and northern parts of West Bengal
     —The western ghats
     —The Himalayan slopes

     Regions of scanty rainfall (below 50 cm)
     —Kutch and western Rajasthan
     —Southern Haryana, south-east Punjab and Ladakh

Forests in India

- In terms of largest forest cover, Madhya Pradesh (11.25%) is followed by Arunachal Pradesh (9.75%), Chhattisgarh (8.09%), Maharashtra (7.33%) and Orissa (7.07%).
- The north-east states, the region which has only 7.76% of the geographical area, together account for about 25% of India's total forest cover.
- Forest cover in the north-eastern states is about 66.81% of the geographic area as against the national average of 21.02%.
- As compared to 2005, gain of 598 km^2 of forest cover has been observed in north–east states.
- Forest cover in different altitude zones assessed for the first time.
- Geographical areas in the 1000–2000 m altitude zone has got the maximum forest cover (72.19%).
- More than half of the forest cover of India occurs in 1–500 m altitude zone.
- Distribution of forest cover in different forest types is being presented for the first time.
- Nearly one-third of India's forest cover falls in the tropical moist deciduous type followed by tropical dry deciduous (30.16%).
- Tropical wet evergreen type group occupies 8.75% of the country's forest cover.
- West Bengal has nearly half of the country's mangroves.
- An increase of 58 km^2 of mangrove at the national level has been observed.
- Decrease in mangrove cover in the Andamans and Nicobar islands is attributed to after effects of tsunami.
- Tree cover in India constitutes the largest in Maharashtra (9466 km^2) followed by Gujarat (8390 km^2), Rajasthan (8274 km^2) and Uttar Pradesh (7381 km^2).
- There is heavy deforestation in the catchment areas of rivers in the Himalayan region.

- There is urgent need for the conservation of natural vegetation to maintain balance in environment by controlling reckless felling of trees, overgrazing in forests, forest fire, Jhuming urbanization and shifting agriculture.
- Research institutes are required to control the spread of plant diseases.
- Planned conservation can be taken up by forest department.
- Manmade forests (afforestation) are to be encouraged to produce trees for commercial purposes and to increase people's participation in forestation and social forestry.
- According to India State of Forests Report 2011 (ISFR, 2011), the total forest cover of the country as per 2011 assessment is 6,92,027 km^2 (21.05% of the total geographic area of the country).
- Out of this, very dense forest is (VDF) 83,471 km^2, 2.54% of total geographic area, moderately dense forest is (MDF) 32,073 km^2, 9.76% of total geographic area and the rest is open forest (OF) 3,20,736 km^2, 8.75% of total geographic area.
- The total forest cover (includes 4662 km^2 under magrovers) equals to 6,92,027 km^2 which is 21.05% of India's total geographic area.
- India's tree cover has been estimated as 90,844 km^2 constituting 2.76 % of its total geographical area. Tree cover is defined as tree patches less than 1 ha area with canopy density above 10%.
- The National Forest Policy 1988 has laid down a target of raising the area covered by forests in India to nearly 33.3%.
- There is a net decrease of 367 km^2 of forest cover in the country as compared to the previous assessment made in 2009. However after accounting for interpretational changes in the assessment of 2009, there is a net increase of 1128 km^2 in the forest cover as compared to the 2009 assessments.
  —State having maximum proportion of its geographical area under dense forest cover, Arunachal Pradesh (20,868 km^2).
  —State having lowest area under forest cover, Haryana (1068 km^2).
  —State having largest area under forest cover, Madhya Pradesh (77,700 km^2).
  —Percentage of forest cover with respect to total geographical area, Mizoram (90.68%).

Forest Cover in Hill and Tribal Districts

Hill Districts: There are 124 hill districts in India. 39.74% of their geographical area is under forest cover. Forest cover in the hill districts has decreased by 548 km^2. All districts of the states of Arunachal Pradesh, Himachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura and Uttarakhand are hill districts. The percentages of these nine states for forest cover is 63.07% of their geographical area.

Tribal Districts: There are 188 tribal districts in India. 37.25% of their geographical area is under forest cover. Forest cover in tribal districts has decreased by 679 km^2.

- The type of natural vegetation cover changes according to fall in temperature as one goes up the mountains.
- In the Himalayas, we find tropical vegetation up to a height of 500 m, sub-tropical vegetation from 500–1500 m, temperate vegetation from 2500–3500 m and cold desert vegetation above 3500 m from the sea level. In southern India the change in vegetation type occurs at relatively high altitudes because of its tropical location.

Types of Forests in India

Evergreen Forests (Tropical): Found in areas where rainfall ranges between 200 and 300 cm, for example western ghats and sub-Himalayan regions. These are coniferous forests with trees having needle-shaped leaves and provide teak, rosewood, mahogany, pine and bamboo.

Deciduous Forests (Monsoon Forests): Found in areas having rainfall between 150 and 200 cms per annum, for example, parts of Deccan plateau stretching across Maharashtra, Madhya Pradesh and Karnataka. They provide fine timber such as teak, sal and sandalwood, etc.

Dry Forests: Found in desert regions of Rajasthan and south of Punjab, where rainfall is below 75–100 cm per annum. The trees include Babul, Neem, Tamarind, etc. In the regions with rainfall below 50 cm per annum like the central and western parts of Rajasthan, we find semi-desert and desert vegetation. The plants include scrubs, thorny bushes and cactus.

Hill Forests: Found in southern India and in the Himalayan regions and provide timber. Oak, deodar, pines and chir are major trees found in these forests.

Tidal Forests (Mangrove): Found in coastal plains which are generally submerged, particularly on river deltas on the east coast (Ganges, Mahanadi, Godavari). The forests on the Gangetic delta in Bengal are called Sunderbans after the Sundari trees found in these forests. The mangrove cover in India is 4639 km^2 (0.14% of India's geographic ares) spread across 12 states and unition territories.

Forests in India: Contribution as a Carbon Sink

- Over the last two decades, progressive national forestry legislations and policies in India aimed at conservation and sustainable management of forests have reversed deforestation and have transformed India's forests into a significant net sink of CO_2.
- The CO_2 removal by India's forest and tree cover is enough to neutralize 11.25% of India's total GHG emission (CO_2 equivalnet) at 1994 levels, the most recent year for which comparable data is available for developing countires based on their respective National Communications (NATCOMs) to the United Nations Framework Convention on Climage Change (UNFCCC).
- This is equivalent to offsetting 100% emissions from all energy in residential and transport sector or 40% of total emissions from the agricultural sector. Clearly, India's forest and tree cover is serving as a major mode of carbon mitigation for India and the world.

Coral Reef Areas in India

- The Indian reef area is estimated to be 2375 km^2. The four major coral reef areas identified for intensive conservation and management are as follows:
  1. Gulf of Mannar
  2. Gulf of Kachchh
  3. Lakshadweep
  4. Andaman and Nicobar

AGRICULTURE

- About 65–70% of people in India are engaged in agriculture. About 142.42 million hectares, or just above 50% of the total geographical area of the country, is under cultivation.

Crop Seasons

- There are two major crop seasons in India, namely:
  1. Kharif
  2. Rabi

Table 3.4 The Crop Seasons

Crop	*Sown in*	*Harvested*	*Examples*
Kharif	June/July	September/ October	Rice, Jowar, Bajra, Ragi, Maize, Cotton and Jute
Rabi	October/ December	April/May	Wheat, Barley, Peas, Rapeseed, Mustard and Grams

Table 3.5 Main Crops and Producers

Type	*Name*	*Major Producers*
Cereals	Wheat	Uttar Pradesh, Punjab, Haryana
	Rice	West Bengal, Andhra Pradesh, Uttar Pradesh
	Gram	Madhya Pradesh, Rajasthan, Uttar Pradesh
	Barley	Maharashtra, Uttar Pradesh, Rajasthan
	Bajra	Maharashtra, Gujarat, Rajasthan
	Maize	Andhra Pradesh, Karnataka, Bihar
	Total coarse cereals	Karnataka, Maharashtra, Rajasthan
	Total pulses	Madhya Pradesh, Uttar Pradesh, Maharashtra
Cash Crops	Sugarcane	Uttar Pradesh, Maharashtra, Tamil Nadu
	Poppy	Uttar Pradesh, Himachal Pradesh
	Potato	Uttar Pradesh, West Bengal, Bihar
	Onion	Maharashtra, Gujarat, Karnataka
Oilseeds	Coconut	Kerala, Tamil Nadu
	Linseed	Madhya Pradesh, Uttar Pradesh
	Groundnut	Gujarat, Madhya Pradesh, Tamil Nadu
	Rapeseed and Mustard	Rajasthan, Uttar Pradesh, Madhya Pradesh
	Sesame	Uttar Pradesh, Rajasthan
	Sunflower	Maharashtra, Karnataka
	Soyabean	Madhya Pradesh, Maharashtra, Rajasthan
	Total oilseeds	Rajasthan, Madhya Pradesh, Gujarat
Fibre crops	Cotton	Gujarat, Maharashtra, Punjab
	Jute	West Bengal, Bihar, Orissa, Assam

(*Continued*)

Type	*Name*	*Major Producers*
	Silk	Karnataka, Kerala
	Hemp	Madhya Pradesh, Uttar Pradesh
Plantations	Coffee	Karnataka, Kerala
	Rubber	Kerala, Karnataka
	Tea	Assam, Kerala
	Tobacco	Gujarat, Maharashtra, Madhya Pradesh
Spices	Pepper	Kerala, Karnataka, Tamil Nadu
	Cashew nuts	Kerala, Tamil Nadu, Andhra Pradesh
	Ginger	Kerala, Uttar Pradesh
	Turmeric	Andhra Pradesh, Orissa
	Chillies	Maharashtra, Andhra Pradesh
	Cloves	Kerala
	Saffron	Karnataka, Tamil Nadu, Jammu and Kashmir

Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation.
Note: Telangana is carved out of Andhra Pradesh as the 29th States. The information above has Andhra Pradesh that includes Telangana and Andhra Pradesh.

Green Revolution

- The green revolution was launched in 1967–68 to improve agricultural productivity in two phases:
  1. *First Green Revolution*: Mainly confined to the progressive wheat-producing states of Punjab, Haryana and western Uttar Pradesh.
  2. *Second Green Revolution*: In 1983–84, the green revolution was extended to eastern and central states including West Bengal, Bihar, Orissa, Madhya Pradesh and Uttar Pradesh.
- As a result of the green revolution, wheat production more than doubled and rice production increased by 53%.

Dairy Farming

- *Operation Flood I (1970–81)*: In collaboration with the World Bank, Operation Flood I was launched with the intention of capturing a commanding share of the liquid milk market in the metropolitan cities.
- *Operation Flood II (1981–85)*: It was launched in 1981 and extended to almost all states.
- *Operation Flood III (1985–90)*: It was launched in 1985 under the Seventh Five Year Plan.
  —The programmes were implemented under the aegis of the National Dairy Development Board (NDDB) and the Indian Dairy Corporation (IDC).
  —As a result of these programmes, India has become the largest milk producer in the world. With the increase in per capita availability of dairy milk from 107–232 gm, the country is beginning to face the problem of surplus.

Irrigation: Methods of Irrigation

1. *Wells*: Used mainly in Uttar Pradesh, Punjab, Tamil Nadu and Maharashtra, accounting for about 48% of the total irrigated area in the country.

2. *Tanks*: Used in central and southern India, especially in Andhra Pradesh. About 10% of total irrigated area is irrigated by tanks.
3. *Canals*: Major source of irrigation in Punjab, Uttar Pradesh and Haryana. About 40% of total irrigated area is irrigated by canals.

MINERAL RESOURCES OF INDIA

- India is rich in iron, mica, manganese, bauxite
- Self-sufficient in antimony, building materials, cement materials, clay, chromite, lime, dolomite and gold
- Deficient in copper, lead, mercury, zinc, tin, nickel, petroleum products, sulphur and tungsten

Table 3.6 Important Minerals

Mineral	*Found in*	*Features*
Iron	Orissa, Bihar, Chattisgarh, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra, Goa	India has the world's largest reserves of iron; approximately one-fourth of world's known reserves
Coal	Bihar, West Bengal, Madhya Pradesh, Orissa, Maharashtra, Andhra Pradesh, Assam	India is the third-largest producer of coal in the world
Manganese	Orissa, Madhya Pradesh, Maharashtra, Gujarat, Karnataka, Jharkhand, Andhra Pradesh	India ranks third in the world in manganese production
Mica	Jharkhand, Rajasthan, Andhra Pradesh, Tamil Nadu	India has the largest deposits of mica in the world
Bauxite (aluminium ore)	Jharkhand, Gujarat, Chhattisgarh, Tamil Nadu, Karnataka, Maharashtra, Jammu and Kashmir, Orissa, Rajasthan	India is the third-largest producer of bauxite in the world
Copper	Jharkhand, Rajasthan, Andhra Pradesh, Karnataka, Madhya Pradesh, Gujarat	
Crude oil	Assam, Tripura, Manipur, West Bengal, Ganges Valley, Himachal Pradesh, Kutch, Andhra Pradesh, off West Bengal, Orissa, Maharashtra and Gujarat	
Lignite	Tamil Nadu, some deposits also found in Gujarat, Puducherry, Rajasthan, Jammu and Kashmir	India ranks third in the production of lignite
Gold	Karnataka and small quantities in Andhra Pradesh	
Magnesite	Tamil Nadu, Uttarakhand, Karnataka	
Gypsum	Rajasthan, Jammu and Kashmir, Tamil Nadu	
Lead-zinc	Andhra Pradesh, Gujarat, Maharashtra, Meghalaya, Tamil Nadu, Orissa, Sikkim and Rajasthan	
Chromite	Orissa, Jharkhand, Karnataka, Tamil Nadu, Maharashtra, Andhra Pradesh and Manipur	

(*Continued*)

Mineral	*Found in*	*Features*
Dolomite	Madhya Pradesh, Orissa, Gujarat, Maharashtra, Uttar Pradesh, West Bengal and Arunachal Pradesh	
Diamond	Madhya Pradesh, traces are also found in Bihar, Orissa, Maharashtra and Andhra Pradesh	

Note: Telangana is carved out of Andhra Pradesh as the 29th States. The information above has Andhra Pradesh that includes Telangana and Andhra Pradesh.

NATIONAL PARKS AND WILDLIFE SANCTUARIES

- *National Parks*: There are around 94 national parks in India, covering an area of approximately 33,988 km^2 or about 1% of India's total area.
- *Wildlife Sanctuaries*: There are around 501 sanctuaries in India covering an area of about 1,07,310, km^2 or about 3% of total land area.

Table 3.7 Important Sanctuaries and Parks

Name	*Location*	*Reserve for*	*Area*
Achanakmar Sanctuary	Bilaspur, Chhatisgarh	Tiger, bear, chital, sambar, bison, hyena, jackal, wild boar, black buck	557.35 km^2
Bandipur Sanctuary	Border of Karnataka and Tamil Nadu	Elephant, tigers, panther, sambar, deer, birds	874.20 km^2
Corbett National Park	Nainital, Uttaranchal	Tiger, leopards, elephants, sambar	1318.54 km^2
Dachigam Sanctuary	Srinagar/Pulwama, Kashmir	Kashmiri stag or Hangul, Himalayan bear, musk deer, exotic Himalayan birds	141 km^2
Gandhi Sagar Sanctuary	Mandsaur and Neemuch, Madhya Pradesh	Chital, sambar, chinkara, barking deer, wild birds	368.62 km^2
Ghana Bird Sanctuary	Bharatpur, Rajasthan	Water birds, black-buck, chital, sambar	29 km^2
Gir Forest	Junagarh, Gujarat	India's biggest wildlife sanctuary famous for Gir lions	1412.13 km^2
Kaziranga National Park	Jorhat, Assam	Rhinoceros, wild buffalo, swan, deer, hog, elephant, leopard, langoor, python	430 km^2
Pakhal Sanctuary	Warangal, Andhra Pradesh	Tiger, panther, sambar, nilgai, chital, spotted deer, wild boar, black buck, mountain gazzle	860 km^2
Periyar Sanctuary	Idukki, Kerala	Elephant, tiger, panther, gaur, nilgai, sambar, Nilgiri tahr	7777 km^2
Ranthambore Tiger Project	Sawai Madhopur, Rajasthan	Tiger, leopard, sloth bear, crocodile	400 km^2
Sariska Sanctuary	Alwar, Rajasthan	Tiger, panther, sambar, nilgai, chital, chinkara	765 km^2

(*Continued*)

Sharaswathy Sanctuary	Shimoga, Karnataka	Elephant, tiger, panther, sambar, gaur, chital	44 km^2
Shikari Devi Sanctuary	Mandi, Himachal Pradesh	Black bear, musk deer, leopard, partridge	72 km^2
Sunderban Tiger Reserve	South 24 Parganas	Tiger, deer, wild boar, leopard	4264 km^2
Sonai-Rupai Sanctuary	Sonitpur, Assam	Elephant, sambar, wild boar, one-horned rhinoceros	175 km^2
Tungabhadra Sanctuary	Bellary, Karnataka	Panther, chital, sloth bear, four-horned antelope	492.46 km^2
Vedanthangal Bird Sanctuary	Tamil Nadu	Pelican, spoon bills, species of birds from Canada, herons, egret	72 acres
Wild Ass Sanctuary	Little Rann of Kutch, Gujarat	Wild ass, wolf, nilgai, chinkara	4953 km^2

Note: Telangana is carved out of Andhra Pradesh as the 29th States. The information above has Andhra Pradesh that includes Telangana and Andhra Pradesh.

IMPORTANT TOWNS AND LOCATIONS

Table 3.8 Indian Cities on River Banks

City	*River*	*State*
Agra	Yamuna	Uttar Pradesh
Ahmedabad	Sabarmati	Gujarat
Allahabad	Confluence of the Ganges, Yamuna and Saraswati	Uttar Pradesh
Alwaye	Periyar	Kerala
Ayodhya	Sarayu	Uttar Pradesh
Badrinath	Gangotri	Uttarakhand
Bhagalpur	Ganges	Bihar
Buxar	Ganges	Bihar
Kolkata	Hooghly	West Bengal
Cuttack	Mahanadi	Orissa
Delhi	Yamuna	Delhi
Dibrugarh	Brahmaputra	Assam
Guwahati	Brahmaputra	Assam
Haridwar	Ganges	Uttarakhand
Howrah	Hooghly	West Bengal
Hyderabad	Musa	Andhra Pradesh
Jamshedpur	Subarnarekha	Jharkhand
Kanpur	Ganges	Uttar Pradesh
Kota	Chambal	Rajasthan
Leh	Indus	Jammu and Kashmir

(*Continued*)

Lucknow	Gomti	Uttar Pradesh
Ludhiana	Sutlej	Punjab
Mathura	Yamuna	Uttar Pradesh
Moradabad	Ram Ganga	Uttar Pradesh
Monghyr	Ganges	Uttar Pradesh
Nashik	Godavari	Maharashtra
Patna	Ganges/Sone	Bihar
Srinagar	Jhelum	Jammu and Kashmir
Surat	Tapti	Gujarat
Tiruchirappalli	Cauvery	Tamil Nadu
Ujjain	Shipra	Madhya Pradesh
Vijayawada	Krishna	Andhra Pradesh
Varanasi	Ganges	Uttar Pradesh

Note: Telangana is carved out of Andhra Pradesh as the 29th States. The information above has Andhra Pradesh that includes Telangana and Andhra Pradesh.

Table 3.9 Important Sites and Monuments

Name	*Location*	*Famous for*
Ajanta Caves	Aurangabad	Buddhist cave temples
Amarnath's cave	Kashmir	Natrually formed ice Shivlinga
Anand Bhawan	Allahabad	Ancestral house of the Nehru family which has been donated by Late Mrs Indira Gandhi for conversion into a National Museum.
Bibi-ka-Makbara	Aurangabad	According to the Arachaeological Survey of India, the Bibi-ka-Maqbara is a mausoleum of Rabia-ul-Daurani alias Dilras Banu Begum, the wife of the Mughal Emperor Aurangzeb. This mausoleum is believed to be constructed by Prince Azam Shah in memory of his mother during 1651–61 AD.
Buland Darwaza	Fatehpur Sikri	The highest and biggest gateway of India near Agra built by Akbar to commemorate his victorious campaign in Deccan
Char Minar	Hyderabad	Monument and Mosque
Dilwara Temples	Mount Abu	Jain temples, Vimal Vasahi, Luna Vasahi, Pittdhar, Parsuvanattra, Mahavir Swami, built between the eleventh and thirteenth century AD
Elephanta Caves	Mumbai	The Elephanta caves, taluka Uran, district Raigad, is located on island hills, 7 km from the mainland Mumbai, known for sculptures
Ellora Caves	Aurangabad	Has 12 Buddhist caves, 17 Hindu caves and 5 Jain caves
Gandhi Sadan	Delhi	Birla house—where Gandhiji was assassinated in 1948

(*Continued*)

Name	*Location*	*Famous for*
Gateway of India	Mumbai	Erected in 1911 on King George V's visit to India
Gol Gumbaz	Bijapur	Largest dome in India
Gomteshwara	Mysore	2000-year-old statue of a Jain sage carved out of a single stone
Golden Temple	Amritsar	Largest Gurudwara
Hawa Mahal	Jaipur	A pink castle of air
Jallianwala Bagh	Amritsar	A public garden infamous for the massacre of hundreds of innocent Indians by the British on 13 April 1919
Jantar Mantar	Delhi	Observatory built in 1724 during the days of Maharaja Jai Singh II of Ajmer
Jama Masjid	Delhi	Biggest mosque built by Shah Jahan
Kanya Kumari	Tamil Nadu	Temple of the Virgin Goddess situated at Cape Camorin on the extreme southern tip of India
Kranti Maidan	Mumbai	Historical avenue where Gandhiji gave the call 'Quit India' in 1942
Khajuraho	Near Bhopal	Mahadeva temple, the embodiment of the great artistic activity of the ninth to twelth centuries
Meenakshi Temple	Madurai	Hindu temple
Qutab Minar	Delhi	Largest minaret
Rajghat	Delhi	Samadhi of Mahatma Gandhi on the bank of the Yamuna
Red Fort	Delhi	A red stone structure built by Shah Jahan on the bank of the Yamuna
Sabarmati	Ahmedabad	Harijan Ashram founded here by Gandhiji
Sarnath	Varanasi	Centre of Buddhist pilgrimage, the place where Gautam Buddha delivered his first sermon after enlightenment
Shaktisthal	Delhi	Situated on the bank of the Yamuna where Mrs Indira Gandhi was cremated
Shantivan	Delhi	Samadhi of Pt Jawaharlal Nehru
Shantiniketan	Kolkata	Famous university founded by Rabindranath Tagore
Sanchi	Madhya Pradesh	Ancient Buddhist monuments
Tower of Victory	Chittorgarh	Famous tower built by Rana Sangha, the King of Mewar in AD 1450 to commemorate his victory over the Muslim forces of Malwa
Victoria Memorial	Kolkata	Famous museum
Vijay Ghat	Delhi	Samadhi of Lal Bahadur Shastri
Vir Bhumi	Delhi	Samadhi of Rajiv Gandhi

(*Continued*)

Table 3.10 Indian Tribes and Their Habitat

Name of Tribe	*Found in*
Abors	Assam, Arunachal Pradesh
Angami	Nagaland, Assam
Ao	Nagaland, Assam
Apatamis	Arunachal Pradesh
Badagas	Tamil Nadu (Nilgiri Hill)
Baiga	Madhya Pradesh, Chhattisgarh
Bhils	Madhya Pradesh, Rajasthan, Gujarat, Chattisgarh, Maharashtra
Bhotias	Uttarakhand (Garhwal and Kumaun)
Birhor	Hazaribagh, Jharkhand
Chenchus	Andhra Pradesh, Orissa
Gaddis	Himachal Pradesh, Jammu and Kashmir
Gallong	North-east Himalayan tract
Garos	Meghalaya
Gonds	Madhya Pradesh, Jharkhand, Chhattisgarh, Orissa, Andhra Pradesh
Khas	Uttar Pradesh, Himachal Pradesh, Uttarakhand, Nepal, Bengal, Sikkim, Bhutan
Khasis	Assam, Meghalaya
Khonds	Orissa, Andhra Pradesh
Kol	Madhya Pradesh, Chhattisgarh
Kolam	Andhra Pradesh, Maharashtra
Kotas	Tamil Nadu (Nilgiri)
Kuki	Manipur
Lahora	Nagaland, Assam
Lepchas	Sikkim
Lushais	Tripura
Mina	Rajasthan
Mikirs	Assam
Monpa	Arunachal Pradesh
Mundas	Jharkhand
Murias	Madhya Pradesh
Oaraons of Kurukh	Jharkhand, Orissa
Onges	Andaman and Nicobar
Santhals	West Bengal, Jharkhand, Orissa, Bihar
Sema	Nagaland and Assam
Sentinelese	Andaman and Nicobar
Shomens	Andaman and Nicobar
Tangkhul	Nagaland, Assam
Todas	Tamil Nadu (Nilgiri Hills)
Uralis	Kerala
Warlis	Maharashtra

Hill Stations (Height in ft)

Almora	5500 ft in Kumaon Hills, Uttarakhand
Cherrapunji	4455 ft 30 miles south of Shillong, Meghalaya
Coonoor	6740 ft in the Nilgiri Hills, Tamil Nadu
Dalhousie	7867 ft in Himachal Pradesh
Darjeeling	7168 ft in West Bengal
Gulmarg	8850 ft in Jammu and Kashmir
Kalimpong	4000 ft near Darjeeling, West Bengal
Kasauli	7200 ft near Shimla, Himachal Pradesh
Kodaikanal	7200 ft in Tamil Nadu
Kullu Valley	3999 ft in Himachal Pradesh
Lansdowne	5597 ft in Garhwal, Uttarakhand
Mahabaleshwar	4500 ft in Maharashtra
Mt Abu	4500 ft in Rajasthan
Mukteshwar	7500 ft in Kumaon Hills, Uttarakhand
Mussoorie	7500 ft in Uttarakhand
Shimla	7000 ft in Himachal Pradesh
Nainital	6365 ft in Uttarakhand
Ootacamund (Ooty)	7500 ft in Tamil Nadu

CENSUS 2011

Population size	Male 62,37,24,248
	Female 58,64,69,174
	—1,21,01,93,422
Population density	Rural 83,30,87,662
	Urban 37,71,05,760
	—382 persons/km^2
Sex ratio	Rural 9470
	—940 females/1000 males
	Urban 926
Literacy Rate	Males (82.14)
	—74.04 (7 + years persons, percent)
	Females (65.46)

- Total population of India has reached 121 crores—comprising 62.37 crore males and 58.65 crore females.
- Total absolute increase in population during the decade is 18.15 crore.
- Population growth during the decade is 17.64%.
  —Population density stands at 382 persons/km^2.
- Sex ratio is 940 females/1000 males.
- Child sex ratio is 914 females/1000 males.
  —Literacy rate has gone up from 64.83% in 2001 to 74.04% in 2011.
- Thane district in Maharashtra is most populated district (1,10,54,131).

- Dibang Valley of Arunachal Pradesh is the least populated district.
- Kurung Kumey of Arunachal Pradesh registered highest population growth rate of 111.01%.
- Longleng district of Nagaland registered negative population growth rate of –58.39%.
- Mahe district of Puducherry has highest sex ratio of 1176 females per 1000 males.
- Daman district has lowest sex ratio of 533.
  —Serchhip district of Mizoram has literacy rate of 98.76%.
- Alirajpur in MP is the least literate district (37.22%).
  —North east Delhi has the highest population density of 37,346 persons/km^2.
- Dibang Valley has the least population density of 1 person/km^2.
- Uttar Pradesh is most populated state (19.96 crores).
- Lakshadweep is the least populated Union Territory.
  —Sikkim is least populated state of India (6,07,688).
- Daman and Diu recorded highest percent growth 55.50%.
- Meghalaya recorded least percent growth –0.47%.
- Delhi NCR has highest density/km^2 of 11,297 persons.
- Arunachal Pradesh has least population density of 17 persons/km^2.
- Kerala has maintained highest sex ratio figure of 1084 females/1000 males.
- Daman and Diu has least sex ratio (618) among union territories.
- Haryana has least sex ratio (877) among states.
  —Kerala has highest literacy rate of 93.91%.
- Bihar has least literacy rate among states (63.82%), however Bihar recorded highest growth in literacy rate in decade 2001–11.

Table 3.11 Basic Data

	Capital	*Area ('000 km^2)*	*Population*	*Percent to Total Population of India*	*Rank in*
			*(2011 census)***	*(2011 census)***	*2011*
India	New Delhi	3287.3	1,21,01,93,422	100.00	
National Capital Territory***	New Delhi	1.5	1,67,53,235	1.38	18
1. Andhra Pradesh	Hyderabad	275.608	8,46,65,533	7.00	5
2. Arunachal Pradesh	Itanagar	83.743	13,82,611	0.11	27
3. Assam	Dispur	78.4	3,11,69,272	2.58	14
4. Bihar	Patna	94.1	10,38,04,637	8.58	3
5. Chhattisgarh	Raipur	136.0	2,55,40,196	2.11	16
6. Goa	Panaji	3.7	14,57,723	0.12	26
7. Gujarat	Gandhinagar	196.0	6,03,83,628	4.99	10

(*Continued*)

	Capital	*Area ('000 km²)*	*Population*	*Percent to Total Population of India*	*Rank in*
8. Haryana	Chandigarh	44.3	2,53,53,081	2.09	17
9. Himachal Pradesh	Shimla	55.7	68,56,509	0.57	21
10. Jammu and Kashmir	Srinagar/ Jammu*	222.2	1,25,48,926	1.04	19
11. Jharkhand	Ranchi	74.7	3,29,66,238	2.72	13
12. Karnataka	Bangalore	191.8	6,11,30,704	5.05	9
13. Kerala	Thiruvan-anthapuram	38.9	3,33,87,677	2.76	12
14. Madhya Pradesh	Bhopal	308.0	7,25,97,565	6.00	6
15. Maharashtra	Mumbai	307.7	11,23,72,972	9.29	2
16. Manipur	Imphal	22.3	27,21,756	0.22	24
17. Meghalaya	Shillong	22.4	29,64,007	0.24	23
18. Mizoram	Aizawl	21.1	10,91,014	0.09	29
19. Nagaland	Kohima	16.6	19,80,602	0.16	25
20. Orissa	Bhubaneswar	155.7	4,19,47,358	3.47	11
21. Punjab	Chandigarh	50.4	2,77,04,236	2.29	15
22. Rajasthan	Jaipur	342.2	6,86,21,012	5.67	8
23. Sikkim	Gangtok	7.1	6,07,688	0.05	31
24. Tamil Nadu	Chennai	130.1	7,21,38,958	5.96	7
25. Tripura	Agartala	10.5	36,71,032	0.30	22
26. Uttar Pradesh	Lucknow	243.3	19,95,81,477	16.49	1
27. Uttarakhand	Dehradun	53.6	1,01,16,752	0.84	20
28. West Bengal	Kolkata	88.8	9,13,47,736	7.55	4
Union Territories					
1. Andaman and Nicobar	Port Blair	8.2	3,79,944	0.03	32
2. Chandigarh	Chandigarh	0.1	10,54,686	0.09	30
3. Dadra and Nagar Haveli	Silvassa	0.5	3,42,853	0.03	33
4. Daman and Diu	Daman	0.1	2,42,911	0.02	34
5. Lakshadweep	Kavaratti	0.03	64,429	0.01	35
6. Puducherry	Puducherry	0.5	12,44,464	0.10	28

*Srinagar (summer capital); Jammu (winter capital).
**As per 2011 provisional figures.
***Seventh UT of India.
Note: Telangana is carved out of Andhra Pradesh as the 29th States. The information above has Andhra Pradesh that includes Telangana and Andhra Pradesh.

Chapter

4 INDIAN ECONOMY

CHARACTER AND SIZE OF THE INDIAN ECONOMY

Character of the Indian Economy

- A policy of mixed economy is followed in the country.
- In a mixed economy, the public sector enterprises (government-owned) exist alongside the private sector to achieve a socialist pattern of society in a welfare state.
- In a mixed economy, a public sector works to achieve certain priorities and goals, both social and economic with an economic plan to guide it.
- A mixed economy is always a planned economy and the Indian economy is as a good example of a mixed economy.
- The public and private sectors are viewed as complementary.

Size of the Indian Economy

- India's GDP at factor cost (at 2004–2005 Prices) in 2012–2013 (advance estimates) stood at 55,03,476 crore.
- It grew by 5% over the previous period (as per revised estimates of 2011–2012).

AGRICULTURE IN THE INDIAN ECONOMY

- Agriculture plays a vital role in the Indian economy.
- 14.1% of India's GDP (at 2004–2005 prices) in 2011–2012 was contributed by the agricultural sector.
- 10% (provisional) of total exports, besides 58% of the work force, was provided employment in this sector.
- 43% of India's geographical area is used for agricultural activity.
- Over 70% of the rural household depends on agriculture as its principal means of livelihood.
- Irrigation facilities are still inadequate in India and the majority agriculture is dependent on monsoons.
- Agriculture, along with fisheries and forestry, accounts for one-third of the nation's GDP and is its largest contributor.
- The average size of landholdings in India is small and subject to fragmentations.
- Agriculture exports constitute a fifth of total exports of India.
- India ranks second worldwide in farm output.
- India is largest producer in the world of milk, cashew nuts, coconuts, tea, ginger, turmeric and black pepper.

- India has the world's largest cattle population which is approximately 285 million.
- India is the second largest producer of wheat, rice, sugar, ground nut and island fish.
- India is the third largest producer of tobacco.
- India is the largest producer of banana and seprta.
- India accounts for 10% of the world's fruit production.
- Growth rate target for agriculture in the Twelfth Five Year Plan remains at 4% as was in the Eleventh Five Year Plan.

CONCEPTS OF NATIONAL INCOME

- National income is the sum of domestic output and net income earned from abroad.
- It is different from the concept of national wealth which measures the stock of commodities held by the nationals of a country at a point of time.
- National income measures the productive power of the economy in a given period to convert commodities or national wealth into goods and services for final consumption.
- The various concepts of national income are as follows:
  1. *Gross National Product (GNP)*: It is the money value of the total output produced or production of final goods and services by the nationals of a country during a given period of time.
  2. *Gross Domestic Product (GDP)*: It is the money value of the total output produced or production of final goods and services within the boundaries of a nation by the nationals of the country during a given period of time.
  3. *Net National Product (NNP)*: It is the value obtained by subtracting the depreciation value from the GNP of a country. So *NNP = (GNP–Depreciation).*

     It can be calculated in two ways: (i) at the market price of goods and services and (ii) at factor cost.
  4. *Personal Income*: It is that income which is actually obtained by the nationals of a country.
  5. Personal income = [national income – (undistributed profits of a corporation) – (payment of the social security provisions) + (government transfer payments) + (business transfer payments) + (net interest paid by the government)].
  6. *Disposable Personal Income*: It is obtained by subtracting personal direct taxes from the personal income of the national of a country.

PLANNING IN INDIA

- Planning in India derives its objectives and social premises from the Directive Principles of State Policy enshrined in the Indian Constitution.
- The main features of planning in India are comprehensive plans, indicative economic planning but based on erratic data and more of social planning than economic planning.
- India has complete 11 Five-Year Plans since 1951.
- Broad objectives of India's Five year Plans include:
  1. Economic growth
  2. Self-reliance
  3. Purging unemployment
  4. Decline of income inequalities
  5. Poverty eradication and modernization

- Apart from basic objectives, each Five Year Plan takes into account the new constraints and possibilities faced during the period and attempts to make the necessary directional emphasis.
- The Planning Commission is an extra-constitutional and non-statutory body.
- National Development Council is an extra-constitutional and extra-legal body.
- In 1934, M. Visvesvaryya, in his book *Planned Economy of India,* advocated the necessity of planning in the country much before independence
- In 1944, the Planning and Development Department was set up under the chairmanship of A. Dalal.
- In 1946, the Planning Advisory Board was set up by the interim government.
- In 1947, the Economic Programme Committee was set up under the chairmanship of Jawaharlal Nehru.

Purpose of the Five Year Plans

- India is a vibrant, pluralistic and federal democratic set-up.
- The decision-making process necessitates consensus building with extensive consultations between the central government, state governments, numerous governmental and non-governmental organizations.
- Within this complex framework, the planning in India over the last 60 years has served three primary objectives:
  1. To provide a common, agreed, framework of objectives and a strategy within which compatible decisions can be evolved
  2. To analyse the rationale of these decisions
  3. To delineate the strategy for accelerated growth of the economy and enhance the welfare of all citizens

Planning Commission (PC)

- In March 1950, the Government of India constituted a statutory body with the prime minister of India as its chairman called the *Planning Commission*.
- Pt Jawaharlal Nehru was the first chairman of the Planning Commission.
- The Planning Commission was charged with the responsibility of making assessment of all resources of the country augmenting deficient resources, formulating a plan for the most effective and balanced utilization of resources and determining priorities.
- It is an extra-constitutional and non-statutory body.
- The Planning Commission has a chairman (usually the prime minister of India), a deputy-chairman and minister of state for planning (ex-officio member) as its important members.

National Planning Council (NPC)

- It is an advisory body attached to the Planning Commission and was established in 1965.
- It includes experts representing a cross-section of the Indian economy.

National Development Council (NDC)

- Chief ministers of the states, together with the members of the Planning Commission, constitute the National Development Council.
- The prime minister of India presides over the Council.
- In 1952, the NDC was formed for the first time as an adjunct to the PC to associate the states in the formulation of the plans.

FIVE YEAR PLANS

- The development plans are drawn by the Planning Commission to establish India's economy on a socialistic pattern in successive phases of five year periods called the *Five Year Plans.*
- The organization was set up to formulate basic economic policies, draft plans and watch its progress and implementation.
- It consists of
  — Planning Commission of India
  — National Planning Council
  — National Development Council and State Planning Commissions

Table 4.1 Five Year Plans at a Glance

Period	*Plan*	*Remarks*
1951–52 to 1955–56	First Plan	Priority given to agriculture and irrigation
1956–57 to 1960–61	Second Plan	Development of basic and heavy industries
1961–62 to 1965–66	Third Plan	Long-term development of India's economy
1966–67 to 1968–69	Annual Plan	Plan holiday period—Chinese and Pakistani wars
1969–70 to 1973–74	Fourth Plan	It brought in a 'scientific temper' to Indian agriculture
1974–75 to 1977–78	Fifth Plan	Terminated a year earlier by the Janata Government which introduced the 'Rolling Plan' concept
1978–79 to 1979–80	Annual Plan	Launched by the Janata Government
1980–81 to 1984–85	Sixth Plan	Originally launched by the Janata Government. However, abandoned by the new Government and a maximize plan for 1981–85 subsequently approved
1985–86 to 1989–90	Seventh Plan	Food, work and productivity were the basic priorities
1990–91 to 1991–92	Annual Plan	Basic thrust was on maximization of employment and social transformation
1992–93 to 1996–97	Eighth Plan	Faster economic growth, faster growth of manufacturing, agricultural and allied sectors, significant growth rates in exports and imports, improvement in trade and current account deficit and significant reduction in central government's fiscal deficit
1997–98 to 2001–02	Ninth Plan	Priority to agriculture and rural development; accelerating growth rate of economy; food and nutritional security for all; containing growth rate of population; empowerment of women and socially disadvantaged groups such as SC/STs, backward classes, minorities, etc.; promoting and developing participatory institutions like 'Panchayati Raj' institutions, cooperatives and self-help groups.

(*Continued*)

Period	*Plan*	*Remarks*
2002–2007	Tenth Plan	Cutting down on unnecessary expenditure; improving farm sector, financial sector, judicial system; eliminating harassment, corruption and red tapism; controlling drought, floods, population growth; increasing FDI and FPIs; labour and economic growth.
2007–2012	Eleventh Plan	Growth in agriculture, education, health care facilities; provision of safe drinking water, providing scholarships; improving and making integrated development services and National Rural Employment Guarantee Scheme to reach more beneficiaries; emphasis on HIV/AIDS, polio, urban development and care of women and children, treatment of communicable diseases.
2012–2016	Twelfth Plan	Basic objective is faster, more inclusive and sustainable growth. (Major sectoral challenges are energy, water and environment which need to be addressed without sacrificing growth. To find resources to create a world class infrastructure in the country. Require better performance in agriculture, for growth to be more inclusive. Plus, faster creation of jobs, especially in manufacturing and stronger efforts at health, education and skill development are given importance. Also, need to improve effectiveness of programmes directly aimed at the poor, special programmes for socially vulnerable groups and special plans for disadvantaged/backward regions.)

Major Direct Tax Acts

- Income Tax Act, 1961
- Wealth Tax Act, 1957
- Expenditure Tax Act, 1987
- Major indirect tax acts administered by the union government are
  — Central Excise and Sales Act, 1944
  — Customs Act, 1962
  — Central Sales Tax Act, 1956
- The state sale tax acts are administered by the respective state governments.

POVERTY IN INDIA

- The head count ratio (HCR) is obtained using urban and rural poverty lines which are applied on the MPCE distribution of the states.
- The aggregated BPL population of the states is used to obtain the final all India HCR and poverty lines in rural and urban areas.

- The all-India HCR has declined by 7.3% points from 37.2% in 2004–05 to 29.8% in 2009–10, with rural poverty declining by 8% points from 41.8% to 33.8% and urban poverty declining by 4.8% points from 25.7% to 20.9%.
- Poverty ratio in Himachal Pradesh, Madhya Pradesh, Maharashtra, Orissa, Sikkim, Tamil Nadu, Karnataka and Uttarakhand has declined by about 10 percentage points and more.
- In Assam, Meghalaya, Manipur, Mizoram and Nagaland, poverty in 2009–10 has increased.
- Some of the bigger states such as Bihar, Chhattisgarh and Uttar Pradesh have shown only marginal decline in poverty ratio, particularly in rural areas.
- Poverty ratio for Social Groups—In rural areas, scheduled tribes exhibit the highest level of poverty (47.4%), followed by scheduled castes (SCs) (42.3%) and other backward castes (OBC) (31.9%), against 33.8% for all classes.
- In urban areas, SCs have HCR of 34.1% followed by STs (30.4%) and OBC (24.3%) against 20.9% for all classes.
- In rural Bihar and Chhattisgarh, nearly two-thirds of SCs and STs are poor whereas in states such as Manipur, Orissa and Uttar Pradesh the poverty ratio for these groups is more than half.
- Among religious groups—Sikhs have the lowest HCR in rural areas (11.9%) whereas in urban areas, Christians have the lowest proportion (12.9%) of poor.
- In rural areas, the HCR for Muslims is very high in states such as Assam (53.6%), Uttar Pradesh (44.4%), West Bengal (34.4%) and Gujarat (31.4%).
- In urban areas, the poverty ratio at all India level is highest for Muslims (33.9%).
- Similarly for urban areas, the poverty ratio is high for Muslims in states such as Rajasthan (29.5%), Uttar Pradesh (49.5%), Gujarat (42.4%), Bihar (56.5%) and West Bengal (34.9%).
- For occupational categories—Nearly 50% of agricultural labourers and 40% of other labourers are below the poverty line in rural areas whereas in urban areas, the poverty ratio for casual labourers is 47.1%.
- As expected those in regular wage/salaried employment have the lowest proportion of poor.
- In the agriculturally prosperous state of Haryana 55.9% agricultural labourers are poor whereas in Punjab it is 35.6%.
- The HCR of casual labourers in urban areas is very high in Bihar (86%), Assam (89%), Orissa (58.8%), Punjab (56.3%), Uttar Pradesh (67.6%) and West Bengal (53.7%).
- Based on the education level of head of the household—In rural areas, as expected households with 'primary level and lower' education have the highest poverty ratio whereas the reverse is true for households with 'secondary and higher' education.
- Nearly two-third households with 'primary level and lower' education in rural areas of Bihar and Chhattisgarh are poor whereas it is 46.8% for UP and 47.5% for Orissa.
- The trend is similar in urban areas.
- For categories by age and sex of head of the household—In rural areas, it is seen that households headed by minors have poverty ratio of 16.7% and households headed by female and senior citizen have poverty ratio of 29.4% and 30.3%, respectively.
- In urban areas, households headed by minors have poverty ratio of 15.7% and households headed by female and senior citizen have poverty ratio of 22.1% and 20.0%, respectively, against overall poverty ratio of 20.9%.
- There has been no uniform measure of poverty in India.
- Arjun Sengupta Report (from National Commission for Enterprises in the Unorganized Sector): 77% of Indians live on less than ₹20 a day.

- N. C. Saxena Committee report: 50% Indians below the poverty line.
- Oxford Poverty and Human Development Initiative (using MPI [Multi-dimensional Poverty Index]: 645 million living under the MPI in India.
- NCAER (National Council of Applied Economic Research) Report: 48% of the Indian households earn more than ₹90,000 (US $1998) annually.
- World Bank estimates about 100 million Indians are 'below-the-poverty-line' households (i.e., about 456 million individuals).
- Important: The Planning Commission of India has accepted the Tendulkar Committee report which says that 37% of people in India live below the poverty line.

INDUSTRIES

Table 4.2 Public Sector Steel Plants

S.No	*Location*	*Set up with assistance of*	*Remarks*
1.	Rourkela (Orissa)	Germany	Set up under the Second Five Year Plan at the cost of ₹171 crore. It went into production in 1959.
2.	Bhilai (Madhya Pradesh)	Russian Government	Set up under the Second Five Year Plan at the cost of ₹8.5 crore. It went into production in 1959.
3.	Durgapur (West Bengal)	British Government	Set up under the Second Five Year Plan at the cost of ₹188 crore. It went into production in 1962.
4.	Bokaro (Jharkhand)	Russian Government	The biggest plant in Asia was set up under the Fourth Five Year Plan. It went into production in 1973.
5.	Burnpur (West Bengal)		Acquired by the nationalization of private sector plant Indian Iron and Steel Co. in 1976.
6.	Vishakhapatnam (AP)	Russian Government	Set up under the Sixth Five Year Plan at the cost of ₹2256 crore.
7.	Salem (Tamil Nadu)		Set up under the Sixth Fiver Year Plan.
8.	Bhadrawati (Karnataka)		Nationalized under the Sixth Five Year Plan.

State-wise Distribution of Industries

- There is great regional imbalance in the location of various industries in India.
- It can be divided into three regions:
  1. *Industrially Advanced States*: Maharashtra, Gujarat, Tamil Nadu and West Bengal
  2. *Middle-Level Industrial States*: Andhra Pradesh, Karnataka, Uttar Pradesh, Haryana, Punjab
  3. *Industrially Backward States*: Rajasthan, Kerala, Orissa, Himachal Pradesh

Major Large-scale Industries

- The large-scale industries cover iron and steel, engineering, jute, cotton, textiles and sugar.

Iron and Steel Industry

- *History*: In 1870, the first steel company, the Bengal Iron Company was set up at Kulti (West Bengal).
- The first large-scale steel plant came into being in 1907 when the Tata Iron and Steel Company (TISCO) was set up at Jamshedpur followed by the Indian Iron and Steel Company (IISCO) at Burnpur (Burdwan in West Bengal) in 1919 (Bengal Iron Company was merged with IISCO in 1936).
- *Public sector steel plant*
  - — The public sector steel plants are managed by the Steel Authority of India Limited (SAIL).
  - — The government of India owns about 86% of SAIL's equity and retains voting control of the company but by virtue of its 'Navratna' status, SAIL enjoys significant operational and financial autonomy.
  - — *SAIL has four integrated steel plants*: Bhilai Steel Plant (BSP), Chhattisgarh; Durgapur Steel Plant (DSP), West Bengal; Rourkela Steel Plant (RSP), Orissa and Bokaro Steel Plant (BSL), Jharkhand.
  - — *SAIL has three special steel plants*: Alloy Steel Plants (ASP), West Bengal; Salem Steel Plant (SSP), Tamil Nadu and Visvesvaraya Iron and Steel Plant (VISL), Karnataka.
  - — *SAIL has three subsidiaries*: Indian Iron and Steel Company (IISCO), West Bengal; Maharashtra Elektrosmelt Limited (MEL), Maharashtra and Bhilai Oxygen Limited (BOL), New Delhi.
- The first large-scale steel plant in the private sector is the Tata Iron and Steel Company (TISCO), Jamshedpur.
  - — Other major steel producers are Essar Steel, NMDC, Jindal Vijaynagar Steels Ltd., Jindal Strips Ltd., JISCO, Lloyds Steel Industries Ltd., Uttam Steels, Ispat Industries Ltd., Mukand Steels Ltd., Mahindra Ugine Steel Company Ltd., Tata SSL Ltd., Usha Ispat Ltd., Saw Pipes Ltd., Kalyani Steels Ltd., Electro Steel Castings Ltd., NMDC, Sesa Goa Ltd.

Engineering Industries

- These industries produce, besides machinery, tools, transport equipment and consumer durables.
- The automobile sector has demonstrated the inherent strengths of Indian labour and capital.
- Several Indian firms have succeeded in getting integrated into global production chains and realized rapid growth of exports.

Jute Industry

- Most of the country's jute mills are in West Bengal.
- As a foreign exchange earner, it is an important industry.

Textile Industry

- It is the oldest industry and ranks largest in terms of employment economy.
- With the phasing out of quota regime under MFA from 1 January 2005, developing countries including India with both textile and clothing capacity may be able to prosper.

Pharma and IT industry

- These are two sunrise sectors of India.
- Among the sectors that have experienced the greatest transformation in India, the pharmaceutical is perhaps the most significant. In information technology (IT), India has built up valuable brand equity in the global markets.
- In IT-enabled services (ITES), India has emerged as the most preferred destination for business process outsourcing (BPO), a key driver of growth for the software industry and the services sector.

Various Organizations Connected with Industries

- *Bureau of Indian Standards (BIS)*: A quasi-government institution established in 1947 for drawing up standards for the products of the Indian industry.
- It allots quality marks to various products, known as the ISI mark.
- *National Productivity Council (NPC)*: An autonomous body formed in 1958 to increase productivity in industries.
- NPC has regional offices throughout India and it endeavours to create productivity consciousness by applying modern methods and techniques for increasing production.
- To encourage productivity, NPC awards are given annually for the highest productivity in various sectors of industry.

Table 4.3 Principal Manufacturing Regions

Regions/ Main Industries	*Jharkhand–Bengal Industrial Belt*	*Mumbai–Pune*	*Ahmedabad–Vadodara*	*Madurai–Coimbatore–Bangalore*
	(a) Hugli: Jute, cotton, electrical, light engineering goods and chemicals	Cotton (over one-third of workers), chemicals, engineering, food processing, printing, consumer goods,	Cotton, chemicals, pottery	Cotton, light consumer goods, light engineering goods
	(b) Chhotanagpur: Iron and steel, wire rolling, vehicles	light enginee-ring, consumer goods		

Table 4.4 Important Resources

Resource	*Jharkhand–Bengal Industrial Belt*	*Mumbai–Pune*	*Ahmedabad–Vadodara*	*Madurai–Coimbatore–Bangalore*
Coal	Damodar Valley (Jharkhand), West Bengal, Assam, Orissa, Arunachal Pradesh	Maharashtra and Madhya Pradesh		Andhra Pradesh

(*Continued*)

Resource	*Jharkhand–Bengal Industrial Belt*	*Mumbai–Pune*	*Ahmedabad–Vadodara*	*Madurai–Coimbatore–Bangalore*
Iron Ore	Singhbhum (Jharkhand)	—	— Extracted from Babbabudan hills	Small iron and steel works at Bhadravati using ores
Power Hydro-Electricity	Damodar Valley	Important supplies from Western Ghats	—	Cauvery, Jog-Nilgiri Project
Other Raw Materials (Agricultural)	Bengal Jute by water routes meeting Damodar Coal (but much of the best jute has gone to Bangladesh)	Cotton, groundnuts on regur soil of plateau to the East	Cotton from surrounding, sugar, soils, salt from salt pans	Some cotton in Madurai and Coimbatore

Table 4.5 Minor Regions and Their Important Industries

Minor Regions	*Important Industries*
Assam Valley	Processing of local tea, rice and oilseeds
Darjeeling terrain	Processing of local tea
North Bihar adjoining Uttar Pradesh plains	Manufacturing sugar from local sugarcane
Delhi–Meerut	Manufacturing of sugar from local sugarcane, some textiles, chemicals, engineering goods
Indore–Ujjain	Cotton cloth for local markets, handicrafts (patronized by former royal courts)
Nagpur–Wardha	Small textiles, iron foundries, railway and general engineering goods, glass and pottery works
Dharwar–Belgaum	Cotton textiles for local and other markets, railway and general engineering goods
Godavari–Krishna delta	Local tobacco, sugarcane, rice and oil, cement, small textiles
Kanpur	Textile and clothing, large modern tanneries, leather works, shoe manufacturing, all founded on early military needs
Chennai	Textiles, light engineering, consumer goods of wide varieties
Malabar–Kollam Trissur	Cashew processing, coconut and oilseeds processing, associated industries (coir manufacturing, soaps) some textiles, numerous handicrafts
Sholapur	Important textiles based on cotton grown in local regular soils, engineering centres

Table 4.6 Important Industries in India

Industry	*Location*
Aircraft industry	Bangalore and Kanpur
Aluminium	Alwaye (Kerala), Asansol (West Bengal), Belur (Karnataka), Hirakud (Orissa), Renukoot (UP), Muri (Jharkhand), Korba (Chhattisgarh)
Automobiles	Mumbai, Burnpur (West Bengal), Calcutta, Jamshedpur (Jharkhand), Chennai
Cables	Rupnarainpur (West Bengal), Rajpura (Punjab)
Cement	Bhadravati (Karnataka), Churk (UP), Dalmianagar (Bihar), Gwalior, Kymor and Katni (MP), Okha (Gujarat), Sawai Madhopur (Rajasthan), Sahabad (Karnataka), Surajpur (Punjab)
Coir goods	Alleppey and Kalavoor (Kerala)
Cotton textiles	Ahmedabad (Gujarat), Bangalore, Mumbai, Kolkata, Coimbatore (Tamil Nadu), Indore (MP), Kanpur (UP), Ludhiana and Amritsar (Punjab), Chennai, Madurai (Tamil Nadu), Nagpur and Sholapur (Maharashtra)
Cycles	Ludhiana (Punjab)
D.D.T.	Alwaye (Kerala) and Delhi
Glass Items	
1. Bangles	Firozabad (UP) and Belgaum (Karnataka)
2. Lampware	Kolkata, Naini (UP)
3. Thermos flasks	Faridabad (Haryana)
4. Glass bottles	Amritsar (Punjab)
5. Glass lenses	Jabalpur (Madhya Pradesh)
6. Glass sheets	Bahjoi, Balawali, Ghaziabad, Jaunpur (MP), Bangalore, Mumbai, Kolkata, Hyderabad, Chennai
Fertilizer	Nangal, Sindri (Jharkhand), Gorakhpur (UP), Nahorkatiya (Assam), Neyveli (Tamil Nadu) Rourkela (Orissa), Trombay (Maharashtra)
Hosiery goods	Amritsar, Ludhiana (Punjab), Kanpur (UP)
Jute goods	Kolkata, Gorakhpur, Kanpur
Lac	Jhalda and Kossipore (West Bengal), Mirzapur and Bareilly (UP)
Leather goods	Kanpur and Agra (UP), Batanagar (West Bengal), Mumbai, Kolkata, Chennai, Delhi
Locomotives	Chittaranjan (West Bengal), Varanasi (UP), Jamshedpur (Jharkhand)
Match boxes	Ahmedabad, Bareilly (UP), Mumbai, Kolkata, Chennai, Pune, Raipur (Chhattisgarh), Srinagar
Paper	Bhadravati (Karnataka), Dalmianagar, Jagadhari (Haryana), Lucknow and Saharanpur (UP), Rajahmundry and Sirpur (Andhra Pradesh), Titagarh (West Bengal), Brajrajnagar (Orissa), Dandeli (Karnataka), Amalai (MP), Ahmedgarh and Malerkotla (Punjab), Nepanagar (Madhya Pradesh). Newsprint paper is produced in Nepanagar.

(*Continued*)

Industry	*Location*
Penicillin	Pimpri (Maharashtra)
Rail coaches	Perambur (Tamil Nadu), Pune (Maharashtra) Kapurthala (Punjab)
Resin industry	Bareilly (UP), Nahan (Himachal Pradesh)
Rubber goods	Ambapur (Tamil Nadu), Mumbai (Maharashtra), Thiruvananthapuram (Kerala), Bareilly (UP)
Salt	Kuchchh (Gujarat), Sambhar lake (Rajasthan)
Sewing machines	Kolkata, Delhi, Ludhiana (Punjab)
Shipbuilding	Visakhapatnam (Andhra Pradesh), Kochi, Mumbai, Kolkata
Silk	Bangalore, Bhagalpur (Bihar), Srinagar
Sugar	Gorakhpur, Sitapur, Rampur, Moradabad, Bijor, Saharanpur, Meerut, Muzaffarnagar (UP), Gaya (Bihar), Zira, Jagraon (Punjab)
Sports material	Agra and Meerut (UP), Batalla and Jalandhar (Punjab), Delhi
Tanks	Avadi (Tamil Nadu)
Telephone	Bangalore, Naini and Rai Bareilly (UP)
Watches	Jalahalli (Bangalore), Pinjore (Haryana)

Note: Telangana is carved out of Andhra Pradesh as the 29th States. The information above has Andhra Pradesh that includes Telangana and Andhra Pradesh.

Table 4.7 Public Sector Industrial Undertakings

Name	*Location*
Chemical and Pharmaceuticals	
1. Hindustan Organic Chemicals Ltd.	Rasayani (Maharashtra)
2. Indian Drugs and Pharmaceuticals Ltd.	
(a) Antibiotics Plant (IDPL)	Rishikesh (Uttaranchal)
(b) Synthetic Drugs Project	Hyderabad (AP)
(c) Surgical Instruments Plant	Chennai
3. Hindustan Antibiotics Ltd.	Pimpri (Maharashtra)
4. Hindustan Insecticides Ltd.	Alwaye (Kerala) and Delhi
Fertilizers	
1. Fertilizer Corporation of India Ltd.	Nangal (Punjab) Sindri (Jharkhand) Trombay (Maharashtra) Gorakhpur (UP) Namrup (Assam) Durgapur (West Bengal)
2. Heavy Water Plants	Neyveli (Tamil Nadu) Nahorkatiya (Assam) Rourkela (Orissa) Trombay (Maharashtra)
Machinery and Equipment	
1. Bharat Dynamics Ltd.	Hyderabad
2. Bharat Electronics Ltd.	Jalahalli (Karnataka) Ghaziabad (UP)

(*Continued*)

Name	*Location*
3. Bharat Heavy Electricals Ltd.	Ranipur (UP) Ramachandrapuram (AP) Tiruchirapalli (TN) Bhopal (MP)
4. Bharat Heavy Plate and Vessels Ltd.	Visakhapatnam (AP)
5. Central Machine Tools	Bangalore
6. Chittaranjan Locomotive Works	Chittaranjan (West Bengal)
7. Cochin Shipyard	Kochi
8. Diesel Locomotive Works	Marwadeeh, Varanasi (UP)
9. Garden Reach Workshop Ltd.	Kolkata
10. Heavy Electricals Ltd.	Bangalore
11. Heavy Electricals (India) Ltd.	Bhopal
12. Heavy Engineering Corpn. Ltd.	Ranchi
13. Heavy Machine Building Plant	Ranchi
14. Heavy Vehicles Factory	Avadi (Tamil Nadu)
15. Hindustan Cables Factory	Rupnarainpur (West Bengal)
16. Hindustan Machine Tools	Jalahalli (Karnataka) near Bangalore Pinjore (Haryana) Hyderabad (AP) Kalamassery (Kerala)
17. Hindustan Shipyard	Visakhapatnam and Kochi
18. Indian Telephone Industries	Bangalore Naini (UP) Rai Bareilly (UP) Mankapur (Gonda, UP)
19. Instrumentation Ltd.	Kota (Rajasthan) Palakkad (Kerala)
20. Integral Coach Factory	Perambur (Tamil Nadu) Kotkapur (Punjab)
21. Machine Tool Corporation of India	Ajmer (Rajasthan)
22. Machine Tools Prototype Factory	Ambarnath, Mumbai
23. Mazagon Docks Ltd.	Mumbai
24. Mining and Allied Machinery Corporation Ltd.	Durgapur
25. Nahan Foundry	Sirmur (HP)
26. National Instruments Factory	Kolkata
27. Praga Tools Corporation	Hyderabad Corporation Ltd.
28. Triveni Structural Ltd.	Naini (HP)
29. Tungabhadra Steel Products Ltd.	Tungabhadra (Karnataka)

(*Continued*)

Name	*Location*
Projects	
1. National Mineral Development Corporation	Hyderabad
2. Hindustan Zinc Limited	Udaipur (Rajasthan)
3. Bharat Aluminium Co. Ltd.	Korba (MP) Ratnagiri (Maharashtra)
4. Hindustan Copper Ltd.	Agnigudala (AP) Dariba (Rajasthan) Malanjkhand (MP) Rakha (Jharkhand)
5. Bharat Coking Coal Ltd.	Dhanbad (Jharkhand)
6. Bharat Gold Mines Ltd.	Kolar (Karnataka)
7. Coal Mines Authority Ltd.	Kolkata
8. Neyveli Lignite Corporation	Neyveli (Tamil Nadu)
9. Zinc Smelter	Zawar (Rajasthan)
Paper	
1. National Newsprint and Paper Mills Ltd.	Nepanagar (MP)
Petroleum	
Indian Refineries Ltd.	Barauni (Bihar) Noonmati (Assam)
Cochin Oil Refinery	Kochi (Kerala)
Koyali Oil Refinery	Koyali (Gujarat)
Steel Plants	
1. Hindustan Steel Ltd.	Bhilai (MP)
2. Hindustan Steel Ltd.	Durgapur (West Bengal)
3. Hindustan Steel Ltd.	Rourkela (Orissa)
4. Bokaro Steel Ltd.	Bokaro (Jharkhand)
Others	
1. India Explosives Factory	Gomia in Hazaribagh (Jharkhand)
2. Hindustan Photo Films Manufacturing Co. Ltd.	Ootacamund (Tamil Nadu)

Note: Telangana is carved out of Andhra Pradesh as the 29th States. The information above has Andhra Pradesh that includes Telangana and Andhra Pradesh.

Table 4.8 Cottage Industries in India

Name of Industry	*States and Cities*
Handloom Industry	
1. Sarees and dhotis	Tamil Nadu, Madhya Pradesh, West Bengal, Varanasi, Karnataka
2. Prints	Murshidabad, Farrukhabad, Jaipur, Mumbai, Karnataka
3. Carpets, rugs	Mirzapur, Bhadohi, Ellora, Kashmir, Jaipur, Bangalore
Silk	
Silk sarees	Bangalore, Kanjivaram, Karnataka
Tussar silk	Sambalpur, Ahmedabad
Patola silk	Baroda

(*Continued*)

Name of Industry	*States and Cities*
Metal and Brassware	
Brass utensils with engraving and polishing	Moradabad
Brassware/Metalware	Jaipur, Kashmir, Varanasi, Madurai, Tanjore
Ivory Works	Andhra Pradesh, Kerala, Karnataka, Tamil Nadu, Rajasthan

Note: Telangana is carved out of Andhra Pradesh as the 29th States. The information above has Andhra Pradesh that includes Telangana and Andhra Pradesh.

Petroleum and Natural Gases

- *History*: In 1867, the first oil well was sunk in India. The first successful well was sunk at Digboi in 1889. This oilfield is still in operation after more than 100 years. Till Independence, Assam was the only oil-producing state in India.
- Now oil has also been struck recently by the Hindustan Oil Exploration Company in Cambay basin near Palej, Gujarat.
- The recently discovered seabed oilfields of Mumbai High are also yielding substantial quantities of oil and are now the richest oil fields of the country.
- *Exploration*: In order to explore the natural resources of oil and natural gas in the country, the Oil and Natural Gas Commission (ONGC) was set up at Dehradun in 1956.
- *Organization Set-Up*: The Department of Petroleum under the Ministry of Petroleum, Chemicals and Fertilizers, deals with the exploration and production of oil and natural gas, refineries and distribution work of these.
- *Oil India Limited*: It is now a Government of India organization which was incorporated in 1959 with headquarters in Duliajan (Assam) in collaboration with the Burmah Oil Company (BOC).
- In 1981, the government took over the share of the Burmah Oil Company, making OIL entirely a public sector company.
- The main objectives of OIL are exploration and production of crude oil (including natural gas) and construction of pipelines to transport crude oil to the government-owned refineries of Noonmati and Barauni.
- *Important Oil-bearing States/Areas*: Assam, Tripura, Manipur, West Bengal, Ganga Valley, Himachal Pradesh, Kuchchh, Ndhra Pradesh and offshore areas adjoining West Bengal, Orissa, Ndhra Pradesh, Tamil Nadu, Karnataka, Maharashtra and Gujarat.
- *Main Oil Fields*: Main oil fields where oil-bearing wells have been drilled are as follows:
  Gujarat: Khambhat, Ankleshwar, Olpad, Sam, Kalori and Weinad
  Assam: Digboi, Rudrasagar, Sibsagar
  Punjab: Adampur, Janauri, Jwalamukhi
- *Off-Shore Drilling*: Bombay High, in the deep waters of the western coast, where drilling operations have been undertaken with the help of the drilling platform, Sagar Samrat.

Corporations

- *Indian Oil Corporation (IOC)*: Established in 1964 by amalgamating Indian Refinery Limited and Indian Oil Company.

- It has three divisions:
  1. Marketing (headquarters in Mumbai)
  2. Refining and Pipeline (headquarters in Delhi)
  3. Assam Oil (headquarters in Digboi)
- *Bharat Petroleum Corporation Ltd. (BPCL)*: It came into being through the acquisition of Burmah Shell in 1976 as Bharat Refineries Limited but on 1 August 1977, the name was changed to Bharat Petroleum Corporation Ltd.
- It is an integrated refining (at Mumbai) and marketing company (throughout the country).
- *Hindustan Petroleum Corporation Ltd. (HPCL)*: It was established in 1974 by amalgamating ESSO and Caltex.
- The government has acquired its full ownership since October 1976.
- Its main activities include refining of crude oil, manufacturing petroleum and lubricating products and marketing and distribution of these products throughout India.
- It is a mega public sector undertaking of the 'Nav Ratna' status (conferred by the Indian government).
- *Gas Authority of India Limited (GAIL)*: It is the largest natural gas marketing company in India.
- It was established in 1984 by the government to handle the transportation, processing, distribution and marketing of natural gas.
- It completed the tough challenge by the government for completing the cross country HBJ (Hazira, Bijapur and Jagdishpur) Pipeline in record time.
- It now operates more than 4000 km of gas pipelines stretched across the country.

Table 4.9 Oil Refineries

Name of the Company	***Location of the Refinery [Capacity in Million Metric Tonnes Per Annum (MMTPA)]***
Indian Oil Corporation Ltd. *Refineries* *Subsidiaries*	Digboi (0.65); Guwahati (1.00); Barauni (6.00); Mathura (8.00); Koyali (13.70); Haldia (6.00); Panipat (12.00); Bongaigaon (2.35) *Sub total* 49.70 CPCL-Chennai (9.50); Narimanam (1.00) *Sub total* 10.50 *Group total* 60.20 (MMTPA equals to 20,000 barrels per day)
Hindustan Petroleum Corporation Ltd. *Refineries*	Mumbai (6.50); Visakhapatnam (7.50) *New project at Mumbai refinery FCCU Project to be completed by the first quarter of 2010–2011 *Mittal Energy Investment Guru Gobind Refinery, Bathinda (9.00). Project to be completed by end 2011
Bharat Petroleum Corporation Ltd. *Refineries*	Mumbai (12.00); Kochi (7.50); Numaligarh (3.00) *Bina Refinery (6.00) to be set up at Bina, District Sagar, Madhya Pradesh

(*Continued*)

Name of the Company	*Location of the Refinery [Capacity in Million Metric Tonnes Per Annum (MMTPA)]*
Chennai Petroleum Corporation Ltd. *Refineries*	Manali (9.50); Nagapattnam (1.00)
Assam Oil Company Ltd.	Digboi (0.65)
Mangalore Refinery and Petrochemicals Ltd.	Mangalore (9.69)
Oil and Natural Gas Corporation Ltd. (ONGC) *Refineries* *Subsidiaries*	Andhra Pradesh (0.10) ONGC Videsh Ltd. (OVL) with the following *Direct Subsidiaries* ONGC Nile Ganga—Syria (0.812); Venezuela (0.671); Sudan (2.443) ONGC Amazon Alaknanda Ltd. (OAAL)—OVL's share (0.370 MMT) Jarpeno Ltd. (0.076 MMT) *Joint venture with Mittal Energy Ltd. (ONGC Mittal Energy Ltd.) *Joint venture with MRPL

Note: Telangana is carved out of Andhra Pradesh as the 29th States. The information above has Andhra Pradesh that includes Telangana and Andhra Pradesh.

Table 4.10 Indian Cities and Towns Associated with Industries

Town	*Industry*
Agra	Shoes and leather goods
Ahmedabad	Cotton textiles
Aligarh	Locks
Alwaye	Rare earths factory
Ambernath	Machines tools prototype factory
Ankleshwar	Oil
Bangalore	Cotton textiles, aircraft, telephone, toys, carpets, motors and machine tools
Bareilly	Resin industry and wood work
Bhilai	Steel plant
Bokaro	Steel plant
Mumbai	Cotton textiles, films
Kolkata	Jute, electric bulbs and lamps
Chittaranjan	Locomotive
Delhi	Textile, DDT
Dhariwal	Woollen goods
Digboi	Oil
Durgapur	Steel plant
Firozabad	Glass and glass bangles
Gwalior	Pottery and textiles

(*Continued*)

Town	*Industry*
Jaipur	Embroidery, pottery, brassware
Jamshedpur	Iron and steel
Jharia	Coal
Kanpur	Leather goods/shoes
Katni	Cement
Khetri	Copper
Ludhiana	Hosiery, sewing machines, cycles
Moradabad	Brass utensils, Calico-printing
Mysore	Silk
Nangal	Fertilizers
Nepanagar	Newsprint
Neyveli	Lignite
Perambur	Rail coach factory
Pimpri (Pune)	Penicillin factory
Pinjore	Machine tool
Raniganj	Coal mining
Rourkela	Steel and fertilizers
Rupnarainpur	Cables
Sindri	Fertilizers
Singhbhum	Copper
Surat	Textiles
Tiruchirapalli	Cigars
Titagarh	Paper
Trombay	Atomic power station
Vishakhapatnam	Ship building

Rate of Inflation

- The cause of inflation lies in the official policies which cause monetary and fiscal indiscipline.
- Budget compression reduces demand as well as supply.
- Hence, the incentive structure should be used judiciously to see that the incentive to speculate does not out-do the incentives for production.
- Before devising appropriate anti-inflationary policies it is important for the government to understand the demand and supply gaps.
- However, despite increases in energy costs and other pressures from the world economy, for most of the period since independence India has not experienced severe inflation.
- The underlying average rate of inflation, however, has tended to rise.
- Consumer prices rose at an annual average of 2.1% in the 1950s, 6.3% in the 1960s, 7.8% in the 1970s and 8.5% in the 1980s.
- Three factors lay behind India's relative price stability.
  1. Government intervention, either direct or indirect, to keep the price of certain staples, including wheat, rice, cloth and sugar, stable
  2. Monetary regulation, which has restricted growth in money supply
  3. Low overall influence of the labour unions on wages because of the weakness of the unions in India's labour surplus economy

Causes of Inflation

- Mismatch among money supply, production and prices.
- Deficit financing of huge public outlays by the government which leaves big financial gaps.
- Black money and parallel economy which attacks money policies and encourages over-funding of businesses.
- Increasing governmental expenditures.
- Growing population adds to the inflationary pressures.
- Administered prices with upward revisions to prices of the inputs for industry adds to inflation.
- The government mobilizes additional resources through indirect taxes; this gives traders the opportunity to increase prices.
- Fluctuations in industrial and agricultural productions.
- Fluctuations in rate of savings and procurement prices.
- Infrastructural and forex bottlenecks.

Remedial Measures to Control Inflation

1. *Short-term Measures*
   - Increase in supply of essential commodities.
   - Increase in money supply and control of deficit financing by government.
   - Improve public distribution system to distribute essential commodities to masses through wide network at fair prices.
2. *Long-Term Measures*
   - Build up buffer stocks of essential commodities.
   - Bring more and more taxpayers within the tax bracket to widen the taxation base.
   - Rationalize public expenditure and plan proper allocation of investment.
   - Increase in the production of food-grains and other articles of mass consumption.
   - Restructure infrastructural sectors.
   - Conservative monetary policy to bring price and fiscal stability in the country.
   - Consequences of inflation
   - People reduce their cash holdings during inflationary times which brings real cash balances.
   - People change their financial assets to physical assets.
   - Fiscal planning becomes difficult for government and individuals. Uncertainties during inflationary period dampens investments and saving. Income redistributes as entrepreneurs and salaried class lose while speculators and real-estate and gold holders tend to gain more.
   - Capacity of the economic system to perform profitably reduces.

CURRENCY SYSTEM

Historical Background

- First gold coins were introduced during the reign of the Guptas, AD 390–550.
- Rupee was first minted in India during the reign of Sher Shah Suri around AD 1542. It was a silver coin weighing around 179 gm and it replaced the gold coins.
- In 1873, when the price of silver fell in the world market, the silver coin lost its metallic value. The exchange value of the Indian rupee was ₹10 per pound sterling till 1873.

- Paper currency in India was introduced in 1882 by the British government.
- With the establishment of the Reserve Bank of India in 1935, the Indian rupee became an independent currency, although for exchange purposes it continued to be dependent on the pound sterling.
- In 1947, India became a member of the International Monetary Fund and the exchange value of the rupee came to be fixed by IMF standards.

Decimal System

- The Indian currency system was converted into a decimal system by Indian Coinage (Amendment) Act, 1955, which was brought into force from 1 April 1957.
- The old system of rupee, annas and paise (1 rupee = 16 annas and 1 anna = 12 paise) was replaced by the rupee and paise system.
- The first 1paise coin under the decimal system was issued in March 1962 and the first ₹1 coin in July 1962.

Issue and Distribution of Currency

- All coins and ₹1 notes are issued by the Government of India.
- Therefore the ₹1 note does not bear the signature of the governor of the Reserve Bank of India.

Currency Denominations

- At present currency notes of denominations of ₹1, 2, 5, 10, 20, 50, 100, 500 and 1000 are in circulation.
- The current series which began in 1996 is called the Mahatma Gandhi Series.
- The currency notes of ₹500, bearing a portrait of Mahatma Gandhi and the Ashoka Pillar emblem were issued by RBI from 3 October 1987.
- All notes above ₹1 denomination are issued by the Reserve Bank of India and, therefore, currency notes above ₹1 denomination bear the signatures of the governor of the Reserve Bank of India. These notes are also called bank notes.
- Distribution and administration of all currency is done by the Reserve Bank of India as an agent of the Government of India.

Demonetization of Currency

- Demonetization refers to the withdrawal of currency from circulation which is done to ambush black market currency and unaccounted money. So far, demonetization has taken place twice.
- The first demonetization was done in 1946, which called for a declaration of notes of ₹100 and above then demonetized all notes of ₹500 denomination and above.
- The second demonetization was done in January 1978, through which currency notes of the higher denominations of ₹1000, ₹5000 and ₹10,000 were demonetized.

Devaluation of Currency

- Devaluation refers to reducing the value of the Indian rupee in comparison to the US dollar in the world market.
- In 1947, India became a member of the International Monetary Fund which necessitated fixing the exchange value of the Indian rupee as per IMF standards. As a result India was obliged to devalue the rupee.
- So far the following devaluations have taken place.

- The first devaluation took place in June 1949, when the Indian rupee was devalued by 30.5%.
- Dr John Mathai was the finance minister.
- In the second devaluation in June 1966, the Indian rupee was further devalued by 57%. Sachindra Chaudhury was the finance minister.
- In the third devaluation on 1 July 1991, the Indian rupee was devalued by 9% and devalued for the fourth time by 11% on 3 July 1991, bringing the total devaluation to 20%.
- This was during the tenure of Dr Manmohan Singh as finance minister.
- Since 20 August 1994, the rupee has been made a freely convertible currency on current account.

BANKING SYSTEM

Development of Banking System in India

- The first bank in India, managed by Indians was the Oudh Commercial Bank founded in 1881.
- It was a bank of limited liability. However many institutions undertook banking business under the British regime as agency houses carrying on banking along with their trading business.
- The second Indian bank to be established was the Punjab National Bank in 1884.
- With the beginning of the Swadeshi Movement in 1906, a number of commercial banks surfaced.
- In 1921, three presidency banks operating in India were amalgamated into the Imperial Bank of India following serious financial troubles.
- In the 1940s, a need for regulating and controlling commercial banks was felt and in January 1946, the first banking act, the Banking Companies (Inspection Ordinance) Act was introduced which was followed by another then Banking Companies (Restriction of Branches) Act in February 1946.
- The Banking Companies Act was amended in 1949 and its name changed to the Banking Regulation Act.
- In 1993, new private sector banks were allowed to be set up in the Indian banking system as the government recognized the need to introduce greater competition which can play an important role in ushering in a more efficient and competitive economy. However a new bank had to satisfy the following requirements.
- It should be registered as a public limited company.
- The minimum paid-up capital should be more than ₹100 crore.
- It should list its shares in the stock exchange.
- The headquarters of the bank should preferably be located where no other banks have headquarter representations.
- The bank should be subject to the prudential norms with respect to banking operations, accounting and other policies as laid down by the RBI.
- It should achieve a minimum capital adequacy of 8% from the very beginning.
- In December 1997, another high-level committee, under the chairmanship of M. Narasimham, was constituted by the Government of India to review the implementation of the financial system reforms recommended in 1991.

- The committee was also required to analyse the contemporary situation and propose reforms necessary in the years ahead to make the banking system stronger and better equipped to compete effectively in the international economic environment.
- The committee submitted its report in April 1998.

Reserve Bank of India

- The basic elements of the Indian financial system were established during the British rule (1757 to 1947).
- The national currency, the rupee, had long been used domestically before independence and even circulated abroad, for example, in the Persian Gulf region.
- Foreign banks, mainly British and some from such other parts of the empire as Hong Kong, provided banking and other services.
- This colonial banking system, however, was geared to foreign trade and short-term loans.
- Banking was concentrated in the major port cities.

Creation

- The Reserve Bank of India came into existence on 1 April 1935, as a privately owned bank with only 5% shares of the Government of India and a share capital of ₹5 crore (the share capital is still ₹5 crore) in accordance with the provision of the Reserve Bank of India Act, 1934.
- The bank was originally constituted as a shareholder's institution on the model of leading foreign central banks of the time.
- The bank's share capital of ₹5 crore was divided into 5 lakh fully paid-up shares of ₹100 each.
- The entire share capital was, in the beginning, owned by private shareholders with the exception of 2200 shares which were allotted to the Central Government.
- It was in February 1947 that the decision to nationalize the bank was taken and in terms of the Reserve Bank of India.
- (Transfer to Public Ownership) Act 1948, the entire share capital was deemed to be transferred to the Central Government. From 1 January 1949, RBI became a state-owned institution.
- The Act of 1948 was empowered the Central Government to issue such directions to the bank as it might consider necessary in the public interest.

Governors

- The first governor Sir Obsborne Arkall Smith (1935 to 1937)
- The first Indian governor C. D. Deshmukh (1943 to 1949)
- The governor and deputy governors hold office for a period not exceeding 5 years. They are eligible for reappointment. The directors hold office for 4 years. The board has delegated some of its functions by means of statutory regulation to the Committee of Central Board. The committee meets once a week.
- It consists of the governor, deputy governors and directors representing the area in which the meeting is held. For each of the regional areas of the country specified in the First Schedule of the Act, there is a local board with headquarters at Mumbai, Kolkata, Chennai and New Delhi.

- Local boards consist of five members, each appointed by the Central Government. They are appointed for a period of 4 years.
- The functions of the local boards are to advise the central board on such matters as may be generally or specifically referred to them.

Functions

- The main functions of RBI are broadly the same as those of other central banks all over the world. These are as follows:
  — The RBI regulates the issue of bank notes above ₹1 denominations.
  — The Government of India issues ₹1 notes and coins of all denominations below ₹1.
  — The RBI undertakes distribution of all notes and coins on behalf of the government.
  — It acts as the banker of the Government of India and the state governments, commercial banks and state cooperative banks.
  — It formulates and administers the monetary policy.
  — It maintains the exchange value of rupee.
  — It represents India at the International Monetary Fund (IMF).
  — It promotes the growth of the economy within the framework of the general economic policy of the government.
  — No personal accounts are maintained and operated in the RBI.
- Other functions of RBI of a secondary nature are as follows:
  — Provision of rural credit
  — Collection and publication of monetary and financial information
  — Issue of paper currency
  — Control over bank credit
  — Acting as the lender of last resort to commercial banks
  — Maintenance of external value of the rupee

Imperial Bank of India

- Before the nationalization of RBI, its functions were performed by the Imperial Bank of India.
- It was created in January 1921 by the amalgamation of three presidency banks—(i) Bank of Bengal, (ii) Bank of Bombay and (iii) Bank of Madras.
- After nationalization in 1955, the Imperial Bank of India was named the State Bank of India.

Scheduled Banks

- The Reserve Bank of India maintains a schedule of banks which undertake to maintain a minimum percentage of their liability with the Reserve Bank of India and a paid-up capital of ₹5 lakh.
- The banks covered under this schedule are called scheduled banks.

Public Sector Banks

State Bank of India

- It is the largest public sector bank of India created after the nationalization of the Imperial Bank of India in 1955.
- It is now the largest commercial bank in India and, in terms of branches (10,836), the largest in the world.

- *Functions*: The State Bank of India provides long-term credit and acts as the agent of the Reserve Bank of India in the country.
- It advances loans and deals in foreign exchange and other banking operations of the government.

Subsidiaries of State Bank of India

- The State Bank of India has seven subsidiaries. These are as follows:
  1. State Bank of Bikaner and Jaipur
  2. State Bank of Hyderabad
  3. State Bank of Indore
  4. State Bank of Mysore
  5. State Bank of Patiala
  6. State Bank of Saurashtra
  7. State Bank of Travancore

Nationalization of Banks

- *Objective*: To use financial institutions as an instrument for promoting economic and social development in a more purposeful manner.
- To overcome the monopoly of SBI over financial resources, the Government of India nationalized 20 commercial banks during the tenure of Prime Minister Indira Gandhi.
- *First Nationalization*: On 19 July 1969, the first nationalization of banks took place whereby the following 14 banks were nationalized.
  (i) Bank of India; (ii) Union Bank of India; (iii) Bank of Baroda; (iv) Bank of Maharashtra; (v) Punjab National Bank; (vi) Indian Bank; (vii) Indian Overseas Bank; (viii) Central Bank of India; (ix) Canara Bank; (x) Syndicate Bank; (xi) United Commercial Bank; (xii) Allahabad Bank; (xiii) United Bank of India and (ix) Dena Bank
- *Second Nationalization*: On 15 April 1980, the second nationalization took place whereby the following six banks were nationalized.
  (i) Andhra Bank; (ii) Corporation Bank; (iii) New Bank of India; (iv) Oriental Bank of Commerce; (v) Punjab and Sind Bank and (vi) Vijaya Bank
- In October 1993, the New Bank of India was merged with the Punjab National Bank. Therefore, at present, there are only 19 nationalized banks in the country besides the Reserve Bank of India.

Commercial Banks

- The major items of liabilities and assets pertaining to commercial banks are used in compilation of all monetary aggregates except reserve money aggregates.
- As per Section 42(2) of the RBI Act, commercial banks are statutorily required to provide major items of the liabilities and the assets on a fortnightly basis which form the basis for compilation of monetary aggregates.
- Since the format of the Section 42(2) is governed by statutory provision, the coverage of Section 42(2) return was expanded by providing an additional annexe to the main format to capture, on the assets side, banks' investment in capital market instruments such as shares and debentures of corporates, commercial paper and foreign currency assets, while on the liabilities side, items such as paid-up capital, reserves, certificates of deposits and maturity structure of time deposits were included.

Regional Rural Banks

- The Regional Rural Banks (RRBs) were established in 1975 to supplement the efforts of cooperative and commercial banks in different states with equity participation from commercial banks, central government and state governments.
- RRBs have been sponsored by public sector banks and are akin to commercial banks in their method of operations and set up but the area of activity and loan operations are restricted to specified areas and target groups.
- As the RRBs are scheduled commercial banks, they report their major items of liabilities and assets on a fortnightly basis as a part of Section 42(2) return which forms the base for compilation of monetary aggregates.

Cooperative Banks

- Cooperative banking is an integral part of the banking system in India.
- The various segments of cooperative banks are Primary Cooperative Banks, State Cooperative Banks, District Central Cooperative Banks, Primary Agricultural Credit Societies, State Cooperative Agriculture and Rural Development Banks and Primary Cooperative Agriculture and Rural Development Banks.
- Cooperative banks include scheduled and non-scheduled cooperative banks.
- Data on scheduled cooperative banks are available in the fortnightly returns while data with respect to non-scheduled cooperative banks are available in the monthly returns filed by them with RBI.
- These data are used for the compilation of monetary aggregates.
- Detailed data relating to the operation of the cooperative banking sector are compiled primarily by NABARD and RBI.
- Primary (urban) cooperative banks send their returns to RBI while other cooperative banks submit their returns to NABARD.
- Firm data for the financial year are made available with a time lag of 18–20 months.
- The NABARD releases detailed information on cooperative banks through its publications.
- RBI publishes assets and liabilities and financial performance of scheduled primary, state and central cooperative banks in the Report on Trend and Progress of Banking in India.

Non-banking Financial Companies (NBFCs)

- A characteristic feature of the non-banking financial companies (NBFCs) is their wide reach in deposit mobilization.
- The main advantages of these companies lie in their lower transaction costs, quick decision-making ability, customer orientation and prompt provision of services.
- NBFCs are classified into the following categories based on their principal business: Equipment Leasing Company (ELC), Hire-Purchase Financing Company (HPFC), Loan Company (LC), Investment Company (IC), Mutual Benefit Financial Company (Nidhi), Mutual Benefit Company (Un-notified Nidhi), Miscellaneous Non-Banking Company (Chit Fund Company), Residuary Non-Banking Company (RNBC) and Housing Finance Company (HFC).
- In the present regulatory framework, the entire gamut of regulation and supervision of the activities of NBFCs has been redefined in terms of both the thrust as well as the focus.

- Consequently, NBFCs are classified into three categories for the purposes of regulation, namely, (i) those accepting public deposits, (ii) those which do not accept public deposits and (iii) core investment companies which hold at least 90% of their assets as investments in the securities of their group, holding or subsidiary companies and are not trading in such securities.
- The companies which accept public deposits are required to comply with all the prudential norms of income recognition, asset classification, accounting standards, provisioning for bad and doubtful debts, capital adequacy and credit or investment concentration norms, etc.
- The NBFCs not accepting public deposits are regulated in a limited manner.
- Prudential norms like income recognition, asset classification, uniform accounting year and accounting standards that disclose the status of their financial health have been made applicable to them.
- The core investment companies have been exempted from all the provisions of directions.

Other Important Banks and Financial Institutions

- *Industrial Credit and Investment Corporation of India Limited*: The Industrial Credit and Investment Corporation of India Limited (ICICI) was established in 1955 as a public limited company to encourage and assist the industrial units of the nation.
- It aimed to provide assistance in the creation, expansion and modernization of industrial enterprises, encouraging and promoting participation of private capital in such enterprises.
- It was also focused to promote industrial development and help in the development of capital markets.
- *Small Industries Development Bank of India*: The Small Industries Development Bank of India (SIDBI) was established on 2 April 1990, as a wholly owned subsidiary of Industries Development Bank of India (IDBI) under the Small Industries Development Bank of India Act, 1989.
- It is the principal financial institution for promoting, financing and assisting in the development of industries falling under the small-scale sector.
- *Indian Banks Abroad*: In over 23 countries, nine Indian banks operate through 97 branches (including offshore branches and mobile agencies).
- The branches are located at all the major international trade centres including London, Singapore, Amsterdam, Bahrain, New York, Hong Kong, Tokyo, Frankfurt and Paris.
- These branches provide services in international banking including financing of foreign trade.
- The largest number of branches are in UK (21), followed by the Fiji Islands (9), USA (8), Singapore (6), Mauritius (7), Sri Lanka (6), Hong Kong (7), UAE (6) and Japan (4).
- Apart from these branches, Indian commercial banks have also opened representative offices in USA, Brazil, Indonesia, Iran, Egypt, Russia, Italy, Zimbabwe, China, Uzbekistan, Philippines and Vietnam.
- These commercial banks also have wholly owned subsidiaries and joint ventures in USA, Canada, Zambia, Nigeria, Uganda, Bhutan, Nepal, Keyna and Mauritius.
- All of these enterprises cater to the needs of Indian exporters and importers and to that extent, they form an integral part of the domestic banking system of the country of their location.

- *National Bank of Agriculture and Rural Development*: The National Bank of Agriculture and Rural Development (NABARD) was set up by a government notification issued on 12 July 1982 and was inaugurated on 5 November.
- Its primary objective is to promote agriculture and rural development through credit facilities to the farmers.
- *Export-Import Bank of India*: The Export-Import Bank of India (EXIM) was set up on 1 January 1982.
- Among other things it grants deferred payment credit of medium- and long-term duration for exports and renders financial assistance/guarantees to Indian exporters to operate in the international market.
- *Industrial Development Bank of India*: The IDBI, established in 1964, is an apex institution for industrial finance.
- *Regional Rural Banks*: The Regional Rural Banks (RRBs) were brought into existence by a Presidential Ordinance in September 1975 and the first regional rural bank in the country called Prathama Gramin Bank sponsored by the Syndicate Bank was set up in October 1975 at Moradabad (UP).
- At present, the largest number of regional rural banks are in Uttar Pradesh.
- *Lead Bank Scheme*: The Nariman Committee recommended the Lead Bank Scheme in 1969.
- Under this scheme, each bank is assigned the major role of assisting in the development of banking and credit in the district allocated to it—by undertaking surveys to assess the credit gap in a particular district and determining the number of new branches required to meet the requirement of the area with the cooperation of other banks.
- *Functions*:
  - — To survey the number of industrial and commercial units and forms in the district to determine the potential of banking.
  - — To examine the facilities for the marketing of agricultural and industrial products and linking credit with marketing.
  - — To assist other primary leading agencies.
  - — To maintain contact with the government and quasi-government agencies.

New Banks in Private Sectors

- In 1993, in recognition of the need to introduce greater competitions, new private sector banks were allowed to be set up in Indian banking system.
- These new banks had to satisfy certain requirements.
- On 19 November 2000, the government of India relaxed entry level for the private sector by reducing the government holding in nationalized banks from 51% to 33%.
- Further, revised guidelines for entry of new banks in private sector were issued on 3 January 2001.
- The applications for setting up new banks received within the stipulated period were scrutinized by RBI and 'on-principle' approvals were issued to two new entities on 7 February 2002 and one of which Kotak Mahindra Bank on satisfactory completion of other formalities was granted banking licence on 6 February 2003.

- The bank commenced its operaton with effect from 22 March 2003 and subsequently it has been included in the Second Schedule to the Reserve Bank of India Act, 1934 on 12 April 2003.
- On satisfactory completion of all formalities, licence has been granted to Yes Bank Ltd., on 24 May 2004.

Old Private Sector Banks

- Bharat Overseas Bank Ltd.
- City Union Bank Ltd.
- Development Credit Bank Ltd.
- Lord Krishna Bank Ltd.
- SBI Commercial and International Bank Ltd.
- Tamilnad Mercantile Bank Ltd.
- The Bank of Rajasthan Ltd.
- The Catholic Syrian Bank Ltd.
- The Dhanalakshmi Bank Ltd.
- The Federal Bank Ltd.
- The Ganesh Bank of Kurundwad Ltd.
- The Jammu and Kashmir Bank Ltd.
- The Karnataka Bank Ltd.
- The Karur Vysya Bank Ltd.
- The Lakshmi Vilas Bank Ltd.
- The Nainital Bank Ltd.

List of Private Sector Banks

- The Nedungadi Bank Ltd.
- The Ratnakar Bank Ltd.
- The Sangli Bank Ltd.
- The South Indian Bank Ltd.
- The United Western Bank Ltd.
- The Vysya Bank Ltd.

New Private Sector Banks

- Bank of Punjab Ltd.
- Centurion Bank Ltd.
- Global Trust Bank Ltd.
- HDFC Bank Ltd
- ICICI Bank Ltd.
- IDBI Bank Ltd.
- IndusInd Bank Ltd.
- UTI Bank Ltd.
- Kotak Mahindra Bank Ltd.
- Yes Bank Ltd.

List of Foreign Banks in India

RBI has been issuing licenses to various foreign banks to operate in India. More than 50 foreign and multinational banks are working in India today.

- ABN AMRO Bank N.V.
- Abu Dhabi Commercial Bank Ltd.
- American Express Bank Ltd.
- Arab Bangladesh Bank Ltd.
- Bank International Indonesia
- Bank of Muscat S.A.O.G.
- Bank of America N.A.
- Bank of Bahrain and Kuwait B.S.C.
- Bank of Ceylon
- Barclays Banks PLC
- BNP Paribas
- Chinatrust Commercial Bank
- Chohung Bank
- Citibank NA
- Commerzbank AG
- Credit Agricole Indosuez
- Credit Lyonnais
- Deutsche Bank AG
- Development Bank of Singapore Ltd.
- Dresdner Bank AG
- HSBC Ltd.
- ING Bank N.V.
- JP Morgan Chase Bank (The Chase Manhattan Bank)
- K.B.C. Bank N.A.

- Krun Thai Bank Public Co. Ltd.
- Mashreqbank PSC
- Mizuho Corporate Bank Ltd. (The Fuji Bank Ltd.)
- Oman International Banks S.A.O.G.
- Overseas-Chinese Banking Corporation Ltd.
- Societe Generale
- Sonali Bank
- Standard Chartered Bank
- Standard Chartered Grindlays Bank Ltd.
- State Bank of Mauritius Ltd.
- Sumitomo Mitsui Banking Corporation (The Sumitomo Bank Ltd.)
- The Bank of Nova Scotia
- The Bank of Tokyo-Mitsubishi Ltd.
- The Siam Commercial Bank
- The Toronto-Domonion Bank Ltd.
- UFJ Bank Ltd. (The Sanwa Bank Ltd.)

INSURANCE

- The first insurance company in India was established in September 1870 at Mumbai.
- As a part of the financial sector reforms, a Committee on Reforms in Insurance Sector (CRIS), headed by R. N. Malhotra, former governor of RBI, was constituted in 1993.
- The main thrust of the committee's recommendations were to open up the insurance sector, improve the service standards of Indian insurance majors and extend insurance coverage to a larger section of the Indian population to inject a greater degree of competition.
- The Insurance Regulatory Development Authority (IRDA) Bill was passed in both the Houses of Parliament in the year 1999 and IRDA came into existence as a regulator for the insurance business in India.
- The act also provides protection to the interests of the holder of the insurance policy and aims to regulate, promote and ensure the orderly growth of the insurance industry.
- It also seeks to amend the Life Insurance Act, 1956; General Insurance Business (Nationalization) Act, 1972 and consequential provisions in the Insurance Act, 1938, with a view to open up the Indian insurance industry to the private sector for further expansion of insurance business and to realize the untapped potential in the Indian insurance market.
- In order to provide better insurance coverage to citizens and also to augment the flow of long-term resources for financing infrastructure, the Insurance Regulatory and Development Authority was constituted with effect from 19 April 2000.
- The Reserve Bank of India has also issued guidelines for the entry of NBFCs and banks into the insurance business in May 2000 and August 2000, respectively.
- Statistical information currently available on insurance is scattered and inadequate.
- With the entry of private insurance companies, the sources of information will be multiplied.
- It is, therefore, necessary that a single source of information which can disseminate information to users is put in place.
- In this context, a Committee on Insurance Statistics was constituted by the National Statistical Commission with H. Ansari, Member of IRDA, as chairman to examine the information required for the insurance sector.
- The committee reviewed the current status of the statistical system in the insurance sector, identified the data gaps and weaknesses in the existing data collection mechanism and recommended measures to correct deficiencies by revamping the system.

Life Insurance Corporation (LIC)

- *Established*: 1 September 1956
- *Head office*: Mumbai
- *Zonal offices*: 77 (Mumbai, Kolkata, Delhi, Chennai, Kanpur, Hyderabad and Bhopal) LIC operates through 101 divisional offices including one salary savings scheme division at Mumbai and 2048 branches.
- The corporation also transacts business abroad and has offices in Fiji, Mauritius and UK.

General Insurance Corporation (GIC)

- *Established*: 1 January 1973
- Before the government took over, there were 107 insurance companies (both Indian and foreign) operating in India.
- By a presidential proclamation issued on 13 May 1970, the government took over control of the general insurance.
- With effect from 1 January 1973 the erstwhile 107 Indian and foreign insurers which were operating in the country prior to nationalization were grouped into four operating companies, namely, (i) National Insurance Company Limited, (ii) New India Assurance Company Limited, (iii) Oriental Insurance Company Limited and (iv) United Insurance Company Limited.
- All these four of GIC operated all over the country competing with one another and underwriting various classes of general insurance business except for aviation insurance of national airlines and crop insurance which is handled by the GIC.
- However, GIC has been formally delinked from its erstwhile subsidiary companies with effect from 3 November 2000.
- The GIC having been notified as Indian insurer has also ceased to carry on Direct Insurance Business and Crop Insurance.
- In its exclusive role as a reinsurance company, GIC's business volume is growing up and it has also opened two representative offices at London and Moscow to expand its foreign reinsurance business.

Major Policies of GIC

- *Personal Accident Insurance Social Security Scheme for Poor Families* (introduced in 1985) covers all the earning members of the families between age group 18 and 60 years whose annual income from all sources does not exceed ₹7200.
- Hut Insurance Scheme for Poor Families in Rural Areas covers the huts and belongings of the landless labourers, small farmers, artisans and other poor families in rural areas.
- Mediclaim Insurance Policy provides for reimbursement of the medical expenses incurred by an individual towards hospitalization/domicillary/hospitalization for any illness, injury or disease contracted or sustained during the period of insurance.
- Jan Arogya Bima Policy (introduced in 1996) is for target segments of populations who cannot afford the high cost of medical treatment and it provides for reimbursement of medical expenses incurred by an individual towards hospitalization/domicillary/hospitalization for any illness, injury or disease contracted or sustained during the period of insurance.
- *Overseas Mediclaim Policy* offers emergency medical expenses cover to overseas travellers which also includes inflight personal accident cover up to US $10,000 and loss of passport cover up to US $150.

- *Videsh Yatra Mitra* (introduced from 1 January 1998) provides for medical coverage, in addition to personal accident cover, loss of personal baggage cover, delayed baggage cover, personal liability of US $2,00,000.
- *Crop Insurance Scheme* (introduced in 1995) covers for the crop for the Kharif.

Social Security Group Scheme

- From 1989 to 1990, the Social Security Fund came into being administered by LIC to meet the requirements of the weaker and vulnerable sections of the society.
- Under the scheme, people in the age group of 18–60 years are covered for a sum of ₹5000 in case of natural death and ₹25,000 in case of death by accident.
- Under the Social Security Group Scheme, the following are the major sub-schemes:
  1. Landless Agricultural Labourers Group Insurance Scheme (LALGI)
  2. Integrated Rural Development Programme (IRDP)
  3. Rural Group Life Insurance Scheme (RGLIS)

Insurance Statistics

- Insurance is a means by which the problem of risk in business or life of an individual person is covered.
- The two main classes of insurance are as follows:
  1. General insurance, which covers all forms of insurance other than life and is usually written on an annual basis
  2. Life insurance, which is generally on a long-term basis against risk of death
- Insurance statistics can be grouped under the following categories:
  1. Life Insurance Statistics
  2. Non-life (General) Insurance Statistics
  3. Reinsurance Statistics
  4. Pension and Superannuation Statistics
  5. Health Insurance Statistics
  6. Crop Insurance Statistics
  7. Other Insurance Statistics like ESI, Postal Insurance, Army Insurance, etc.

Insurance Regulatory Authority

- Considering an insurance regulatory apparatus essential for proper monitoring and control of the insurance industry, the government formulated an interim Insurance Regulatory Authority (IRA) on the recommendations of the Malhotra Committee.
- The interim IRA will function subject to the overall directions and guidelines of the government.
- IRA will be headed by a chairperson who will be appointed as the controller of insurance for the purpose of the Insurance Act, 1938.
- The other members not more than seven in number of which more than three shall serve full time shall be nominated by the Central Government, IRDA.

Insurance Regulatory Development Authority (IRDA) Bill

- The bill was passed in 1999 and IRDA came into existence as a regulator for the insurance business in India.

- The act provides protection to the interests of holder of insurance policy and aim to regulate, promote and ensure orderly growth of the insurance industry.
- It also seeks to amend the Life Insurance Act 1956, General Insurance Business (Nationalization) Act, 1972 and consequential provisions in the Insurance Act 1938, with a view to open up the Indian insurance industry to the private sector for further expansion of insurance business and to realize the untapped potential in the Indian insurance market.
- In order to provide better insurance coverage to citizens and also to augment the flow of long-term resources for financing infrastructure the IRDA was constituted with effect from 19 April 2000.
- The RBI also issued guidelines for the entry of NBFCs and Banks into the insurance business in May 2000 and August 2000, respectively.
- The IRDA on the advice of the Insurance Advisory Committee framed 15 regulations under IRDA Act, to be followed by all insurers.
- It has also prescribed a number of returns to monitor various provisions of these regulations and the insurers in the life and general insurance business are required to statutorily submit these returns to the IRDA as per the periodicity and time frame specified.

List of Major Private Sector Insurance Companies

Life Insurance

- HDFC Standard Life Insurance Co. Ltd.
- ICICI Prudential Life Insurance Co. Ltd.
- Tata AIG Life Insurance Co. Ltd.
- SBI Life Insurance Co. Ltd.
- Max New York Life Insurance Co. Ltd.
- Om Kotak Mahindra Life Insurance Co. Ltd.
- Allianz Bajaj Life Insurance Co. Ltd.
- ING Vysya Life Insurance Co. Ltd.
- Aviva Life Insurance Co. Ltd.
- Sahara India Insurance Co. Ltd.
- Met Life India Insurance Co. Ltd.
- AMP SANMAR Assurance Co. Ltd.

General Insurance

- IFFCO Tokyo General Insurance Co. Ltd.
- Royal Sundram Alliance Insurance Co. Ltd.
- HDFC Chubb General Insurance Co. Ltd.
- TATA AIG General Insurance Co. Ltd.
- ICICI Lombard General Insurance Co. Ltd.
- Cholamandalam General Insurance Co. Ltd.
- Bajaj Allianz General Insurance Co. Ltd.
- Reliance General Insurance Co. Ltd.
- Export Credit Guarantee Corporation (ECGC) Ltd.

Subsidiary Companies

There are four subsidiary companies of General Insurance Corporation, namely:

1. National Insurance Co. Limited, Kolkata
2. The New India Assurance Co. Limited, Mumbai
3. The Oriental Fire and General Insurance Co. Limited, New Delhi
4. United India Fire and General Insurance Co. Limited, Chennai

INVESTMENT

Unit Trust of India

- The purpose of establishment of the Unit Trust of India (UTI) was to encourage and mobilize the saving funds of small investors through the sale of 'units' to channelize these funds into corporate securities.
- UTI is a major investor in government securities and money market instruments.
- The following are the salient features of UTI.
  - — UTI has an investor base of about 50 million investor accounts.
  - — It has a wide distribution network of 51 branches all over country.
  - — Its asset portfolio exceeds ₹55,550 crore, with portfolio exposure in various companies covering all profitable companies in public, private, joint venture and financial sectors.
  - — It has an array of 72 different innovative savings plans/funds.
- The first offshore fund, 'The Indian Fund', was launched by UTI in July 1986, which is listed on the London Stock Exchange.
- Another offshore fund was launched in August 1988, which was listed on the New York Stock Exchange.

Bifurcation of UTI

- The Unit Trust of India (Transfer of Understanding and Repeal) Act 2002 enacted in December 2002, provided inter-alia that erstwhile Unit Trust of India shall be bifurcated and the specified undertaking, namely, UTI-I, comprising of US-64, Assured Return Scheme and Development Reserve Fund (appearing in the Schedule-I to the Act) will be transferred and vest in a government appointment administrator and the undertaking, namely. UTI-II, comprising of Net Asset Value (NAV) based schemes (appearing in the Schedule-II to the Act) will vest in a specified company from 1 February 2003.
- UTI-I has been named as 'Administrator of the Specified Undertaking of the Unit Trust of India'.
- For UTI-II, the State Bank of India, Punjab National bank, Bank of Baroda and the Life Insurance Corporation of India have set up a mutual fund named UTI Mutual Fund, UTI Trustee Company and the UTI Asset Management Company as per SEBI (Mutual Fund) Regulations.
- UTI Trustee Company has been notified as the specified company.

Global Depository Receipts/Foreign Currency Convertible Bonds

- In 1992, the Indian corporate sector was allowed to access global capital markets through the issue of shares under Global Depository Receipts (GDRs) and Foreign Currency Convertible Bonds (FCCBs).
- Under these schemes, the companies with a proven track record were allowed to access international markets.
- Comprehensive guidelines for Euro issues were announced in June 1996 which provided for greater flexibility to Indian companies to access the global market through GDR and FCCB issues.

- Indian corporates have successfully launched Euro issues in the international markets, raising about US $8.1 billion.
- Initially, individual proposals for ADR/GDR issues required prior approval of the government with effect from 19 January 2000; such prior approval of government has been dispensed with where the ADRs/GDRs are issued against fresh underlying shares.

Recent Initiative

- With a view to further liberalizing the capital account transactions Foreign Currency Convertible Bond (FCCB) up to the value of US $500 million has been put under the automatic route and beyond US $500 million is under the RBI route.

Portfolio Investment from Foreign Institutional Investors

- In September 1992, the government launched a scheme for attracting portfolio investment from Foreign Institutional Investors (FIIs).
- FIIs along with other institutions like mutual funds, pension funds, investment trusts, asset management companies, nominee companies and incorporated/institutional portfolio managers and their associates were among the beneficiaries of the scheme that the government launched.
- Under this scheme, all the above mentioned were allowed to invest in all the securities traded in the primary and secondary markets.
- FIIs are permitted under this scheme to invest in government securities as well as treasury bills.
- Among the other benefits to FIIs under this scheme is that they have also been allowed to take exchange cover for the portion of their investment exposure.
- The number of FIIs registered with SEBI till 31 October 1997 was 471 and the net FII investment flow into the country by then amounted to about US $9 billion.

Non-Resident Indian Investments

- To promote non-resident Indian (NRI) investments, the government has envisaged many attractive schemes.
- Some of these are as follows:
  - — Investment up to 100% equity, with full benefits of repatriation of capital invested and income accruing thereon in high priority industries.
  - — Investment through stock exchanges under the Portfolio Investment Scheme with an investment ceiling of 5% of paid-up capital of invested company in the case of individual NRI and a collective ceiling of 10% for all NRIs/OCBs (Overseas Corporate Bodies).
  - — For NRIs, RBI has set up a special working group which looks into various schemes and incentives available to NRIs.

Mutual Funds

- Mutual funds signify the institutional segment of capital markets.
- As in the mature markets, mutual funds in emerging markets have been among the fastest growing institutional investors.

Recent Policy Developments

- *Development of trading of government securities, through order-driven screen-bases system*: Trading in government securities through a nationwide, anonymous, order-driven, screen-based trading system of the stock exchanges has been launched on 16 January 2003.
- *T+2 Rolling Settlement*: The stock exchanges were directed to implement it by April 2003.
- *Launch of interest rate derivatives on stock exchanges*: With a view to realizing the advantages of an exchange-traded mechanism, trading in interest rate derivatives on stock exchanges was launched on 24 June 2003.
- *Demutualization and Corporation of the Stock Exchanges*: A bill proposing necessary legislative amendments to the securities contracts corporatization of stock exchanges in the country was introduced in the Lok Sabha in August 2003.
- Since then it has been referred to the Standing Committee on Finance for examination.
- The bill is expected to be reintroduced in the newly constituted 14th Lok Sabha.
- *Amendments to the Securities Contracts (Regulation) Rules, 1957*: In order to allow banks to participate in trading carried out vide GOI Gazette notification dated 28 August 2003.
- *Regulation of private placement of deft by listed companies*: SEBI has, vide its circular dated 30 September 2003, prescribed certain conditions for issuance, listing and trading of privately placed debt securities by listed companies.

Pension Reforms

- The Government of India on 23 August 2003 approved the proposal to implement the budget announcement of 2003 to 2004 relating to the introduction of a new restructured defined contribution pension system for the new entrant to central government service except to Armed Forces in the first stage replacing the existing system of defined benefit pension system.
- The new system will also be available on a voluntary basis to all persons including self-employed professionals and others in the unorganized sector.
- However mandatory programmes under the Employees Provident Fund Organization (EPFO) and other special provident funds would continue to operate as per the existing system under the Employee Provident Fund and Miscellaneous Provisions Act 1952 and other special acts governing these funds.
- Pension Fund Regulatory and Development Authority (PFRDA).
- The government approved the basic features of the new pension system and setting up of a pension fund regulatory and development authority (PFRDA).
- The functions of PFRDA are (a) to deal with all matters relating to promotion and orderly growth of pension market, (b) to propose comprehensive legislation for the purpose indicated above and (c) to carry out such other functions as may be delegated to the Authority for the purposes indicated in (a) and (b) above.
- New Pension System (NPS).
- NPS, regulated by PFRDA (Pension Fund Regulatory and Development Authority), is a milestone in the development of a sustainable and efficient voluntary defined contribution pension in India.

- It has the following broad objectives:
  1. To provide old age pension
  2. Reasonable market based returns in the long term
  3. Extending old age security coverage to all citizens
- NPS offers the following important features to help some for retirements.
- The pensioner under this scheme will be allotted a unique Permanent Retirement Account Number (PRAN) which will remain the same for the entire life and one will be able to use this account number from any location in India.

Main Features and Architecture of the New Pension System

- The new pension system would be based on defined contributions.
- It will use the existing network of bank branches and post offices, etc., to collect contributions.
- There will be seamless transfer of accumulations in case of change of employment and/or location.
- It will also offer a basket of investment choices and fund managers.
- The new pension system will be voluntary.
- The system would however be mandatory for new recruits to the Central Government service (except the Armed Forces).
- The monthly contribution would be 10% of the salary and DA to be paid by the employee and matched by the Central Government.
- However there will be no contribution from the government with respect to individuals who are not government employees.
- The contributions and returns thereon would be deposited in a non-withdrawable pension account.
- The existing provisions of defined benefit pension and GPF would not be available to the new recruits in the Central Government service.
- In addition to the above pension account each individual can have a voluntary tier-II withdrawable account at his option.
- Government will make no contribution into this account.
- These assets would be managed in the same manner as the pension.
- The accumulations in this account can be withdrawn anytime without assigning any reason.
- Individuals can normally exit at or after age 60 years from the pension system.
- At exit, the individual would be required to invest at least 40% of pension wealth to purchase an annuity.
- In the case of government employees, the annuity should provide for pension for the lifetime of the employee and his dependent parents and his spouse at the time of retirement.
- The individual would receive a lump-sum of the remaining pension wealth which she would be free to utilize in any manner.
- Individuals would have the flexibility to leave the pension system prior to age 60.
- However, in this case, the mandatory annuitization would be 80% of the pension wealth.
- There will be one or more central record keeping agencies (CRA), several pension fund managers (PFMs) to choose from which will offer different categories of schemes.
- The participating entities (PFMs, CRA, etc.) would give out easily understood information about past performance and regular NAVs, so that the individual would be able to make informed choices about which scheme to choose.

- The individual would receive a lump sum of the remaining pension wealth, which he/she would be free to utilize in any manner.
- Individuals would have the flexibility to leave the pension system prior to age 60.
- However in this case, the mandatory would be 80% of the pension wealth.

Scope of the NPS

- The option of joining the new system would also be available to the state governments and as the when they decide and the new system would be capable of accommodating the new participants.
- Mandatory programmes under the Employee Provident Fund Organization (EPFO) and other special provident funds would continue to operate as per the existing system.
- However, individuals under these programmes could voluntarily choose to additionally participate in this scheme.

Status of Implementation

- A Resolution was issued on 10 October 2003 to operationalize the decision of the government to introduce a new pension system on defined contribution basis.
- A notification was issued on 22 December 2003 outlining the major features of the new pension system.
- The NPS became operative from 1 January 2004.
- The scheme is applicable to all new entrants to the Central Government.
- In terms of the resolution, an interim Pension Fund Regulatory and Development Authority (PFRDA) has been constituted which started functioning from 1 January 2004.
- Till the CRA and PFMs are in place as an interim arrangement, the Central Pension Accounting Office will be acting as the interim CRA.
- All contributions under NPS are currently going to the public account and earning a return equal to GPF rate.

STOCK EXCHANGES

Stock Markets in India

- India has a rapidly expanding stock market that as in 1993 listed around 5000 companies in 14 stock exchanges although only the stocks of about 400 of these companies were actively traded.
- Financial institutions and government bodies controlled an estimated 45% of all listed capital.
- Today, there are 22 stock exchanges operating in the country.
- Of these, 20 stock exchanges are regional and operate in their allocation areas.
- The remaining two, the National Stock Exchange (NSE) and Over-the-Counter Exchange of India (OTCEI) are for nationwide trading.
- The network of stock exchanges provides an organized market for transaction of shares and other securities.
- In April 1992, the Bombay stock market, the nation's largest with a market capital of US $65.1 billion, collapsed in part because of the revelations about financial malpractice amounting to US $2 billion.

- Afterwards, the Securities and Exchange Board of India (SEBI), the government's capital market regulator, implemented reforms designed to strengthen investor confidence in the stock market.
- In the mid-1990s, foreign institutional investors took greater interest than ever before in the Indian stock markets investing around US $2 billion in FY 1993 alone.

Securities and Exchange Board of India

- In April 1988, a non-statutory body, the Securities and Exchange Board of India (SEBI) was constituted by the government to deal with matters of development and regulation pertaining to the securities market and to protect investors from fraudulent dealings.
- However in 1992, SEBI was given the statutory powers through a promulgated ordinance which was replaced by an Act of Parliament in April 1992.
- As per this act, SEBI has power over corporates in the issuance of capital, transfer of securities and imposition of monetary penalties on capital market intermediaries and participants who violate the issued guidelines.

MINTS AND PRESSES

- There are four government mints situated at
  1. Mumbai
  2. Kolkata
  3. Hyderabad
  4. Noida
- The main functions of government mints are as follows:
  1. Minting of coins to meet the domestic requirements
  2. Gold and silver assaying
  3. Medal production
- There are five presses whose functions are as follows:
  1. *India security press (Nashik Road)*: It consists of two units—a stamp press which prints postal stationery, postal and non-postal stamps, judicial and non-judicial stamps, RBI/ SBI cheques, bonds, national savings certificates, Indira Vikas Patra, Kisan Vikas Patra, postal orders, passports, promissory notes and other security documents and the central stamp depot which takes care of the delivery of all the finished products to the respective indentors.
  2. *Bank note press (Dewas)*: It consists of two units—the ink factory which manufactures security inks and a main press for printing bank notes of the denomination of ₹20, ₹50, ₹100 and ₹500.
  3. *The currency note press (Nashik Road)*: It prints bank notes of the denomination of ₹10, ₹50 and ₹100.
  4. *Security printing press (Hyderabad)*: This press prints postal stationery to meet the demand of the southern states and central excise stamps for the use of the whole country. Also printed here are inland letter cards, postcards, competition, postcards and embossed envelopes to supplement the production of the India Security Press.
  5. *Security paper mills (Hoshangabad)*: This paper mill manufactures the special paper used for printing bank notes and non-judicial stamp paper of higher denominations.

Chapter

5 INDIAN MISCELLANEA

FIRST IN INDIA: WOMEN

First Prime Minister	Indira Gandhi
First Chief Minister of a State	Sucheta Kriplani (Uttar Pradesh)
First Cabinet Minister	Vijayalakshmi Pandit
First Central Minister	Rajkumari Amrit Kaur
First Speaker of Lok Sabha	Shanno Devi
First Governor of a State	Sarojini Naidu
First President of Indian National Congress	Dr Annie Besant
First Indian President of Indian National Congress	Sarojini Naidu
First President of UN General Assembly	Vijayalakshmi Pandit
First Woman on the throne of Delhi	Razia Sultan
First to swim across the English Channel	Arti Saha (now Mrs Arti Gupta)
First to climb Mount Everest	Bachhendri Pal
First to Circumnavigate (Sail round the world)	Ujwala Rai
First IAS Officer	Anna George Malhotra
First IPS Officer	Kiran Bedi
First Advocate	Camelia Sorabji
First Judge	Anna Chandi
First Judge of a High Court	Anna Chandi
First Judge of Supreme court	M. Fathima Beevi
First Chief Justice of a High Court	Leila Seth
First Doctor	Kadambini Ganguli
First to Pass MA	Chandra Mukhi Bose
First Editor of English newspaper	Dina Vakil
First Chief Engineer	P. K. Thresia
First to receive a Sena Medal	Constable Bimla Devi (88 BN of CRPF)–1990
Youngest to Climb Mount Everest	Dicky Dolma (19) from Manali–1993
First Magistrate	Omana Kunjamma
First woman to climb Mount Everest two times	Santosh Yadav (ITBP officer)–1993

(*Continued*)

First to be crowned 'Miss World'	Reita Faria
First to be crowned 'Miss Universe'	Sushmita Sen
First to be crowned 'Miss India'	Pratima (1947)
First woman cosmonaut from India	Kalpana Chawla
First woman President	Pratibha Devisingh Patil
First woman to win Nobel Prize	Mother Teresa

FIRST IN INDIA: MEN

First Indian to swim across the English Channel	Mihir Sen
First to Climb Mount Everest	Tenzing Norgay
First to climb Mount Everest without Oxygen	Phu Dorjee
First to climb Mount Everest twice	Nwang Gombu
First Indian to join ICS (now IAS)	Satyendra Nath Tagore
First Indian to receive a Nobel Prize	Rabindra Nath Tagore
First Indian in Space (first cosmonaut)	Sqn Ldr Rakesh Sharma
First British Governor-General	Warren Hastings
First Governor-General of Free India	Lord Mountbatten
First Viceroy of India	Lord Canning
First and the last Indian Governor-General of Free India	C. Rajagopalachari
First President of India	Dr Rajendra Prasad
First Vice-President of India	Dr S. Radhakrishnan
First Muslim President of India	Dr Zakir Hussain
First Sikh President of India	Giani Zail Singh
First Prime Minister	Pt Jawaharlal Nehru
First Speaker of Lok Sabha	G. V. Mavlankar
First Chief Justice of India	Justice H. L. Kania
First President of Indian National Congress	W. C. Bannerjee
First Indian to become member of Viceroy's Executive Council	S. P. Sinha
First Indian to become President of International Court of Justice (UN)	Dr Nagendra Singh
First Emperor of Mughal Dynasty	Babur
First Field Marshal	S. H. F. J. Manekshaw
First Indian Commander-in-Chief of India	Gen. K. M. Cariappa
First Chief of the Army Staff (India)	Gen. Maharaja Rajendra Singh
First Chief of the Naval Staff (Indian)	Vice-Admiral R. D. Katari
First Chief of the Air Staff (Indian)	Subroto Mukherjee
First Air Marshal	Arjan Singh
First Indian in British Parliament	Dadabhai Nauroji
First Indian to Circumnavigate	Lt Col K. S. Rao

(*Continued*)

First Indian High Court Judge	Justice Syed Mehmood
First Indian to make a solo air flight	J. R. D. Tata
First Indian leader to visit England	Raja Rammohun Roy
First Indian member of House of Lords (Britain)	Lord S. P. Sinha
First Bar-at-Law	J. M. Tagore
First Chairman of Rajya Sabha	Dr S. Radhakrishnan
First Indian Test Cricketer	K. S. Ranjit Singh
First Indian to reach the South Pole	Col J. K. Bajaj
First Indian recipient of Victoria Cross (highest award before Independence)	Khudada Khan
First judge to face impeachment in the Lok Sabha	Justice V. Ramaswami
First Indian tennis player to win a grand slam event	Mahesh Bhupathi

WORLD RECORDS HELD BY INDIA

Trade and Industry

- Largest exporter of tea *(over 23,00,000 million tonnes per year)*
- Largest manufacturer of cycles *(Hero Cycles)*
- Largest exporter of cut-diamonds *(world's 68% cut-diamonds from India)*
- India tops the world in film production
- Reliance Group of Companies in India has the maximum number of shareholders in the world
- Brooke Bond Lipton India Ltd. is the world's largest tea manufacturing company
- State Bank of India has the maximum number of branches
- Indian Railways is the world's largest employer
- In 1989 to 1990, India became the largest producer of sugar by producing 85 lakh tonnes

Agriculture/Natural Resources

- Largest Producer of millet in the world
- Largest producer of tea
- Leads the world in irrigated area
- Leads the world in cattle population
- Largest producer of Cardamom *(Kerala produces 60% of world production)*
- Largest exporter of spices in the world
- Largest turmeric production in the world
- Largest ginger production in the world
- Largest sugarcane producer in the world
- Largest grower of pulses in the world
- Highest yield of potato–46,797 kg/ha
- Highest rice yield–17,862 kg/ha
- Highest productivity of grapes *(22 tonnes/ha)*
- Largest producer of milk
- Largest producer of mangoes

Miscellaneous

- The Ganges and Brahmaputra Delta *(Sunderbans)* form the world's largest delta (7500 km^2)
- Indira Gandhi National Open University (IGNOU) has emerged as the world's largest open university
- India has the world's largest reserves of iron *(approx. one-fourth of the world's known reserves)*
- India has the largest deposits of mica in the world
- South Point High School, Kolkata is the world's largest school
- World's highest post office is at Spiti Valley in HP.

Buildings/Roads/Bridges

- Khardungla Road in Leh–Manali sector is the world's highest road (*5602 m above sea level*)
- All India Radio, Leh, is the world's highest radio station
- Qutab Minar is India's tallest minaret
- Mahatma Gandhi Setu (over Ganga at Patna) is the world's longest river bridge
- Kharagpur Railway Platform in West Bengal is the world's longest railway platform (833 m)
- Farakka River Barrage (Kolkata) is the world's largest river barrage
- Yuva Bharati Stadium (Kolkata) is the world's largest covered stadium
- First hospital on wheels in the world: Jeevan Rekha (Life Line) Express

Individual Achievements

- Shakuntla Devi holds the world record for fastest computing—faster than a computer
- Dr Rajinder Singh of Himachal Pradesh holds the world record for accurate and fastest typing (96.8 wpm, 1998)
- Shambhoo Govind Anbhawane holds the world record for marathon typing (non-stop typing, 123 hours)
- Dr M. C. Modi holds the world record for performing maximum eye operations at the rate of 40 operations per hour
- Mihir Sen of Kolkata holds the world record for long distance swimming
- Capt. Durga Bannerjee is the world's first woman air pilot holding the record for logging maximum flying hours
- Lata Mangeshkar holds the world record for maximum number of recordings
- Dicky Dolma from Manali holds the world record for being the youngest climber of Mount Everest at the age of 19 years
- Ms Santosh Yadav holds the record for climbing Mount Everest twice (among women)

INDIA'S SUPERLATIVES

Structures

Highest Tower (Minaret)	Qutub Minar
Highest Gateway	Buland Darwaza (Fatehpur Sikri)
Highest Dam	Bhakra Dam
Highest Bridge	Chambal Bridge

(*Continued*)

Largest Residence	Rashtrapati Bhawan
Largest Cinema Hall	Thangam (Madurai)—Capacity over 2500 seats
Largest Museum	Indian Museum, Kolkata
Largest City	Kolkata
Largest Tunnel	Jawahar Tunnel
Largest River Barrage	Farakka Barrage
Longest Dam	Hirakud Dam
Largest Auditorium	Sri Shanmukhanda Hall, Mumbai (3012 seats)
Largest Zoo	Zoological Garden, Alipur (Kolkata)
Largest Cave Temple	Ellora
Largest Gurudwara	Golden Temple, Amritsar
Biggest Church	The St John's Cathedral, Goa
Largest Mosque	Jama Masjid, Delhi
Largest Dome	Gol Gumbaz, Bijaur (Karnataka)
Largest Cantilever Bridge	Howrah Bridge
Longest River Bridge	Mahatma Gandhi Setu, Patna
Longest Corridor	Rameshwaram Temple Corridor
Longest Platform (Railway)	Kharagpur (World's longest)
Longest Road Bridge	Sone Bridge, Bihar
Longest Road	G. T. Road
Biggest Fort	Red Fort, Delhi
Tallest Light House	Prongs Reef, Mumbai
Tallest Statue	Gomateshwar Statue, Mysore
Tallest Chimney	Thermal power station of Tata Electric Co., Mumbai (275 m high)
Largest man-made Lake	Govind Sagar (Bhakra)

Natural

Highest Mountain Peak	Nanga Parvat
Longest River	Ganges
Largest Desert	Thar (Rajasthan)
Largest Delta	Sunderbans (West Bengal)
Largest Lake	Wular Lake

States

Largest State	Rajasthan
Smallest State	Goa
Largest Union Territory	Andaman and Nicobar Islands
Smallest Union Territory	Lakshadweep
State having Maximum-Number of Cities	Uttar Pradesh
Most Densely Populated State	West Bengal
Most Populous State	Uttar Pradesh
State with Maximum Forest Area	Madhya Pradesh
State with Highest Cattle Population	Uttar Pradesh

(*Continued*)

State having Highest Literacy Rate	Kerala
Union Territory having Highest Literacy Rate	Chandigarh
State with Highest Mineral Output	Jharkhand
State having Maximum Paper Mills	Uttar Pradesh
State producing Maximum Sugar	Uttar Pradesh
State producing Maximum Wheat	Uttar Pradesh
State producing Maximum Rice	West Bengal
State producing Maximum Tea	Assam
State producing Maximum Cotton	Gujarat
State producing Maximum Sugarcane	Uttar Pradesh

DANCES OF INDIA

- *Bharatanatyam*: A solo dance, originating from the temples of *South India*, it is based on '*Natya Shastra*', written by Bharat Muni in around 4000 BC. It is a highly traditional dance form comprising items such as *alarippu*, *varnam*, *padam*, *thillana*, etc.
- *Odissi*: It is a dance form which originated in Orissa during second century BC. It is also based on the principles of *Natya Shastra*.
- *Chakiarkoothu*: It is a highly orthodox dance form believed to have been introduced to *Kerala* by the earlier Aryan immigrants. It is performed by the members of Chakiar caste inside the temples and is only witnessed by the Hindus of higher castes.
- *Manipuri*: Manipuri is a dance form popular in the north-east. It is a highly lyrical and ritualistic dance but lacks dramatic facial and gestural expressions.
- *Kuchipudi*: Kuchipudi is a solo dance popular in Andhra Pradesh. It is also based on the principles of *Natya Shastra*. Traditionally it was performed by men attired like women.
- *Kathak*: It is a popular dance of *North India* which originated in temples in the form of Radha and *Krishna lilas*. With the advent of muslim rule, it came out of the temples to Mughal courts. Lucknow, Jaipur and Varanasi became its centres.
- *Kathakali*: It is a popular dance from Kerala, which is more dramatic than narrative in form. It is considered to be the most scientific dance form. The body gestures, hand movement and eye/eyeball movements comprise its language.
- *Mohiniattam*: It is a solo dance form from Kerala. It is also the heir to Devdasi dance heritage similar to Bharatanatyam, Odissi and Kuchipudi.
- *Ottam Thullal*: Also known as poor man's Kathakali, it is a solo dance which originated in Kerala.

Other Popular Dances

Bhangra	Punjab and Haryana
Bidesia	Bihar
Bihu	Assam
Chakri	Jammu and Kashmir
Chamar Gindad	Rajasthan
Chau	West Bengal
Chiraw (Bamboo dance)	Mizoram
Dandiya Raas	Rajasthan

(*Continued*)

Danda Nata	Orissa
Dasi Atitam	Kerala
Garba	Gujarat
Ganpati Bhajan	Gujarat
Gangore	Rajasthan
Gidda	Punjab and Haryana
Giddha/Parhaun	Himachal Pradesh
Gopiki Leela	Rajasthan
Jata Jatin	Bihar
Jatra	West Bengal
Ghoomar	Rajasthan
Kajir	Uttar Pradesh
Kayanga Bakayanga	Himachal Pradesh
Karyala	Himachal Pradesh
Kammi	Tamil Nadu
Khayal	Rajasthan
Khel Gopal	Assam
Kolattam	Tamil Nadu
Koodiyattam	Kerala
Kottam	Andhra Pradesh
Krishnavattam	Kerala
Lagui	Bihar
Lai Haroba	Manipur
Lota	Madhya Pradesh
Luddi Dance	Himachal Pradesh
Munzra	Himachal Pradesh
Nachari	Bihar
Nautanki	Uttar Pradesh
Pandavani	Madhya Pradesh
Raslila	Gujarat
Roof	Jammu and Kashmir
Swang	Haryana
Tamasha	Maharashtra
Therukkoothu	Tamil Nadu
Tobal Chougbi	Assam
Veeti Bhagavatam	Andhra Pradesh
Wangala Laho	Meghalaya
Yakshagana	Karnataka

TRANSPORT AND COMMUNICATION

Postal Service

- First postal service started in: 1837
- First postal stamp issued (provincial): 1852 in Karachi
- First all-India postal stamp issued: 1854

- Establishment of Postal Department: 1854
- Money Order service started in: 1880
- Airmail Service: 1911 (Allahabad to Nainital)
- PIN Code started: 1972
- Number of post offices in India: 1,54,866 as on March 2013 (Rural Area: 1,39,040 (89.70%); Urban Area: 15,826 (10.16%))
- On an average a post office in India serves a geographic area of about 21.23 sq. km and a population of 7817 people.
- India has the largest postal network in the world and it has 3 catergories of post offices: Hed Post offices, Sub-Post Offices and Extra Departmental Branch Post Offices.
- Indian postal network has grown 7 times since independence.
- In addition to post offices the basic postal facilities are alos offered through Franchise Outlets and Panchayat Sanchar Seva kendras. As on March 2013, there are 1670 Franchise Outlets and 3746 Panchayat Sanchar Seva Kendras in India.

Telecommunication

- First telephone line: 1851, between Kolkata and Diamond Harbour
- First telephone service: 1881 Kolkata
- First telephone exchange: 1881 Kolkata (50 lines only)
- First international telephone line: 1870 between London and Mumbai
- First automatic telephone exchange: Shimla, 1913–14 (Capacity–700 lines)
- Number of telephone subscribers in India (as on June 2013)
  —903.10 million total (Landline: 29.73 million and Mobile/Wireless: 873.37 million)
  —Number of telephones (Rural 357.74 million; Urban: 545.36 million]
  —Villages covered with VPT is 5.82 lakh (97.14%) as on April 2013.
  —Number of Broadband subscribers is 15.19 million
  —Number of Internet subscribers incl. Broadband (as on march 2013) 21.61 million.
- First automatic telephone exchange—Shimla, 1913–14 (Capacity–700 lines
- Department of Telecommunications (DoT) has four PSUs:
  1. MTNL (Mahanagar Telephone Nigam Ltd.)
  2. BSNL (Bharat Sanchar Nigam Ltd.)
  3. ITI Ltd.
  4. TCIL (Telecomunications Consultants India Ltd.)
- Average Teledensity in India—73.50% (as on June 2010) (Rural 41.96% and Urban 145.00%)

Indian Railways

- First train in India: On 16 April 1853–Mumbai to Thane
- Fastest Train: The Bhopal Shatabdi Express
- First Electric Train: Deccan Queen, 1929
- The Indian Railway system is the largest in Asia and third in the world after US and Canada
- It is the biggest employer in the world and largest single undertaking in the country
- It has the second biggest electrified system in the world after Russia

13 PSUs of Indian railways

1. RITES (Rail India Technical and Economic Services Ltd.)
2. IRCON (Indian Railway Construction) International Ltd.
3. IRFC (Indian Railway Finance Corporation Ltd.)
4. CONCOR (Container Corporation of India Ltd.)
5. KRCL (Konkan Railway Corporation Ltd.)
6. MVRL (Mumbai Railway Vikas Corporation Ltd.)
7. IRCTC (Indian Railway Catering and Tourism Corporation Ltd.)
8. Rail Tel (Railtel Corporation of India Ltd.)
9. MRVNL (Mumbai Rail Vikas Nigam Ltd.)
10. RVNL (Rail Vikas Nigam Ltd.)
11. DFCCIL (Dedicated Freight Corridor Corporation of India Ltd.)
12. BWFL (Bharat Wagon and Engineering Company Ltd.)
13. BCL (Braithwaite and Company Ltd.)

Plus, CRIS (Centre for Railway Information Systems)—a registered society to design and implement various railway computerization projects and RDSO (Research and Development Standards Organization) at Lucknow is the R & D wing of Indian Railways.

Table 5.1 Railway Tracks

Rail Tracks	*Distance Between Rails*	*Route (km)*	*Running Track (km)*	*Total Track (km)*
1. Broad Gauge	1676 mm	55,956	80,779	1,04,693
2. Metre Gauge	1000 mm	6347	6725	7801
3. Narrow Gauge	762 mm/610 mm	2297	2297	2568
Total		64,600	89,801	1,15,062

Table 5.2 Railway Zones

Zone	*Date When Created*	*Headquarters*
1. Southern	14 April 1951	Chennai
2. Central	5 November 1955	Mumbai CST
3. Western	5 November 1951	Mumbai
4. Northern	14 April 1951	New Delhi
5. North-Eastern	14 April 1952	Gorakhpur
6. Eastern	1 August 1955	Kolkata
7. South-Eastern	1 August 1955	Kolkata
8. North-East-Frontier	15 January 1958	Maligaon-Guwahati
9. South-Central	2 October 1966	Secunderabad
10. East Central	1 October 2002	Hajipur
11. East Coast	1 April 2003	Bhubaneswar
12. North Central	1 April 2003	Allahabad
13. North Western	1 October 2002	Jaipur
14. South East Central	1 April 2003	Bilaspur
15. South Western	1 April 2003	Hubli
16. West Central	1 April 2003	Jabalpur
17. Metro Railways	24 October 1984	Kolkata

Table 5.3 Railway Manufacturing Units

Name	*Location*	*Establishd in*	*Items Manufactured*
1. Chittaranjan Locomotive Works	Chittaranjan	1950	Locomotives
2. Diesel Locomotive Works	Varanasi	1964	Locomotives
3. Integral Coach Factory	Perambur	1955	Coaches
4. Rail Coach Factory	Kapurthala	1988	Coaches, wagons and special containers
5. Rail Wheel Factory	Bangalore	2004	Wheels and axles

Jeevan Rekha: Jeevan Rekha or Life Line Express, the world's first hospital on wheels was flagged off from Mumbai on 16 July 1991. The Express will cater to the medical needs of people in rural areas.

Roads

Expressways	200 km
National Highways/Expressways	79,243 km
State Highways	1,32,899 km
Major District Roads	4,67,763 km
Rural Roads	26,50,000 km

National Highways (% Age in Terms of Width)

Single lane	19,430 km (24%)
Double Lane	40,658 km (52%)
Four lane/Six lane/Eight lane	19,155 km (24%)

Other Facts About Roads in India

- Indian road network of 33 lakh kilometers is the second largest in the world.
- National Highways comprise about 1.7% of the length of roads.
- National Highways carry over 40% of the total traffic across the length and breadth of India
- About 65% of freight and 80% passenger traffic is carried by the roads.
- Number of vehicles have been growing at an average pace of 10.16% per annum over the last five years.
- National Highways and their Length and Information on States through which passing

SHIPPING

- Shipping plays a significant role in the transport sector of India's economy.
- India's merchant shipping fleet ranks 20th in the world.
- *Shipping Corporation of India (SCI)*: Established on 2 October 1961, SCI became a Public Ltd. entity on 18 September 1992 and was subsequently conferred 'Mini Ratna' status on 24 February 2000.

- *SCI in India is a poineer for*: (a) STS opeations for crude PDL and dry cargoes; (b) Crifogenic Operations (LNG/LPG); (c) Joint Ventures and other type of collaborations in Shipping and (d) Shipping Consultancy services.
- *Major Shipyards*: (i) Cochin Shipyard Ltd. (CSL); (ii) Hindustan Shipyard Ltd. (HSL) and (iii) Hooghly Dock and Port Engineers Ltd. (HDPEL)

Other Facts About Shipping

- About 95% of India's trade volume (68 % in terms of value) is moved by sea.
- Indian merchant shipping fleet ranks 16th in the world and is the largest among the developing nations.
- Average age of Indian merchant shipping fleet is 18.03 years only.
- The 7517 km long Indian coastline is studded with 13 major ports and 200 non-major ports.
- The strengthened aids to navigation consists of 1 lightship, 178 lighthouses, 64 Racons, 21 Deep Sea Lighted Buoys, 2 Wrek Marking Buoys and 23 Differential Global Positioning Systems (DGPS).
- India with a coastline of 7500 km has 12 major ports which are directly under Government of India's administration.
- There are about 184 minor and intermediate ports in the country.

Table 5.4 Major Ports of India

Sea Port	*State*	*Sea*	*Coast Side*
1. Mumbai	Maharashtra	Arabian Sea	West
2. Kolkata	West Bengal	Bay of Bengal	East
3. Kochi	Kerala	Arabian Sea	West
4. Kandla	Gujarat	Gulf of Kutch	West
5. Chennai	Tamil Nadu	Bay of Bengal (Indian Sea)	East
6. Mormugao	Goa	Arabian Sea	West
7. Mangalore	Karnataka	Arabian Sea	West
8. Tuticorin	Tamil Nadu	Indian Ocean	East
9. Visakhapatnam	Andhra Pradesh	Bay of Bengal	East
10. Paradeep	Orissa	Bay of Bengal	East
11. Nhava Sheva	Mumbai	Arabian Sea	West
12. Ennore	Maharashtra	Arabian Sea	East

Inland Waterways: Inland waterways in India comprise of rivers, lakes, canals. Creeks, backwaters etc. extending to about 14,500 km. Development and regulation of inland waterways of country rests with the Inland Waterways Authority of India (IWAI) though the potential of this important mode of transport has not been fully exploited so far.

AIR TRANSPORT

- *First Solo Flight*: J. R. D. Tata, from Mumbai to Karachi (now in Pakistan) in 1931.
- There are 449 airports/airstrips in the country, out of which Airports Authority of India (AAI) manages a total of 125 airports, which include 11 International Airports, 08 Customs Airports, 81 Domestic Airports and 25 Civil Enclaves at Defence Airfields.

- AAI also provides Air Traffic Management Services (ATMS) over entire Indian Air Space and adjoining oceanic areas with ground installations at all Airports and 25 other locations to ensure safety of Aircraft operations.
- The airports at Ahmedabad, Amritsar, Calicut, Guwahati, Jaipur, Trivandrum, Kolkata and Chennai which have been established as International Airports are open to operations even by Foreign International Airlines.
- Besides, the International flights, National Flag Carriers operate from Coimbatore, Tiruchirappalli, Varanasi and Gaya Airports.
- Not only this but also the Tourist Charters now touch Agra, Coimbatore, Jaipur, Lucknow, Patna Airports etc.
- AAI has entered into a Joint Venture at Mumbai, Delhi, Hyderabad, Bangalore and Nagpur Airports to upgrade these Airports and emulate the world standards.
- All major air-routes over Indian landmass are radar covered (29 radar installations at 11 locations) along with VOR/DVOR coverage (89 installations) co-located with Distance Measuring Equipment (90 installations).
- 52 runways are provided with ILS installations with Night Landing Facilities at most of these Airports and Automatic Message Switching System at 15 Airports.
- Indian Civil Aviation completed 100 years on 18th February, 2011.
- The year 2011–12 is declared as the Civil Aviation Centenary Year, starting from 18th February, 2011 and ending on the same date in 2012.
- On this date in 1911, the first commercial plane flew in India between Allahabad and Naini.
- Since, aviation in India has grown from strength to strength.
- Today India is the 9th largest civil aviation market in the world and this forward march is likely to culminate in India becoming one of the three largest markets in the world by 2020.
- Air transport in India operates at three levels:
  1. Air India (International level).
  2. Air India (domestic level).
  3. Private Airlines and charters such as.
- *Air India Express*: A key initiative in Air India to modernize its fleet. Under this Air India has inducted twelve B777 widebody aircrats and eighteen B737–800 and 43 A320 family aircrafts. Its fleet strength will also get boosted with addition of twenty seven B787 Dreamliner.
- *Major Private scheduled operators*: Jet Airways, Spicejet, GoAir, Indigo are major private airlines currently operational in Indian domestic circuit. However recently Indian and some private airlines have been allowed to fly across some select international destinations.
- The merger of Air India (erstwhile) and Indian Airlines was approved by the Government on 1 March, 2007 and a new company namely, National Aviation Company of India Ltd. (NACIL) was incorporated on 30 March, 2007 with the brand name of 'Air India'.
- The merger of two airlines was envisaged to provide, among other benefits, an integrated international/domestic footprint which will significantly enhance customer proposition and allow easy entry into one of the three global airline alliances.
- Also it will enable optimal utilization of existing resources through improvement in load factors and yields, on commonly used service routes as well as deploy 'freed up' aircraft capacity on alternate routes.

Airports in India

- *International Airports*: The airports are available for scheduled international operations by Indian and foreign carriers.
- *Custom Airports*: Custom Airports have customs and immigration facilities for Ltd. international operations by national carriers and for foreign tourist and cargo charter flights. These include the airports at Bangalore, Hyderabad, Ahmedabad, Kozhikode, Kochi, Goa, Varanasi, Patna, Agra, Jaipur, Amritsar and Tiruchirapalli.
- *Model Airports*: Model Airports are domestic airports which have a minimum runway length of 7500 feet and adequate terminal capacity to handle Airbus A320 type of aircraft and can cater to Ltd. international traffic, if required. These include the airports at Lucknow, Bhubaneswar, Guwahati, Nagpur, Vadodara, Coimbatore, Imphal and Indore.
- *Other Domestic Airports*: All other airports are covered in this category.
- *Civil Enclaves in Defence Airports*: There are 28 civil enclaves in Defence Airfields.

Major Airports of India

Amritsar International Airport (Rajasansi Airport)	Amritsar
Indira Gandhi International Airport	New Delhi
Lokpriya Gopinath Bordolio International Airport	Guwahati
Sardar Vallabhbhai Patel International Airport	Ahmedabad
Netaji Subhash Chandra Bose International Airport	Kolkata
Chhatrapati Shivaji International Airport	Mumbai
Rajiv Gandhi International Airport	Shamshabad (Hyderabad)
Goa Airport	Dabolim (Goa)
Chennai International Airport	Chennai (Meenambakkam Airport)
Bengaluru International Airport	Devanhalli (Bengaluru)
Cochin International Airport	Kochi
Trivandrum International Airport	Thiruvananathapuram
Kozhikode Airport	Calicut
Pune Airport	Pune

Pawan Hans Helicopters Ltd. (PHHL): Incorporated in 1985, PHHL commenced its operations within one year to provide helicopter services to the oil sector, in hilly and inaccessible areas and to make available charter flights for promotion of travel and tourism. PHHL has a fleet of 35 helicopters and operates from 39 destinations covering 64 sectors by 148 weekly flights under the aegis of the State Governments of Meghalaya, Tripura, Sikkim and Arunachal Pradesh.

Seaplane Operations: On 27 December 2010, the Seaplane service was operationalized in Andaman and Nicobar Islands as per MOU signed between Andaman and Nicobar Administration and Pawan Hans Helicopters. This is the first time that Seaplane operations are being introduced in India. The service shall be provided with a Cessna 208A (capacity 2 + 8 passengers) Amphibian seaplane.

Project GAGAN: GAGAN (GPS Aided Geo Augmented Natigation) is an augmentation system to enhance the accuracy and integrity of GPS signals to meet precision approach requirements in Civil Aviations and it is being implemented jointly by AAI and ISRO. The footprint of this satellite will cover a vast geographical area from Africa to Australia and hence would facilitate the expansion of the service of GAGAN far beyond Indian airspace. This ambitious project of the satellite based air navigation system (GAGAN) will also help in the growth of the sector by enabling to handle more air traffic in a much more safer manner.

DEFENCE AND SECURITY

India's Defence Set-Up

- *Supreme Commander*: President of India
- *Administrative Control*: Ministry of Defence

Commissioned Ranks

Following are the commissioned ranks in the three armed Services, each rank is shown opposite to its equivalent of the other service:

Table 5.5 Commissioned Ranks

Army	*Air Force*	*Navy*
General	Air Chief Marshal	Admiral
Lieutenant General	Air Marshal	Vice-Admiral
Major General	Air Vice-Marshal	Rear Admiral
Brigadier	Air Commodore	Commodore
Colonel	Group Captain	Captain
Lieutenant Colonel	Wing Commander	Commander
Major	Squadron Leader	Lieutenant Commander
Captain	Flight Lieutenant	Lieutenant
Lieutenant	Flying Officer	Sub-Lieutenant

Army

- Headed by—Chief of Army Staff
- Headquarters—New Delhi

  The Chief of the Army Staff is assisted by (a) Vice-Chief of Army Staff and (b) Seven Principal Staff Officers:

  1. Two Deputy Chief
  2. Adjutant General
  3. Master General of Ordinance
  4. Quarter-Master General
  5. Military Security
  6. Engineer-in-Chief

Table 5.6 Number of Commands—Seven

Command	*Headquarters*
Western Command	Chandimandir
Eastern Command	Kolkata
Northern Command	Udhampur
Southern Command	Pune
Central Command	Lucknow
Training Command (added in 1991)	Mhow
South-Western Command (added in 2005)	Jaipur

South-Western Command (added in 2005)

- Each command is under a General Officer Commanding-in-Chief.
- There is a Nuclear and Strategic force Command.

India's Combat Vehicles

- *Main Battle Tanks MBTs*: T-90S Bhishma, Arjun Mk1, Upgraded T-72M1 Ajeya.
- Vijayanta and T-55 MBTs are being phased out.
- *Light Battle Tanks LBTs*: PT-76 (Amphibious) and AMX-13 light tanks.
- *Combat Vehicles*: Ferret armoured cars, BRDM-2 amphibious reconnaissance vehicles, BMP-1and BMP-2 Sarath (mechanized infantory combat vehicles)

India's Missiles and Other Artillery

- *Medium-range ballistic missiles*: Agni-II (Intermediate Range ballistic missile) and Agni-IIAT (advanced version of Agni-II).
- Agni-II will always be in a ready-to-fire mode and can be launched within 15 minutes.
- *Short-range ballistic missiles*: SS-150/Prithvi-I and SS-250/Prithvi-III and Agni-I
- *Multiple Rocket Launch Systems*: Smerch 9K58 (300 mm); Pinaka (214 mm); BM-21 (122 mm) (BM-21 are being phased out).
- *Howitzers*: Abbot (105 mm) and M-46 Catapult (130 mm) being replaced by 150mm self-propelled howitzers], Bofors FH-77B, upgraded. Soltam M-46 155mm towed howitzers, IFG Mk 1/2/3 field guns being replaced by Soltom M-46 (130 mm filed guns) and D-30 (122 mm) towed howitzers.

India's Air Defence Artillery

- Tunguska M1 and upgraded ZSU-23-4M Schilka self-propelled air defence guns.
- Bofors L40/70 (40 mm) AA guns replacing L40/60 and ZSU-23-2 twin 23 mm guns
- ZRK-SD Kvadrat/SA-6a Gainful air defence system being upgraded (soon to be replaced by fully developed Akash missile programme)
- OSA-AKM/AS-8b Gecko air defence system being upgraded (soon to be replaced by fully developed Trishul missile programme)

Air Force

- *Headed by*: Chief of Air Staff
- *Headquarters*: New Delhi

The Chief of the Air Staff is assisted by
1. Vice-Chief of Air Staff
2. Deputy Chief of Air Staff
3. Central Air Command
4. Officer Incharge, Maintenance
5. Inspector General, Flight Safety and Inspection

Number of Commands

The Indian Air Force has seven commands, out of which five are operational and two functional, namely:

Five Operational Commands

1. HQ Central Air Command, Allahabad
2. HQ Eastern Air Command, Shillong
3. HQ Western Air Command, New Delhi
4. HQ Southern Air Command, Thiruvananthapuram
5. HQ South-Western Air Command, Gandhi Nagar

Two Functional Commands

1. HQ Maintenance Command, Nagpur
2. HQ Training Command, Bangalore

Aircraft

Helicopters

- MI-26 (heavy lift helicopter)
- MI-17s and MI-8s (rotorcrafts)
- ALOUETTE III, renamed Chetak (anti-tank) and Cheetah (general duties)
- Advanced Light Helicopter (ALH) named DHRUV, developed by Hindustan Aeronautics Ltd.

Trainer

HT-2 primary trainers (with the HPT-32 named Deepak, the HJT 16 named Kiran)

Fighter/Ground Attack

- SU-30 (Russian)
- Mirage-2000 (French, rechristened as Vajra)
- MiG-29 (rechristened as Baaz), MiG-27, MiG-23 MF and MiG-21 BIS (all Russian)
- Jaguar (Anglo-French)
- IL-76 and AN-32 (Russian)
- VRO (British)
- Dornier (German)
- Boeing 737-200 (American)
- MI-26, MI-25 and MI-17 (Russian)
- Chetak and Cheetah (French)
- Lakshya (a Pilotless Target Aircraft developed by DRDO)

Modernization Plan

- IAF plans to induct more Su-30 aircrafts, the Light Combat Aircraft (LCA) the Medium Multi Role Combat Aircraft (MMRCA) and augment the helicopter and transport fleets.
- It has initiated the process for acquisition of additional Mi-17 IV helicopters, heavy lift helicopters, Advanced Light Helicopters and Light Combat Helicopters.
- For the transport fleet, induction of Boeing Business Jets (BBJ), Flight Refuelling Aircraft (FRA) and Airborne Warning and Control Systems (AWACS), Heavy Transport Aircraft (HETAC), C-130J Hercules and Medium Transport Aircraft (MTA) is also planned.
- Among trainer aircraft, the Hawk Advanced Jet Trainer has been inducted and the Intermediate Jet Trainer (IJT) would be acquired.
- The IAF is also in the process of acquiring radars in various categories to meet the Air Defence requirements, accurate and advanced weapons, Network Centric Warfare systems, etc., to meet its assigned tasks.

NAVY

- *Headed by* Chief of Naval Staff
- *Headquarters*: New Delhi

  The Chief of the Naval Staff is assisted by five Principal Staff Officers:
  1. Vice-Chief of Naval Staff
  2. Chief of Personnel
  3. Chief of Material
  4. Deputy Chief of Naval Staff
  5. Controller of Logistic Support

Table 5.7 Number of Commands—Three

Command	*Headquarters*
Western Naval Command	Mumbai
Eastern Naval Command	Vishakhapatnam (operational command)
Southern Naval Command	Kochi (used for training)

*Each Command is headed by a Flag Officer Commanding-in-Chief.

Fleets

1. Western Fleet
2. Eastern Fleet

Aircraft Carriers

- INS Vikrant was India's first aircraft carrier and it retired from Indian Navy in 1997.
- Presently, INS Viraat is the largest aircraft carrier.
- INS VIkramaditya (ex-Soviet Admiral Gorshkov) which has been procured by India and is estimated to enter service in the Indian Navy after 2012.
- Presently, it is being extensively refitted at the Sevmash shipyard in Severodvinsk, Arkhangelsk Oblast, Russia.
- It is projected to replace India's only currently serving aircraft carrier, INS Viraat.

A Peek into India's Naval Fleet

Surface Ships

Aircraft Carriers

1. INS Viraat

Destroyers

1. Delhi Class—Delhi, Mumbai, Mysore
2. Rajput Class—Rajput, Rana, Ranvir, Ranjit, Ranvijay.

Frigates

1. Godavari Class—Ganga, Godavari, Gomati;
2. Talwar Class—Talwar, Trishul, Tabar;
3. Brahmaputra Class—Brahmaputra, Betwa, Beas;
4. Giri Class—Dunagiri, Udaygiri, Taragiri, Vindhyagiri.

Corvettes

1. Khukri Class—Khukri, Kuthar, Kirpan, Khanjar;
2. Kora Class—Kora, Kirch, Kulish, Karmuk;
3. Veer Class—Veer, Nirbhik, Nipat, Nishank, Nirghat, Vibhuti, Vipul, Vinash, Vidyut, Nashak, Pralaya, Prabal;
4. Abhay Class—Abhay, Ajay, Akshay, Agray.

Offshore Patrol Vessels

1. Sukanya Class—Sukanya, Subhadra, Suvarna, Savitri, Sharada, Sujata.

Minesweepers

1. Pondicherry/Karwar Class—Pondicherry, Porbandar, Bedi, Bhavnagar, Allepey, Ratnagiri, Karwar, Cannonore, Cuddalore, Kakinada, Kozhikode, Konkan;
2. Mahe Class—Mahe, Malpe.

Landing Ships

1. Magar Class (LST)—Magar, Gharial;
2. Kumbhir Class (LST-M)—Ghorpad, Cheetah, Guldar, Sharabh, Mahish, Kumbhir LCU–L33, L35–L39.

Missile Boats

1. Chamak Class—Chamak, Chapal.

Training Ships

1. Tir Class—Tir;
2. Leander Class—Krishna;
3. Sail Training Ships—Tarangini.

Fleet Auxilliaries

1. Fleet Tankers—Jyoti, Aditya, Shakti;
2. Diving Support Ship—Nireekshak;
3. Torpedo Recovery Vessel—Astravahini, TRV A-72;
4. Oceangoing Tugs—Matanga, Gaj.

Survey and Research Ships

1. Sagardhwani Class—Sagardhwani;
2. Sandhayak Class—Sandhayak, Nirdeshak, Nirupak, Investigator, Jamuna, Sutlej, Darshak, Sarvekshak.

Seaward Defence Forces

1. Tarasa Class FAC(G)—Tarasa, Trinkat;
2. Seaward Defence Boats—T 54–59, Mithun FACs – T 80–84.

Aircrafts and Helicopters

1. *Sea Harrier*: (British Aerospace-Sea Harrier FRS MK 51/T);
2. *Sea King*: (Sea King 42/42A/42B/42C);
3. *Chetak*: (Aerospatiale—HAL);
4. *Kamov*: (Kamov Ka-28/Helix B);
5. *Ka-25* (Hormone);
6. *Islander*;
7. *Advanced Light Helicopter*: (HAL Advanced Light Helicopter);
8. *Dornier*: (Dornier 228);
9. *IL 38*: (Ilyushin II-38);
10. *TU-142*: (Tupolev Tu-142 M-Bear F);
11. *Kiran*: (Mk 1/1A).

Submarines

Shishumar Class: Shishumar, Shankush, Shalki, Shankul.

Sindhughosh Class: Sindhughosh, Sindhudhvaj, Sindhuraj, Sindhuvir, Sindhuratna, Sindhukesari, Sindhukirti, Sindhuvijay, Sindhurakshak, Sindhushastra.

Submarine-based Missiles: India has a deployed number of foreign-made cruise missile systems (such as Klub SS-N-27) and some indigenous cruise missiles systems such as lakshya PTA. Under development are some SLCMs (Submarine-Launched Crusie missile) systems (such as the Sagarika and Lakshya variants) and an Anti-ship Missile system (BrahMos).

INS Kursura: It was commissioned at Riga, erstwhile USSR, on 18 December 1969 and its induction show-cased the augmentation of the 3rd dimension of the Indian Navy. During her 31 glorious year of service, the submarine participated in almost all type of Naval operations and played a vital role in the 1971 Indo-Pak war. INS Kursura was decommissioned on 27th February 2001.

Submarine Museum: After decommissioning, INS Kursura has been converted into a submarine museum (in 2002) on RK Beach, Visakhapatanam.

Location of Defence Establishments

Army

Indian Military Academy	Dehradun
Army Officers' Training School	Pune and Chennai
The Armoured Corps Centre and School	Ahmednagar
The College of Military Engineering	Kirkee
The School of Signals	Mhow
The School of Artillery	Deolali
The Infantry School	Mhow
The Army Ordnance Corps School	Jabalpur
The Army Education Corps and Training Centre	Pachmarhi
The Service Corps School	Bareilly

The Remount, Veterinary and Farms Corps Centre and School	Meerut
The School of Physical Training	Pune
The School of Mechanical Transport	Bangalore
The Corps Military Police Centre and School	Faizabad
The Military School of Music	Pachmarhi
The Electrical and Mechanical Engineering School	Trimulghery and Secundrabad

Navy

Indian Naval Academy	Kochi
INS Venduruthy	Kochi
Naval Air Station	Kochi
INS Shivaji	Lonavla
INS Valsura	Jamnagar
INS Circars	Vishakhapatnam
INS Hamla	Mumbai
INS Agrani	Coimbatore
INS Gomantak	Mormugao
INS Jarawa	Port Blair
Naval Gunnery School	Kochi
Torpedo/Anti-Submarine School	Kochi
Navigation Direction School	Mormugao

Air Force

Pilot Training Establishment	Allahabad
Air Force Administrative College	Coimbatore
School of Aviation Medicine	Bangalore
Jet Training and Transport Training Wings, Air Force Station	Hyderabad
Air Force Technical Training College	Jalahali
Air Force School	Jalahali
Air Force School	Tambaram
Paratrooper's Training School	Agra

Inter-Services Institutes

National Defence Academy	Khadakvasla
National Defence College	New Delhi
Defence Services Staff College	Wellington
School of Land/Air Warfare	Secunderabad
School of Foreign Language	New Delhi
Rashtriya Indian Military College	Dehradun
Armed Forces Medical College	Pune
Himalayan Mountaineering Institute	Darjeeling

Defence Production Undertakings

- Hindustan Aeronautics Ltd. (HAL) at Bangalore (five factories), Koraput, Nashik, Karwa, Kanpur, Lucknow, Barrackpore and Hyderabad.

- Bharat Electronics Ltd. (BEL) at Bangalore, Ghaziabad, Pune, Machilipatnam, Taloja, Panchkula, Kotdwara, Hyderabad and Chennai.
- Bharat Earth Movers Ltd. (BEML) at Bangalore, Mysore and Kolar Gold Fields at Hyderabad.

  Ship Building Factories:
  1. Mazagaon Dock Ltd. (MDL), Mumbai;
  2. Garden Reach Shipbuilders and Engineering Ltd. (GRSE), Kolkata;
  3. Goa Shipyards Ltd. (GSL), Goa.

SCIENCE AND TECHNOLOGY

India's Missile Programme

- India's Integrated Missile Development Programme (IGMDP) was started in 1982–83 by the Defence Research and Development Organization (DRDO) under the chairmanship of Dr A. P. J. Abdul Kalam. Agni, Prithvi, Trishul, Akash, Nag and Astra also form part of the IGMDP and DRDO is working on development of specialized missiles such as Brahmos, Sagarika etc.

Agni

- The Agni missile family is envisaged to be the mainstay of the Indian missile-based strategic nuclear deterrence.
- The Agni family will continue to grow its stable, providing a breadth of payload and range capabilities.
- The Agni-I is a short range ballistic missile (SRBM) with a single stage engine.
- While the Agni-II is an intermediate range ballistic missile (IRBM) with two solid fuel stages and a Post Boost Vehicle (PBV) integrated into the missile's reentry Vehicle (RV).

Variants

- Agni-TD: Two stage, solid booster and liquid fuelled second stage.
- IRBM Technology Demonstrator.
- Agni-I (A-1): Single stage, solid fuel, road and rail mobile, short-range ballistic missile (SRBM). (Payload 1000 kg; Range 700–800 km)
- Agni-II (A-2): Two stage, solid fuel, road and rail mobile, Intermediate Range Ballistic Missile (IRBM). (Payload 750–1050 kg; Range 2000–3000 km)
- Agni-IIAT (A-2AT): Improved A-2 variant using more advanced and lighter material.
- Two stage, solid fuel, road and rail mobile IRBM.
- Agni-III: Two stage, solid fuel, submarine, road and rail mobile, IRBM/ICBM.
- (inducted in June 2011, India's nuclear deterrent against China) (Payload 2000–2500 kg; Range 3500–5000 km)
- Agni-IV: Three stage, solid fuel, road and rail mobile, ICBM. (launch failed in July 2006)
- Agni-V: Scientists are working on this variant. It is an upgraded version of Agni III. (Range 5000–6000 km)

Brahmos

- It is a Supersonic Cruise Missile that can be launched from submarine, ship, aircraft and land based Mobile Autonomous Launchers (MAL).

- The missile is launched from a Transport-Launch Canister (TLC) which also acts as storage and transportation container.
- Primarily BRAHMOS is an anti-ship missile.

Variants

- *BrahmosD01*: The first flight-test of the BRAHMOS missile was conducted on 12 June 2001 at the Interim Test Range in Orissa state of India.
- *Brahmos D02*: The second flight test (D02) of the BRAHMOS supersonic cruise missile was conducted successfully from Interim Test Range in Orissa, on 28 April 2002.
- *Brahmos D03*: The Brahmos D03 missile was successfully flight tested on 12 February 2003 from one of the warships off the eastern coast.

Prithvi

- India launched the Integrated Guided Missile Development Program (IGMDP) in 1983 to concurrently develop and produce a wide range of missiles for surface-to-surface and surface-to-air roles.
- Prithvi was the first missile developed as part of IGMDP.
- Prithvi-II, the first indigenous surface to surface strategic Missile capable of attacking targets at ranges of 350 kms was successfully tested in June 2011.

Variants

- SS-150/Prithvi-I is a battlefield support system for the army (Payload 1000 kg; Range 150 km).
- It is a single stage, dual engine, liquid fuel, road-mobile, short-range surface-to-surface missile. (Inducted in Indian Army in 1994)
- SS-250/Prithvi-II is dedicated to the Indian Air Force (Payload 350–750 kg; Range 350 km).
- It is a single stage, dual engine, liquid fuel, road-mobile, short-range surface-to-surface missile.
- DRDO has decided to increase the payload capability of the SS-250/Prithvi-II variant to 1000 kg by using boosted liquid propellant to generate higher thrust-to-weight ratio. (Inducted in Indian Army in 1994)
- SS-350/Prithvi-III is a solid fuelled version with a 350 km range and a 1000 kg payload.
- It is a two stage, solid fuel, road-mobile, short-range, surface-to-surface missile.
- Sagarika is the submarine-launched variant of Prithvi-III intended for nuclear-powered submarines.
- A related program, known as Project K-15 is in development and will enable the missile to be launched from a submerged submarine. (Payload 500–1000 kg; Range 350–600 km)
- Dhanush (Sanskrit/Hindi word meaning Bow) is a system consisting of a stabilization platform (Bow) and the Missile (Arrow).
- The system can fire either the SS-250 or the SS-350 variants.
- There may likely be certain customizations in missile configuration to certify it for sea worthiness. (Payload 1000 kg; Range 350 km)
- The Prithvi Air Defense missile has been named as Pradyumna Ballistic Missile Interceptor.

Akash

- It is a medium-range, theatre defence, surface-to-air missile.
- The Akash's first flight occurred in 1990, with development flights up to March 1997.
- It operates in conjunction with the Rajendra surveillance and engagement radar.
- This system will replace the SA-6/Straight Flush in Indian service and is also expected to be integrated with the S-300V (SA-10 Grumble) low-to-high altitude SAM in an integrated air defence system to counter SRBM/IRBM threats along the Pakistani and Chinese borders.

Trishul

- It is a short range, quick reaction, all weather surface-to-air missile designed to counter a low-level attack.
- It has been flight tested in the sea-skimming role and also against moving targets.
- It has a range of 9 km and is fitted with a 5.5 kg HE-fragmented warhead.
- It's detection of target to missile launch is around 6 seconds.
- But due to the enormous development costs of the missile India had officially decided to shut down Trishul Missile project in 2008.
- Trishul missile had been delinked from user service, although it continues as a technology demonstrator.

Nag

- It is a third generation, all weather, top-attack, fire- and -forget anti-tank guided missile.
- It is one of five missile systems developed by the Defence Research and Development Organization (DRDO) under the Integrated Guided Missile Development Program (IGMDP).
- Design work on the missile started in 1988 and the first tests were carried out in November 1990.

Astra

- Astra is a state-of-the-art beyond visual range air to air missile (BVRAAM) designed for a range of over 80 km in head-on mode and 20 km in tail-chase mode.
- Its first test flight were conducted in May 2003.
- Astra can engage highly manoeuvring targets.

INDIA'S SPACE PROGRAMME

- The Indian Space Programme began in 1962.
- In 1969, the Indian Space Research Organization (ISRO) was set up with headquarters in Bangalore.
- The Space Commission was established in 1972.
- In 1975, India launched its first satellite, Aryabhata and thus entered the space age.

First Indian in Space

The manned space program of the ISRO has depended entirely upon Russia and the first Indian cosmonaut became the 138th man into space, he spent 8 days in space aboard Salyut 7. Launched along with two other Soviet cosmonauts aboard Soyuz T-11 on 2 April 1984,

was then Squadron Leader Rakesh Sharma, a 35 year old Indian Air Force pilot. Squadron Leader Sharma and his backup, Wing Commander Ravish Malhotra also prepared an elaborate series of zero-gravity Yoga exercises which the former had practised aboard the Salyut 7. Retired with the rank of Wing Commander, Rakesh Sharma joined Hindustan Aeronautics Ltd. (HAL) as a test pilot.

Space Missions

Aryabhata: India launched its first experimental satellite on 19 April 1975 from a Soviet cosmodrome to perform scientific X-ray experiments in space and send back data to earth.

Bhaskara-I: India's second 436 kg satellite was launched on 7 June 1979 to collect information on India's land, water, forest and ocean resources.

Rohini

- The Rohini series of satellites were designed and built for Indian scientific programs.
- Four satellite were launched in the the Rohini series; Rohini-1A, -1B, -2 and -3.
- The Rohini-1B was also the first Indian satellite launched by an Indian rocket.
- *Rohini 1B*: Launched on 18 July 1980 from Sriharikota aboard the SLV-3.
  —It was India's first successful launch.
  —This experimental satellite followed the failure of the Rohini-1A.
  —Launched on 10 August 1979.
  —It re-entered orbit on 20 May 1981.
- *Rohini 2*: Launched on 31 May 1981 by SLV-3 from Sriharikota.
- *Rohini 3*: Launched on 17 April 1983 from Sriharikota aboard the SLV-3.
  —It carried two cameras and L-band beacon.
  —This satellite returned around 5000 earth images before being de-activated on 24 September 1984.
  —It re-entered orbit on 19 April 1990.

APPLE (Ariane Passenger Payload Experiment): India's first experimental, geostationary satellite weighing 673 kg was launched on 19 June 1981.

Bhaskara-II: India's second satellite for earth observation was launched on 20 November 1981.

SLV Mission (Satellite Launch Vehicle)

- India's first satellite launch vehicle SLV-3 was successfully launched on 18 July 1980 from Sriharikota.
- Rohini-2 (RS-D2) was put into orbit on 17 April 1983, using SLV-3 and this completed the planned developmental flights of the SLV-3.

IRS Mission (Indian Remote Sensing Satellite)

- IRS-1A, India's first IRS was launched on 17 March 1988 for monitoring and management of natural resources.
- IRS-1B, India's second remote sensing satellite was launched on 29 August 1991 to replace IRS-IA which was nearing the end of its life.
- The IRS system has been further enhanced by IRS-IC, IRS-P3, IRS-ID and IRS-P4, the last three having been launched on 28 December 1995 by a Russian rocket and IRS-ID launched by PSLV on 29 September 1997.
- IRS-P3 was launched by the third developmental flight of PSLV-D3 on 21 March 1996.

- IRS-P4 (OCEANSAT) another satellite was launched by PSLV on 26 May 1999.
- IRS-P5 and IRS-P6, two more satellites, for cartography and agricultural resources survey respectively are planned for launch in next three years.

ASLV Mission (Augmented Satellite Launch Vehicle): ASLV is designed to augment indigenous satellite launching capability and put 150 kg class satellite into low earth orbit.

SROSS (Stretched Rohini Satellite Series):

- After failure of two ASLV launches, SROSS-III, a 105 kg satellite was successfully placed in a 450 km high orbit via the launching of ASLV-D3, on 20 May 1992 though the lifespan of the satellite was only 55 days.
- The fourth developmental flight was made on 4 May 1994 and SROSS-C4 was successfully placed into the earth orbit from Sriharikota.
- ASLV is the forerunner of the more powerful Polar Satellite Launch Vehicle (PSLV) and the Geosynchronous Launch Vehicle (GSLV).
- The first developmental flight of the PSLV called PSLV-Dl on 20 September 1993, failed.
- However, according to ISRO it was a partial success which established India's capabilities in liquid propulsion system.

INSAT Mission (Indian National Satellite System)

- The Indian National Satellite (INSAT) system is a joint venture of the Department of Space, Department of Telecommunications, Indian Meteorological Department, All India Radio and Doordarshan.
- The overall coordination and management of INSAT system rests with the Secretary-level INSAT Coordination Committee.
- Established in 1983, INSAT is one of the largest domestic communication satellite systems in the Asia Pacific Region with nine satellites in operation—INSAT-2E, INSAT-3A, INSAT-3B, INSAT-3C, INSAT-3E, KALPANA-1, GSAT-2, EDUSAT and INSAT-4A.
- The latest, INSAT-4A, which was launched successfully from Kourou in French Guyana on 22 December 2005, has given further boost to INSAT capability, especially, for Direct-To-Home (DTH) television broadcast.
- Launch of INSAT-4C was unsuccessful on 10 July 2006.
- A quick look at INSAT launches is given below:
  - —INSAT-1A On 10 April 1982—it failed prematurely
  - —INSAT-1B On 30 August 1983—it was successful
  - —INSAT-1C On 22 July 1988—it became redundant in 1989
  - —INSAT-10 On 17 July 1990—it was successful and completed the mission

INSAT-2 Projects

- INSAT-2A, India's first indigenously built second generation satellite. It was launched on 10 July 1992. It is equipped with 50% more capacity than the INSAT-I series.
- INSAT-2B, India's second indigenously built satellite. It was launched by the European Space Agency from Kourou, French Guinea on 23 July 1993. INSAT-2B took place of INSAT-1B whose functioning ended following the completion of its ten-year life.
- At present, the system is served by ISRO-built satellites, INSAT-2C, INSAT-2E, INSAT-3B and INSAT-2DT procured from ARABSAT in October 1997.

- INSAT-3B was launched in March 2000, carried 12 extended C-band transponders, 3 ku-band transponders and CxS mobile satellite service transponders.
- The Press Trust of India (PTI) has implemented a system to provide its news and information services at high speed and increased volume by utilizing broadcast facilities of INSAT satellite.
- With the availability of INSAT-2C, INSAT-2E and INSAT-3B business communication in ku-band and mobile satellite service are being tried out.
- INSAT has enabled a vast expansion in the television services with over 1079 TV transmitters linked through INSAT.
- The fourth developmental flight of ASLV-4 was made on 4 May 1994 and the SROSS-C4 was successfully placed into the near earth orbit from Sriharikota.
- Today, India has realized the operational launch vehicle, PSLV, capable of launching 1200 kg IRS class of remote sensing satellite into polar sun synchronous orbit.
- The first successful developmental launch (PLSV-D2) took place on 15 October 1994 when it placed the IRS-P2 remote sensing satellite into polar orbit.
- The second and final developmental test (PSLV-D3) was conducted on 21 March 1996 when IRS-P3 was placed into the intended polar orbit.
- The first operational flight, PSLV-C1 placed IRS-1D in orbit.
- PSLV-C2 places IRS-P4 (OCEANSAT), a Korean satellite KITSAT-3 and a German satellite TUBSAT into 727 km polar sun synchronous orbit on May 26, 1996.
- PSLV-C3 is planned to launch IRS-P5 and Belgium satellite PROBA
- The development of Geosynchronous Satellite Launch Vehicle (GSLV), incorporating a cryogenic stage which will be capable of placing 2000 kg INSAT class of satellites in geosynchronous transfer orbit is at first developmental test stage.
- PSLV C-7 carries four satellites—the 680 kg Indian Remote Sensing Satellite CARTOSAT-2, the 550 kg Space Capsule Recovery Equipment, Indonesia's LAPAN-TUBSAT and Argentina's 6 kg nanosatellite, PEHUENSAT-1.
- ISRO projects are conducted at following five space centers:
  1. SHAR–Sriharikota Launching Range
  2. VSSC–Vikram Sarabhai Space Center
  3. ISAC–ISRO Satellite Center (under development)
  4. SAC–Space Applications Center (under development)
  5. ISTRAC–ISRO Telemetry Tracking and Command Network (under development)
- India has developed the following space launch vehicles:
  —SLV–Satellite Launch Vehicle
  —ASLV–Augmented Satellite Launch Vehicle
  —PSLV–Polar Satellite Launch Vehicle
  —GSLV–Geosynchronous Satellite Launch Vehicle
- India is also developing the following space launch vehicles:
  —GSLV Mk-I
  —GSLV Mk-II
  —GSLV Mk-III
- The launcher and propulsion represents the ISRO's largest single development area.
- The launcher program has seen a gradual evolution (from the all-solid SLV-3 to solid, liquid and cryogenic fuelled stages currently used in PSLV series (Delta class launcher) and GSLV (Ariane-class)

Table 5.8 Indian Space Programme

Satellite	*Launch Date*	*Launch Vehicle*	*Type of Satellite*
GSAT-14	05.01.2014	GSLV-D5	Geo-Stationary Satellite
Mars Orbiter Mission Spacecraft	05.11.2013	PSLV-C25	Space Mission
GSAT-7	30.08.2013	Arine-5; VA-215	Geo-Stationary Satellite
INSAT-3D	26.07.2013	Arine-5; VA-214	Geo-Stationary/Meteorological Satellite
IRNSS-1A	01.07.2013	PSLV-C22	navigation Satellite
SARAL	25.02.2013	PSLV-C20	Earth Observation Satellite (World's First Phone-operated Nano-satellite)
GSAT-10	29.09.2012	Ariane-5VA209	Geo-Stationary Satellite
SPOT-6	09.09.2012	PSLV-C21	Earth Observation Satellite
PROITERES	09.09.2012	PSLV-C21	Experimental/Small Satellite
RISAT-1	26.04.2012	PSLV-C19	Earth Observation Satellite
Jugnu	12.10.2011	PSLV-C18	Experimental/Small Satellite
SRM Sat	12.10.2011	PSLV-C18	Experimental/Small Satellite
Megha-Tropiques	12.10.2011	PSLV-C18	Earth Observation Satellite
GSAT-12	15.07.2011	PSLV-C17	Geo-Stationary Satellite
GSAT-8	21.05.2011	Ariane-5	Geo-Stationary Satellite
RESOURCESAT-2	20.04.2011	PSLV-C16	Earth Observation Satellite
YOUTHSAT	20.04.2011	PSLV-C16	Experimental/Small Satellite
GSAT-5P	25.12.2010	GSLV-F06	Geo-Stationary Satellite
STUDSAT	12.07.2010	PSLV-C15	Experimental/Small Satellite
CARTOSAT-2B	12.07.2010	PSLV-C15	Earth Observation Satellite
GSAT-4	15.04.2010	GSLV-D3	Geo-Stationary Satellite
Oceansat-2	23.09.2009	PSLV-C14	Earth Observation Satellite
ANUSAT	20.04.2009	PSLV-C12	Experimental/Small Satellite
RISAT-2	20.04.2009	PSLV-C12	Earth Observation Satellite
Chandrayaan-1	22.10.2008	PSLV-C11	Space Mission
CARTOSAT – 2A	28.04.2008	PSLV-C9	Earth Observation Satellite
IMS-1	28.04.2008	PSLV-C9	Earth Observation Satellite
INSAT-4B	12.03.2007	Ariane-5ECA	Geo-Stationary Satellite
CARTOSAT - 2	10.01.2007	PSLV-C7	Earth Observation Satellite
SRE - 1	10.01.2007	PSLV-C7	Experimental/Small Satellite
INSAT-4CR	02.09.2007	GSLV-F04	Geo-Stationary Satellite
INSAT-4C	10.07.2006	GSLV-F02	Geo-Stationary Satellite
INSAT-4A	22.12.2005	Ariane-5GS	Geo-Stationary Satellite
HAMSAT	05.05.2005	PSLV-C6	Experimental/Small Satellite
CARTOSAT-1	05.05.2005	PSLV-C6	Earth Observation Satellite
EDUSAT (GSAT-3)	20.09.2004	GSLV-F01	Geo-Stationary Satellite
Resourcesat-1 (IRS-P6)	17.10.2003	PSLV-C5	Earth Observation Satellite
INSAT-3A	10.04.2003	Ariane-5G	Geo-Stationary Satellite

(*Continued*)

Satellite	*Launch Date*	*Launch Vehicle*	*Type of Satellite*
INSAT-3E	28.09.2003	Ariane-5G	Geo-Stationary Satellite
GSAT-2	08.05.2003	GSLV-D2	Geo-Stationary Satellite
KALPANA-1(METSAT)	12.09.2002	PSLV-C4	Geo-Stationary Satellite
INSAT-3C	24.01.2002	Ariane-42L H10-3	Geo-Stationary Satellite
Technology Experiment Satellite (TES)	22.10.2001	PSLV-C3	Earth Observation Satellite
GSAT-1	18.04.2001	GSLV-D1	Geo-Stationary Satellite
INSAT-3B	22.03.2000	Ariane-5G	Geo-Stationary Satellite
Oceansat(IRS-P4)	26.05.1999	PSLV-C2	Earth Observation Satellite
INSAT-2E	03.04.1999	Ariane-42P H10-3	Geo-Stationary Satellite
INSAT-2DT	January 1998	Ariane-44L H10	Geo-Stationary Satellite
IRS-1D	29.09.1997	PSLV-C1	Earth Observation Satellite
INSAT-2D	04.06.1997	Ariane-44L H10-3	Geo-Stationary Satellite
IRS-P3	21.03.1996	PSLV-D3	Earth Observation Satellite
IRS-1C	28.12.1995	Molniya	Earth Observation Satellite
INSAT-2C	07.12.1995	Ariane-44L H10-3	Geo-Stationary Satellite
IRS-P2	15.10.1994	PSLV-D2	Earth Observation Satellite
Stretched Rohini Satellite Series (SROSS-C2)	04.05.1994	ASLV	Space Mission
IRS-1E	20.09.1993	PSLV-D1	Earth Observation Satellite
INSAT-2B	23.07.1993	Ariane-44L H10+	Geo-Stationary Satellite
INSAT-2A	10.07.1992	Ariane-44L H10	Geo-Stationary Satellite
Stretched Rohini Satellite Series (SROSS-C)	20.05.1992	ASLV	Space Mission
IRS-1B	29.08.1991	Vostok	Earth Observation Satellite
INSAT-1D	12.06.1990	Delta 4925	Geo-Stationary Satellite
INSAT-1C	21.07.1988	Ariane-3	Geo-Stationary Satellite
Stretched Rohini Satellite Series (SROSS-2)	13.07.1988	ASLV	Earth Observation Satellite
IRS-1A	17.03.1988	Vostok	Earth Observation Satellite
Stretched Rohini Satellite Series (SROSS-1)	24.03.1987	ASLV	Space Mission
INSAT-1B	30.08.1983	Shuttle (PAM-D)	Geo-Stationary Satellite
Rohini (RS-D2)	17.04.1983	SLV-3	Earth Observation Satellite

(*Continued*)

Satellite	*Launch Date*	*Launch Vehicle*	*Type of Satellite*
INSAT-1A	10.04.1982	Delta 3910 PAM-D	Geo-Stationary Satellite
Bhaskara-II	20.11.1981	C-1 Intercosmos	Earth Observation Satellite
Ariane Passenger Payload Experiment (APPLE)	19.06.1981	Ariane-1(V-3)	Geo-Stationary Satellite
Rohini (RS-D1)	31.05.1981	SLV-3	Earth Observation Satellite
Rohini (RS-1)	18.07.1980	SLV-3	Experimental/Small Satellite
Rohini Technology Payload (RTP)	10.08.1979	SLV-3	Experimental/Small Satellite
Bhaskara-I	07.06.1979	C-1 Intercosmos	Earth Observation Satellite
Aryabhata	19.04.1975	C-1 Intercosmos	Experimental/Small Satellite

INDIA'S ATOMIC RESEARCH

First Nuclear Explosion

- It was carried out on 18 May 1974, at Pokharan in Rajasthan (Thar) desert.
- The main objective was the use of atomic energy for peaceful purposes, i.e. digging canals, reservoirs, oil exploration, as well as to study rock dynamics.
- This successful explosion made India the sixth nuclear nation in the world.

NRSC	:	National Remote Sensing Centre,
PRL	:	Physical Research Laboratory
NARL	:	National Atmospheric Research Laboratory,
NE-SAC	:	North Eastern Space Applications Centre,
SCL	:	Semi-Conductor Laboratory,
ISRO	:	Indian Space Research Organization,
Antrix	:	Antrix Corporation Ltd.,
VSSC	:	Vikram Sarabhai Space Centre,
LPSC	:	Liquid Propulsion Systems Centre,
SDSC	:	Satish Dhawan Space Centre,
ISAC	:	ISRO Satellite Centre,
SAC	:	Space Application Centre,
IISU	:	ISRO Interial Systems Unit,
DECU	:	Development and Educational Communication Unit,
MCF	:	Master Control Facility,
ISTRAC	:	ISRO Telemetry Tracking and Command Network,
LEOS	:	Laboratory for Electro-optic Systems,
IIST	:	Indian Institute of Space Science and Technology,
IIRS	:	Indian Institute of Remote Sensing

Atomic Energy Commission

- Established in 1948, with Dr H. J. Bhabha as its first Chairman, to look after India's atomic energy programmes.

Department of Atomic Energy (DAE)

- Set up in August 1954 for implementation of atomic energy programmes and headed by the Prime Minister of India.
- It has five research centers:
  1. *Bhabha Atomic Research Centre (BARC)*: Established in 1957, it is located in Trombay (Maharashtra) and is India's largest atomic research centre.
  2. *Indira Gandhi Centre for Atomic Research*: Established in 1971, it is located at Kalpakkam (Tamil Nadu).
  3. *Centre for Advanced Technology (CAT)*: Established in 1984, it is located at Indore.
  4. *Variable Energy Cyclotron Centre (VECC)*: Kolkata.
  5. *Atomic Minerals Directorate for Exploration Research (AMD)*: Hyderabad

  —It has three Industrial Organizations:
    1. Heavy Water Board (HWB), Mumbai.
    2. Nuclear Fuel Complex (NFC), Hyderabad.
    3. Board of Radiation and Isotope Technology (BRIT), Mumbai.

  —Four Public Sector Undertakings:
    1. Nuclear Power Corporation of India Ltd. (NPCIL), Mumbai.
    2. Uranium Corporation of India Ltd. (UCIL), Jaduguda (Jharkhand).
    3. Indian Rare Earth Ltd. (IRE), Mumbai.
    4. Electronics Corporation of India Ltd. (ECIL), Hyderabad.

  —Four Service Organizations:
    1. Directorate of Purchase and Stores (DPS), Mumbai.
    2. Construction, Services and Estate Management Group, Mumbai.
    3. General Services Organization (GSO), Kalpakkam (Tamil Nadu).
    4. Atomic Energy Education Society (AEES), Mumbai.
- DAE also financially supports seven autonomous national institutes:
  1. Tata Institute of Fundamental Research (TIFR), Mumbai.
  2. Tata Memorial Centre (TMC), Mumbai.
  3. Saha Institute of Nuclear Physics (SINP), Kolkata.
  4. Institute of Physics (IOP), Bhubaneswar.
  5. Harish-Chandra Research Institute (HRI), Allahabad.
  6. Institute of Mathematical Studies (IMS), Chennai.
  7. Institute of Plasma Research (IPR), Ahmedabad.
- The Board of Research in Nuclear Sciences (BRNS) and the National Board for Higher Mathematics (NBHM) promote research in nuclear and allied fields and mathematics respectively.

Nuclear Power Projects

- The Nuclear Power Corporation of India Ltd. (NPCIL) set up in 1987, is responsible for the design, construction and operation of nuclear power plants in the country.
- India expects to have 20,000 MW nuclear capacity by 2020.
- It aims to supply 25% of electricity from nuclear power by 2050.

Table 5.9 Atomic Power Plants

Name	*Location*	*Features*
1. Tarapur Atomic Power Station (TAPS)	Tarapur (Maharashtra)	Asia's first atomic station commissioned in 1969
2. Madras Atomic Power Station (MAPS)	Kalpakkam (Tamil Nadu)	India's first indigenously built atomic power station
3. Rajasthan Atomic Power Station (RAPS)	Rawatbhata (Rajasthan)	
4. Narora Atomic Power Station (NAPS)	Narora (Uttar Pradesh)	First unit commissioned in March 1989 and second in October 1991
5. Kakrapar Atomic Power Project (KAPP)	Kakrapar (Gujarat)	
6. Kudankulam Nuclear Power Project (KNPP)	Kudankulam (Tamil Nadu)	Project stage conceived in 1988
7. Kaiga Power Project (KPP)	Kaiga (Karnataka)	Project stage

ROBOTICS AND AUTOMATION

- Robotics is one of the major thrust area of R&D programme both at BARC and IGCAR.
- The Bilateral Master Slave Servo Manipulators, manufactured under collaboration between BARC and HMT-Bangalore, have undergone field trials.
- A five-degree of freedom robot for deployment in radioactive chemical laboratories and a six-degree of freedom robot and a mobile robot have been depolyed at Trombay.
- At IGCAR, for automation and non-destructive evaluation, Mobile Scanner (MOBSCAN), a Remotely Operated Power Manipulator (ROPMAN) and a robot for capping and decapping bottles, have been developed.

POKHRAN TESTS

- On 18 May 1974, India conducted a peaceful underground nuclear experiment at Pokhran in Rajasthan desert.
- India successfully conducted five nuclear tests on 11th and 13th May, 1998 at Pokhran.
- These included a thermonuclear device, a fission device and a three sub-kiloton nuclear device.
- Analysis of the measurements carried out at the time of tests confirmed the initially declared yields and other design parameters for all the devices.

CHANDRAYAN-I

- The Chandrayan-I mission was announced by former Prime Minister Atal Behari Vapayee on 15 August 2003 during his Independence Day address to the nation.

- The 525kg Chandrayan-I was launched in 2008 on one of India's own Polar Satellite Launch Vehicle (PSLV) space rockets.
- The Chandrayan-I mission carried X-ray and gamma-ray spectrometers and sends back data that scientists on Earth would use to produce a high-resolution digital map of the lunar surface.
- The Chandrayan-I mission carries out a physical and chemical mapping of the moon and is unmanned.
- The Indian mission, Chandrayan-I, carried five Indian instruments alongwith three developed by the European Space Agency, two US payloads developed by NASA and one from Bulgaria.

MANGALYAAN (MARS ORBITER MISSION)

- One of the main objectives of the first Indian mission to Mars is to develop the technologies required for design, planning, management and operations of an interplanetary mission.
- *Technological Objectives of the Mission*: Design and realisation of a Mars orbiter with a capability to survive and perform Earth bound manoeuvres, cruise phase of 300 days, Mars orbit insertion/capture and on-orbit phase around Mars. Deep space communication, navigation, mission planning and management. Incorporate autonomous features to handle contingency situations.
- *Scientific Objectives of the Mission*: Exploration of Mars surface features, morphology, mineralogy and Martian atmosphere by indigenous scientific instruments.
- *Launch Vehicle*: *PSLV-C25*, On November 5, 2013 the PSLV-C25, 25th flight of PSLV launched Mars Orbiter Mission Spacecraft from the First Launch Pad at SDSC (Satish Dhawan Space Centre) SHAR, Sriharikota. The challenging PSLV-C25 mission was optimised for the launch of Mars Orbiter Mission spacecraft into a highly elliptical Earth orbit with a perigee (nearest point to Earth) of 250 km and an apogee (farthest point to Earth) of 23,500 km with an inclination of 19.2º with respect to the equator. With six Liquid Engine firing, the spacecraft gradually maneuvered into a hyperbolic trajectory with which it escaped from the Earth's Sphere of Influence (SOI) and arrived at the Mars Sphere of Influence. When spacecraft reaches nearest point of Mars (Peri-apsis), it is maneuvered in to an elliptical orbit around Mars by firing the Liquid Engine. The spacecraft then moves around the Mars in an orbit with Peri-apsis of 366 km and Apo-apsis of about 80,000 km.

IMPORTANT PERSONALITIES

Rakesh Sharma

Born of January 13 1949, a test pilot and consomault, Rakesh Sharma was the first Indian to venture into space as part of Intercosmos programme. On 3rd April 1984, Rakesh Sharma flew into space aboard Soviet aircraft Soyuz T-11 and spent 8 days travelling in space around the Earth's orbit.

Kalpana Chawla (1 July 1961–1 February 2003)

Kalpana Chawla was an Indian born American astronaut and space shuttle mission specialist. She was one of seven crew members who died aboard Space Shuttle Columbia

during mission STS-107 when the shuttle disintegrated upon re-entry into the Earth's atmosphere on 1 February 2003. On 5 February 2003, India's Prime Minister announced that the meteorological series of satellites, 'METSAT', will be named as 'KALPANA'. The first satellite of the series, 'METSAT-1', launched by India on 12 September 2002 will be now known as 'KALPANA-1'. 'KALPANA-2' is expected to be launched by 2007. Asteroid 51,826 Kalpanachawla is named for her. She died a hero and a role model for many young women, especially in India and particularly those in her hometown of Karnal, where her life serves to encourage young people to follow her footsteps.

Sunita L. Williams

Sunita L. Williams was born on 19 September 1965, in Euclid, Ohio. She was awarded the Navy Commendation Medal (2), Navy and Marine Corps Achievement Medal, Humanitarian Service Medal and various other service awards. Williams was commissioned as an Ensign in the United States Navy from the United States Naval Academy in May 1987. She was designated as a Naval Aviator in July 1989. Sunita has logged over 2770 flight hours in more than 30 different aircraft. Selected by NASA in June 1998, she reported for training in August 1998. Williams has worked in Moscow with the Russian Space Agency on the Russian contribution to the International Space Station (ISS) and with the first Expedition Crew to the ISS. After the return of Expedition-1, Williams worked within the Robotics branch on the ISS Robotic Arm and the follow on Special Purpose Dexterous Manipulator. As a NEEMO2 crew member, she lived underwater for 9 days in the Aquarius habitat. Sunita Williams currently lives and works aboard the International Space Station. She launched with the crew of STS-116 on 9 December 2006, docking with the station on 11 December 2006. Williams joined Expedition-14 in progress and served as a flight engineer during her 195 days tour of duty aboard the ISS. Williams returned to earth on 22 June 2007, at the end of STS-117 mission.

NATIONAL INSIGNIA

National Flag

- The National Flag was adopted by the Constituent Assembly of India on 22 July 1947 and presented to India at the midnight session of the Assembly on 14 August 1947.
- The ratio of the width of the flag to its length is 2 : 3.
- All the three bands are of equal width with deep saffron at the top, white in the middle and dark green at the bottom.
- In the centre of the white band is a wheel in navy-blue colour.
- The diameter of the wheel (chakra) approximates the width of the white band and it has 24 spokes.

The Flag Code of India 2002

- It takes into effect from 26 January 2002 and supersedes the '*Flag Code-Indias*' as it existed.

- As per the provision of the Flag Code of India 2002, there shall be no restriction on the display of the National flag by members of general public, private organizations, educational institutions, etc., except to the extent provided in the emblems and names (Prevention of Improper Use) Act, 1950 and the Prevention of Insults to National Honour Act, 1971 and any other law enacted on the subject.

National Emblem

- The National Emblem and Seal of the Government of India is a replica of the Capitol of Ashoka's Pillar at Sarnath.
- In the original capitol of the stone pillar, four lions are carved out standing back to back.
- In the emblem, however only three lions are visible.
- The capitol is mounted on an abacus (base plate).
- There is a *Dharma Chakra (Wheel of the Law)* in the centre of the base plate on the right of which is a figure of a bull and on the left, that of a horse.
- There is an inscription in Devanagari script which reads *Satyameva Jayate (from Mundaka Upanishad)* which means 'Truth Alone Triumphs'.
- The National Emblem was adopted by the Government of India on 26 January 1950.

National Anthem (Jana Gana Mana)

- *Composer*: Rabindranath Tagore (in 1911).
- *First Sung on*: 27 December 1911, at the Calcutta Session of the Indian National Congress.
- *Adopted on*: 24 January 1950, by the Constituent Assembly of India
- *English Translation*: Rendered by Tagore himself in 1919 under the title '*Morning Song of India*'.
- *Playing time*: About 52 seconds for the full version; however, a shorter version comprising the first and the last lines has a playing time of 20 seconds and is played on ceremonial occasions.

National Song (Vande Mataram)

- *Composer*: Bankimchandra Chatterjee
- *Adopted on*: 24 January 1950 along with the National Anthem
- *English Translation*: Rendered by Sri Aurobindo
- It has been taken from Bankim Chandra Chatterjee's novel '*Ananda Math*', published in 1882.
- It was composed in Sanskrit and was a source of inspiration to the people in their struggle for freedom.
- It was first sung during the 1896 session of the Indian National Congress.

National Calendar (*Saka*)

- From 22 March 1957 (Saka 1879) a unified Indian National Calendar to be used for official purposes was introduced based on the Saka era which began with vernal equinox of ad 78.
- Chaitra is the first month and Phalguna is the last month of the Saka year.
- Chaitra 1 falls on 22 March in a normal year and on 21 March in a leap year.

National Animal

- Since November 1972, the tiger (*Panthera tigris*) has been adopted as the national animal.
- *Project Tiger*: To check the dwindling tiger population in India, 'Project Tiger' was launched in April 1973. At the moment, there are 27 tiger reserves in India spread in an area of 3776 km^2.

National Bird

- Peacock (*Pavo cristatus*): It is fully protected under the Indian Wildlife (Protection) Act, 1972.
- Adopted as the national bird in 1964, its hunting has since then been banned.

National Flower

- Lotus (*Nelumbo nucifera*): It has been an auspicious symbol of Indian culture since time immemorial.

National Tree

- The Banyan Tree *(Ficus benghalensis)*: It has the widest reaching roots of all known trees, easily covering several acres.

National Fruit

- Mango *(Manigifera indica)*: It is cultivated throughout India (with exception of hilly areas) since the time immemorial.

National Days

Independence Day	15 August (India achieved independence on this day in 1947)
Republic Day	26 January (India became a Republic on this day in 1950)
Martyrs' Day	30 January (Mahatma Gandhi was assassinated on this day in 1948)
Teachers' Day	5 September (Birthday of Dr S. Radhakrishnan, first Vice-President of India)
Childrens' Day	14 November (Birthday of Pt Jawaharlal Nehru)
Gandhi Jayanti	2 October (Birthday of Mahatma Gandhi)

Other Important Day

Air Force Day	8 October
Army Day	15 January
Flag Day	7 December
National Integration Day	9 November
National Maritime Day	5 April
National Rededication Day	28 February
National Science Day	28 February
National Youth Day	12 January
Navy Day	4 December
Post Office Day	9 October
Quit India Day	19 August

PART B

Chapter

6 PHYSICAL AND WORLD GEOGRAPHY

PHYSICAL GEOGRAPHY

- *Physical geography* deals with those elements of Earth that are natural in origin (such as landforms, weather and climate).
- *Cultural geography* deals with elements of human endeavor (such as language, religion, etc.).
- For this reason, physical geography is sometimes referred to as environmental geography and cultural geography is sometimes referred to as *human geography.*

SOLAR SYSTEM

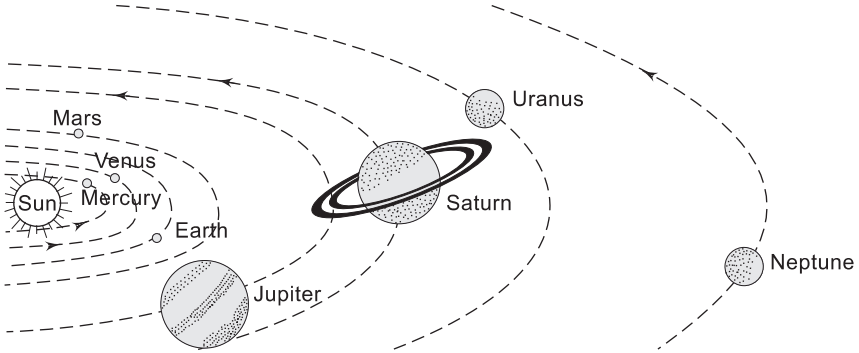
- Our solar system comprises the sun and eight known planets which orbit around it.
- The solar system also consists of
  —The natural satellites accompanying the planets.
  —Several thousand minor planets called asteroids.
  —A large number of comets.

The Planets

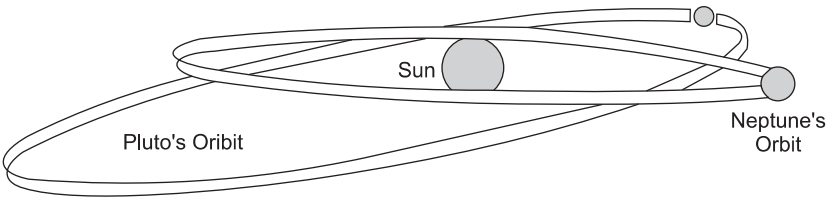
- The bodies revolving around the sun (at the same time rotating on their own axis) are called planets.
- There are eight* known planets.
- The four inner planets are smaller, denser and less oblate. They are more nearly spherical than the four outer planets.
- *The Inner Planet* rotates more slowly on their axes. The inner planets are composed principally of mineral matter and they have, except for airless Mercury, diverse but relatively shallow atmospheres.
- *Mercury:* It is the planet closest to the sun. It rotates on its own axis in 58.65 days and takes 88 days to complete one revolution around the sun. Thus, it is also the fastest planet in our solar system.

**Pluto:* From its discovery in 1930 until 2006, it was considered the ninth and smallest planet. However, on 24 August 2006, the International Astronomical Union (IAU) has reclassified Pluto as a dwarf planet. Therefore, we now have eight planets in our solar system.

- *Venus:* It is the brightest object in the sky after the sun and the moon. It is also the hottest planet in our solar system. It rotates backwards unlike other planets on its axis.
- *Earth:* Details follow.
- *Mars:* It is the fourth planet from the sun and is next after the earth. It is also known as the red planet. Because of its similarities with earth, astronomers have been speculating on the existence of some kind of life on this planet.
- *The Outer Planets* seem to be composed entirely of gases, principally hydrogen with dense and turbulent atmospheres; their chemical composition is similar to that of the Sun.
- *Jupiter:* Is the largest planet in our solar system. Its diameter is 11 times the diameter of the earth. It has 63 satellites.
- *Saturn:* Is the outermost planet visible to the naked eye and second largest in size after Jupiter. The most spectacular feature of Saturn is its system of rings.
- *Uranus:* Is the seventh planet from the sun and is not visible to the naked eye. It was discovered in 1781 by William Herschel.
- *Neptune:* It is the eighth in position from the sun. It was discovered by J. G. Galle in 1846.



- *Which Is Farthest, Neptune or Pluto?* Pluto revolves farther from the sun than any of the planets for most of its orbit. However, because of its orbital eccentricity, Pluto moves closer to sun for approximately 20 years, leaving Neptune at a farther distance. From 23 January 1979, Pluto moved closer to the sun and remained in that position till 15 March 1999. After 1999, it is now Pluto's turn to go further and Neptune will remain closer to the sun for approximately 228 years.



Satellites

Satellites are bodies which revolve around the planets. There are approximately 180 satellites in our solar system:

Table 6.1 Satellites in Our Solor System

Planet	*Number of Satellites*	
Mercury	0	Important data on the Moon
Venus	0	Distance from the earth (Centre to centre)—3,84,400 km
Earth	1	Distance from the earth (Surface to surface)—3,76,284 km
Mars	2	Diameter (Period of option units axis 28 days)—3475 km
Jupiter	67	Orbital speed—3680 km/s
Saturn	62	Period of rotation on its axis—28 days
Uranus	27	
Neptune	13	

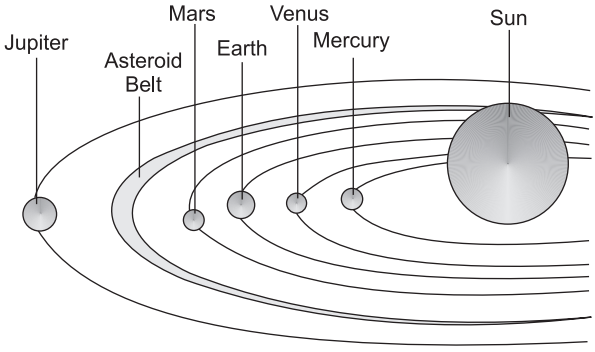
Note: *Pluto a dwarf planet has five moons.

The Moon

- The Moon is earth's natural satellite and is its nearest neighbour in space.
- It revolves around the earth while rotating on its own axis.
- The moon is about 1/6th the size of the earth.
- The moon takes 27 days, 7 hr, 43 min and 11.47 sec to complete one revolution of the earth.
- It rotates on its axis in exactly the same time.
- Hence, we see only one side of the moon.
- Moon is the first member of our solar system to have been visited by man.
- Neil Armstrong and Edwin Aldrin created history on 21 July 1969, when they first set foot on the moon.

Asteroids

- It is believed that asteroids are debris left over from the formation of the inner planets.
- They are too small to retain any atmosphere of their own.
- Asteroids are also called 'planetoids' or small planets.



- They circle around the sun between the orbits of Mars and Jupiter.
- There are about 50,000 known asteroids in our solar system.
- The largest is *Ceres* with a diameter of 1025 km.

Meteors

- Meteors are small bodies often seen in the sky, shooting with great speed from one point to another and producing a trail of light.
- Meteors may burn up or fall on earth known as shooting stars in the form of dust or fragments called meteorites.

Comets

- Comets are celestial bodies that move around the sun.
- A prominent feature of a comet is its long tail and hence, its name which comes from the Greek word *kometes*, meaning 'hair-like'.
- Some important comets are Halley's D'Arrest, Encke, Borrelly, Pons-winnecke, Finlay, Faye and Smith-tuttle.

Important Comets

- *Halley's Comet* is perhaps the most famous comet, named after the British astronomer, Edmund Halley, who discovered it in 1705. He stated that the comets seen in 1531, 1607 and 1683 were in fact the same body which circles the sun every 76 years. Halley's comet last appeared in 1986 and it may reappear again after 76 years.
- *Comet 'Smith-Tuttle'* is a huge comet heading on a collision course with earth on 17 August 2116. It was first sighted in 1862 and rediscoverd in 1992. It could kill most forms of life with an explosion more powerful than the explosion of a million nuclear bombs put together.

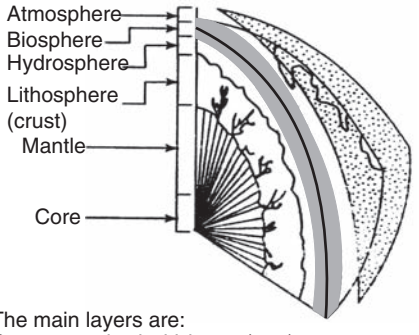
BASIC KNOWLEDGE ABOUT THE EARTH

- The earth is in the third position from the sun and is the fifth largest planet in the solar system.
- Earth's maximum relief the difference between the highest and lowest points is 19,883 meters or 65,233 feet. This distance is miniscule compared to the 12,753 kilometer (7909 mile) diameter of earth.
- Likewise, although earth's atmosphere extends 10,000 kilometers (6000 miles), more than 50% of its mass is compressed within 26 kilometers (16 miles) of Earth's surface.

Shape of the Earth

- Though, for most purposes of study, Earth may be considered a sphere, although it is actually an oblate spheroid and not a true sphere.
- The earth is an oblate spheroid, ball flattened at the poles, i.e., almost spherical, flattened a little at the poles and with a slight bulge at the centre (equator).
- Because we are studying the physical aspects of Earth's geography, it is important to keep in mind that its shape is affected by
  —the pliability of Earth's lithosphere, which allows it to develop a bulge in the midriff and
  —topographical irregularities in Earth's surface.

- The spinning (rotation) of the earth at a high speed has caused its mass to bulge at the equator and sinking at the poles.
- *Structure of the Earth:* The earth is made up of a number of concentric layers of material as in the bulb of an onion.



The main layers are:
Crust: 8–40 km in thickness (avg.);
Mantle: 2,895 km in thickness (avg.)
Outer core: 2,100 km of molten material (avg.);
Inner core: 1,255 km of solid mass (avg.).

- *Composition of the Earth:* The earth is made up of more than 100 different elements. The important ones are

Oxygen	46.6%
Silicon	27.72%
Aluminium	8.13%
Iron	5.01%
Calcium	3.63%
Sodium	2.85%
Potassium	2.62%
Magnesium	2.09%

- The earth has four distinct spheres:
  1. *Lithosphere:* Top crust which includes land surface and ocean floor.
  2. *Hydrosphere:* Water surface which includes oceans, seas, rivers and lakes.
  3. *Atmosphere:* The cover of air that envelops the earth's surface.
  4. *Biosphere:* The region where life exists.

Important Data About the Earth

Mass: 5.879×10^{21} tons
Equatorial Radius: 6377 km
Equatorial Diameter: 12,756.27 km
Polar Diameter: 12,713.50 km
Mean Diameter: 12,734 km
Equatorial Circumference: 40,075 km
Polar Diameter: 40,007 km
Total Surface Area: 50,97,00,000 km^2

Total Land Area (29.08%): 14,84,00,000 km^2
Total Water Area (70.92%): 36,13,00,000 km^2
Mean Distance from the Sun: 14,94,07,000 km
Time for Rotation on its own Axis: 23 hr, 56 min and 4.09 s
Period for Revolution Around the Sun: 365 days, 6 hr, 9 min and 9.54 sec
Total Coastlines: 3,56,000 km
Total Mass of Earth: 5880×10^{21} tonnes
Total Volume of Earth: 10,83,20,88,40,000 km^3
Mean Depth of Hydrosphere: 3554 m
Approximate Age of Earth: 46,000 million years
Lowest Point (on Earth's surface): Shores of Dead Sea (Israel Jordan) 396 m below sea level
Highest Point: Mt. Everest
Deepest Part in the Ocean: 'Mariana Trench' east of Phillipines 10,900 m below sea level

Longitude and Latitude: Parallel, Meridian, Equator and Prime Meridian

- Latitudes range from 0° to 90° north and south, while longitudes range from 0° to 180° east and west.
- While both are imaginary lines, parallels actually run parallel to each other so that the distance between two will not change.
- In contrast, meridians are only parallel where they cross at the equator; otherwise, their distances shift, with them closing in on each other the further north or south they go; they converge at the poles. They are aligned in a true north–south direction, whereas parallels run east–west.
- The prime meridian is an imaginary north–south plane passing through Greenwich, England and through Earth's axis of rotation. The angle between this plane and a plane passed through any other point and the axis of Earth is a measure of longitude.
- The equator is the parallel of 0° latitude and serves as the baseline from which all other parallels are measured (north and south latitudes).
- Earth rotates continually on an axis that penetrated Earth's surface at the North Pole and the South Pole.
- The shape of the earth is that of an oblate spheroid or solid of revolution whose meridian sections are ellipses while the sections at right angles are circles.
- The equatorial circumference is divided into 360° of longitude, which is measured in degrees, minutes and seconds east or west of the Greenwich meridian (0°) to 180°, the meridian 180° E.
- Distance from north to south of the equator is measured in degrees, minutes and seconds of latitude.
- The equator is 0°, the North Pole is 90°N and the South Pole is 90°S.
- The tropis lie at 23°27'S (tropic of capricorn).
- The Arctic Circle lies at 66°33'N and the Antarctic Circle at 66°33'S.
- The tropics and the Arctic and Antarctic circles are affected by the slow decrease in obliquity of the ecliptic, of about 0.47 arcseconds per year.
- The effect of this is that the Arctic and Antarctic circles are currently moving towards their respective poles by about 14 m p/a, while the tropics move towards the equator by the same amount.

- The radial velocity on the Earth's surface at the Equator is about 1670 km/h.
- The Earth's mean velocity in its orbit around the Sun is 1,07,229 km/h.
- The Equator divides the Pacific Ocean into the North and South Atlantic.
- The dateline was internationally ratified on 13 October 1884.
- The position of dateline has been modified on occasions, most recently on 1 January 1995 when it was moved to the east of Kiribari.
- *Earth's Movements:* The earth has two types of movements:
- *Rotation:* The earth spins on its own imaginary axis from west to east once in 24 hours. It is also called *Diurnal or Daily motion* which causes the formation of day and night.

Table 6.2 The Formation of Day and Night

Longest Days and Nights	*Northern Hemisphere*	*Southern Hemisphere*
Longest day (shortest night)	21 June	22 December
Shortest day (longest night)	21 December	21 June

- Days and nights are equal at the equator throughout the year because the circle of illumination always divides the equator into two equal parts.
- *Revolution:* While rotating on its axis, the earth also revolves around the sun along an almost circular path (elliptical) called its orbit.
- It is also called annual motion or yearly motion because it takes one solar year to complete the journey i.e., 365 1/4 days or 365 days, 6 hours 9 minutes and 9.54 seconds.
- The earth's revolution causes a change in season.
- *Inclination of Earth's Axis:* Earth's axis is not perpendicular to the plane of the ecliptic (the imaginary plane that passes through the Sun and through every point of Earth's orbit around the Sun) but rather is inclined at an angle of 23.5°. This inclination, in combination with the polarity of Earth's axis, allows for seasons to occur.
- *Polarity of Earth's Axis*, also called parallelism, occurs because Earth's axis points toward Polaris, the North Star, no matter where Earth is in its orbit.
- The plane of the ecliptic does not coincide with the equatorial plane because Earth's rotation axis is not parallel to the plane of the ecliptic. Instead, Earth's axis is tilted about 23.5° away from the perpendicular. This allows for the annual march of the seasons.
- The combination of rotation, revolution, inclination and polarity result in the seasonal patterns experienced on Earth

How Seasons Change?

- The earth's axis is inclined at an angle of 66.5° to the plane of its orbit.
- As a result of this, the earth is in different positions while revolving around the sun.
- During the first half of the year the northern hemisphere tilts towards the sun resulting in the season of summer in the region.
- During the second half of the year the southern hemisphere tilts towards the sun and thus experiences summer and the northern hemisphere experiences winter during this period.
- The revolution causes the four seasons:
  Spring: When the sun is directly overhead the equator.
  Summer: When the sun is directly overhead the Tropic of Cancer—the north temperate zone experiences summer.

Autumn: When the sun returns to the equator and the north temperate zone experiences the season of autumn.

Winter: The sun is at the Tropic of Capricorn and the north temperate zone experiences winter.

Equinoxes: are dates when the nights and days are equal. During these days the sun shines directly over the equator. 21 March is called *vernal equinox* and 23 September is called *autumnal equinox*.

Solstice: The time of the year when the difference between the length of days and nights is the largest it is referred to as solstice.

- On, or around 21 June, the North Pole tilts towards the sun and the sun shines directly over the Tropic of Cancer which is called *summer solstice*. On or around 22 December, the earth is at the opposite end of its orbit, as a result, the South Pole tilts towards the sun and the North Pole away from it. This is called *winter solstice*.
- *Eclipses:* When the light of the sun or the moon is obscured by another body the sun or moon is said to be in eclipse.
- *Lunar Eclipse:* When the earth comes between the moon and the sun, the shadow cast by the earth on the moon results in a *lunar eclipse*. Lunar eclipse occurs only on a full moon day but not on every full moon day.
- *Solar Eclipse:* When the moon comes between the sun and the earth, it causes obstruction of the sun's light when viewed from the earth and is called *solar eclipse*. A solar eclipse occurs on a new moon day when the moon is in line with the sun. However, solar eclipse does not occur on every new moon day.

Global Positioning Systems (GPSs)

- Determining the location of a place on Earth's surface has become much easier with the development of *global positioning systems (GPSs)*.
- The GPSs are a navigational tool originally developed by the US government for military use but now available for civilian purposes worldwide.
- The system consists of a fleet of satellites that orbit Earth, broadcasting digital codes.
- A portable receiver 'listens' to these signals.
- By measuring very small differences in arrival times of the signals, it determines its own location.
- GPS is revolutionizing many business operations, especially those related to transportation and mapping.
- Many new automobiles now offer GPS-based mapping systems that continually track the vehicle's location and display a moving digital map on the console.
- Hikers carry GPSs to avoid getting lost and surveyors determine their locations by GPS instead of using optical devices that are useful only for distances of 1-2 kilometers at best, assuming a clear line of sight.
- *Difference Between GPS and GIS (Geographic Information System):* While both are high-tech systems that provide excellent tools for the geographer, GPS and GIS are very different.
- Global Positioning Systems (GPS) is used to accurately determine one's position on earth, using a satellite-based system.

- Geographic Information Systems (GIS) is used to capture, store, retrieve and analyze spatial data, using both computer hardware and software.
- GIS and GPS can be used together in a myriad of ways to assist in the study of physical geography. For example, both are used for ocean floor mapping and environmental monitoring.

Isoline, Isotherms, Isobars and Elevation of Contour Lines

- *Isoline:* An isoline is a commonly used cartographic device for portraying the spatial distribution of some phenomenon.
- Some of the basic characteristics of isolines are that they are always closed lines and they have no ends.
- These lines represent gradations in quantities, so they only touch or cross one another in very rare and unusual circumstances.
- Isolines are placed at a regular interval which is defined as the numerical difference between one isoline and the next.
- The size of interval is up to the cartographer's discretion but it is best to maintain a constant interval on a map.
- Isolines' proximity depends on the gradient (i.e., the change in the interval). The closer they lay together, the steeper the gradient; the further apart they are, the more gentle the gradient.
- Isolines are a very useful mapping tool in that they help to reveal spatial relationships that otherwise might go undetected.
- Specifically, they can significantly clarify patterns that are too large, too abstract, or too detailed for ordinary comprehension.
- Isotherms, Isobars and Elevation contour lines are lines that show some 'surface' characteristic.
- *Elevation Contour Lines* join points of equal elevation, isotherms join points of equal temperature and isobars join points of equal atmospheric pressure.

Time

- *Local Time:* Parallels of longitude determine the time at a place. Local time varies, from GMT (London) at the rate of four min/degree of longitude.
- *Standard Time:* It is the uniform time fixed by each country. As the local time is found to vary constantly from one plain to another, there is an arrangement by which all places in a certain region agree to use the same time.
- *Greenwich Mean Time (GMT):* It is the UK Standard time. It is based on the local line of the meridian passing through Greenwich near London.
- *International Date Line:* The 180° east meridian and 180° west meridian are one and the same line, running over the Pacific Ocean, deviating at Fiji, Samoa and Gilbert Islands.
  - —The International date line roughly corresponds to 180° east west meridian of longitude which falls on the opposite side of the Greenwich meridian.
  - —When one crosses the date line from east to west the date is to be advanced by one day.
  - —Similarly, when one crosses the date line from west to east, the date is to be set back by one day.

ATMOSPHERE

- The atmosphere is a gaseous envelop that surrounds the earth.
- The composition of atmosphere changes as we go higher from the earth's surface.
- Up to about a height of 50 km from the earth, the atmosphere is composed of
  —Nitrogen (78.09%)
  —Oxygen (20.95%)
  —Argon (0.93%)
  —Minor gases (carbon dioxide, hydrogen, neon, helium, methane, xenon, krypton, etc., 0.03%)
- *Atmospheric Layers:* The atmosphere of earth is arranged into four layers, namely,
  —*Troposphere:* The layer nearest to earth's surface up to a height of about 15 km.
  —*Stratosphere:* The region of uniform temperature extending from an altitude of about 15 km above the earth to about 50 km.
  —*Mesosphere:* The very cold region which extends from 50 km to 90 km above the earth's surface.
  —*Ionosphere:* Lies immediately above the mesosphere and extends from 80 to 400 km above the earth's surface.
  —The middle layer of this region is called the *thermosphere* where the temperature is above 100°C.
  —The outer limit of the atmosphere is called *exosphere* where the gravity of the earth is exceedingly weak.
- *How Deep is Atmosphere:* The atmosphere has no definite top, with no true boundary between it and outer space.
  —Although most of its mass is concentrated at very low altitudes more than 50% below 6.2 km and more than 98% within 26 km, traces of atmosphere extend for thousands of kilometers above Earth.
  —Moreover, air expands to fill empty spaces, so it penetrates into caves and crevices in rocks and soil, thus extending down into Earth.
- *How Atmospheric Pressure Changes with Increasing Altitude:* Normally, air pressure is highest at sea level where there is more air above it to cause compression and it diminishes rapidly with increasing altitude with air in upper layers being subjected to less compression.
  —By 5.6 km above sea level, air pressure is at 50% the level it was at sea level.
  —By 16 km above, it is only 10% and by 32.3 km above, only 1%.
- *Ozone:* is a molecule of three oxygen atoms. Mostly concentrated in a layer about 15 to 48 km (9 to 30 miles) above Earth's surface, it shields life on Earth from the deadly impact of ultraviolet solar radiation by absorbing, or filtering, those solar rays.
- *Hole in the Ozone Layer:* The hole in the ozone layer is really a thinning of the amount of ozone in this layer of Earth's atmosphere.
  —There are both naturally occurring phenomena and human-produced factors that have been thinning the ozone layer and therefore reducing its capacity for shielding life from biologically destructive solar rays.
  —The natural factors include an oscillation of the stratospheric winds that occurs about once every 2.3 years, the 11 year sunspot cycle, lingering debris from volcanic eruptions and El Niño ocean current effect every 3 to 5 years.

—In addition, human made chemicals called chlorofluorocarbons (CFCs) are affecting the ozone layer, because when CFCs break down in the atmosphere, their chlorine molecules cause a chemical reaction so that the ozone molecules break down to being oxygen molecules.

Whether and Climate

- The other zones of the atmosphere do not play much of a role in what we know as 'weather'. Instead, storms and essentially all other weather phenomena occur in the troposphere.
- *Difference Between Weather and Climate:* Weather and climate are related, not synonymous, terms.
  - —Both are generated in the atmosphere, but weather refers to the short-term dynamics involved in momentary states of the atmosphere, whereas climate consists of the long-term atmospheric conditions.
  - —In addition to differing in their time frame, they differ in spatial context: weather can vary greatly within a small region, whereas climate refers to larger expanses.
  - —Finally, one needs weather information over an extended period in order to describe climate.
- The four main elements of weather and climate are temperature, pressure, wind and moisture.
- Certain semipermanent attributes, or controls are latitude, distribution of land and water, general circulation of the atmosphere general circulation of the oceans, elevation, topographic barriers and storms.
- These either cause or influence the four main elements, often with much overlap and interaction. e.g., distribution of land and water, general circulation of atmosphere, elevation and topographic barriers will all affect moisture in a region.
- *The Coriolis Effect:* It is the apparent deflection of moving objects on or over Earth's surface. These objects are deflected to the right of their paths in the Northern Hemisphere and to the left of their paths in the Southern Hemisphere. This force can significantly influence long-range movements.
- The four basic points to remember regarding the Coriolis effect are as follows:
  1. Free-moving object appears to deflect to right in Northern Hemisphere and to left in Southern Hemisphere
  2. The apparent deflection is strongest at poles, decreasing progressively toward equator, where there is zero deflection
  3. Fast-moving objects seem to be deflected more than slower ones because Coriolis effect is proportional to speed of object
  4. Coriolis effect influences direction only not speed.
- *Effects of the Coriolis Effect:* It influences winds and ocean currents in particular serving as an important component of general circulation of oceans.
  - —Contrary to the belief of many, the Coriolis effect does not affect the circulation pattern of water draining out of a washbowl. The time involved is too short and water speed so slow. Rather, the draining direction is determined by the characteristics of the plumbing system, the shape of the washbowl and pure chance.

WINDS

- Whenever there is a horizontal difference in air pressure, air from high pressure areas flows to the low pressure areas.
- This horizontal movement of air causes formation of winds.
- The force which results due to horizontal pressure differences and drives the winds is called pressure gradient force.

Types of Winds

- *Local Winds:* Local winds are generated due to local differences in the temperature and air pressure. Mostly local winds develop by depressions. If the air is drawn in from the tropical region in front of the depression—hot winds are produced and if air is drawn in from polar regions in the rear of the depression—cold winds are produced. Some of the local winds are:
  —*Hot Winds:* Santa Ana (Mexico), Brickfielder (Australia), Sirocco, Leneche (Sahara), Harmattan (W. Africa), Khamsin (Egypt), Simoon (Sahara), Zonda (Paraguay)
  —*Cold Winds:* Bora (Yugoslavia), Southerly Buster (Australia), Buran (Europe), Panyero (Argentina), Mistral (France).
- *Trade Winds:* These winds blow from the sub-tropical high pressure areas about 30° North and South towards the equatorial low pressure belt.
  —They blow constantly and steadily in the same direction, on the North-eastern trades in the Northern hemisphere and the South-eastern trades in the Southern hemisphere.
  —Due to rotation of earth, these winds do not cross the isobars at right angles, but are deflected to the right in the Northern hemisphere and to the left in the Southern hemisphere. When these winds meet at equator and clash, they cause heavy rainfalls at the line of convergence.
- *The Westerlies:* These winds blow from the subtropical high pressure belts towards the sub-polar low-pressure belts.
  —In the Northern hemisphere, they blow from South-West to North-East and in the Southern hemisphere they blow from North-West to South-East.
- *Land and Sea Breeze:* These winds or breezes are formed across the coastal strip, due to pressure gradient at the sea and land.
  —During day time, the land becomes more heated up as compared to sea, thus developing higher pressure at sea. The air from sea starts flowing towards land which has less pressure, which is called the *sea breeze*.
  —During nights, due to heat radiation land becomes cooler than sea and develops higher pressure than sea. The air which blows from land to sea during night is called *land breeze.*
- *Periodic Winds:* Some winds change their directions due to change in seasons, these winds are called periodic winds.
  —Monsoons are also a type of periodic wind. Monsoon In summer, due to changing pattern of solar heating of earth, the subtropical high pressure belt and the thermal equator are displaced northwards. In response to this, the equatorial westerlies also move northwards.

—The route they take is from the oceans to the lands as they blow over the Asian continent bringing the South-West Summer Monsoons.
—In winters, the subtropical high pressure belts and thermal equator are displaced to south direction, thus, re-establishing the normal trade winds causing the winter monsoon. Actually, the monsoons are seasonal modifications of the general planetary wind system.
—They blow over the regions of India, Pakistan, Sri Lanka, Bangladesh, Myanmar, China, Northern Australia.

- *Planetary Winds:* The latitudinal differences in air pressure cause these winds to blow throughout the year from one latitude to the other.
- *Mountain and Valley Breeze:* During day time, the air pressure in the valley is more than on the mountain slopes as the mountain slopes get heated up more compared to the valley floor.
  —This causes formation of breeze from valley to the slopes in upward direction called *valley breeze.*
  —During nights, the pattern is reversed and the air starts breezing from the mountain slopes, lower down to the valley floor causing mountain breeze.
- *Jet Streams:* These are the narrow meandering bands of swift winds which blow from West to East in the upper troposphere near the tropopause. They get embedded into the westerlies on this course and encircle the whole globe.
  —There are two types of jet streams: (i) Sub-tropical jet streams and (ii) Polar front jet streams.
  —The average speed of jet stream is 350 km per hour in summers and as high as 450 km per hour during winters.
- *Tropical Winds:* The air masses which are created at the tropical regions, extending over hundreds of kilometers and made up of several layers are called tropical winds.
  —These are further subdivided into two types: (i) Maritime tropical and (ii) Continental tropical
- *Polar Winds:* The air masses, much of the type of tropical winds which are generated at the polar regions are called polar winds.
  —They are again subdivided in two types: (i) Maritime polar and (ii) Continental polar
- *Warm and Cold Fronts:* When the warmer and lighter air masses move along the colder and more dense air mass, the warm air mass rides above the colder one.
  —The boundary zones of convergence separating the two air masses are called warm fronts.
  —If the cold air mass forces its way under the mass of warmer air and tends to push the warm air mass upward, then this form is called a cold front.

LITHOSPHERE

- The lithosphere is the topmost crust of the earth.
- The continents and oceans rest on it.

Rocks

- The earth's crust is formed of mineral material called rocks. The rocks can be grouped into three broad categories:
  1. *Igneous Rocks:* Formed by the solidification of molten magma from the interior of the earth. About 90% of the earth's crust is made of this type of rock.
     Examples: Granite, basalt and volcanic rocks.
  2. *Sedimentary Rocks:* Formed from the sediment deposits on the ocean beds. It comprises only about 5% of the earth's crust. These rocks are also known as stratified rocks because they are formed in horizontal layers or strata.
     Examples: (a) Gypsum, chalk and limestone, which are formed by the deposits created by chemical action or chemical sedimentation; (b) Peat, lignite, bituminous coal and anthracite, which are formed by deposits of organic matter or marine remains and (c) Gravel, pebbles and shingle, sandstone and shale, which are formed by the deposits of sediments in water.
  3. *Metamorphic Rocks:* These rocks were originally either igneous or sedimentary. They metamorphose or change due to pressure, temperature or the action of water and chemicals.
     Examples: Slate, quartzite, gneiss and marble.

The Continents

- The earth's surface is made up of immense land masses, divided into seven continents covering about one quarter of the total surface area.
  —*Largest Continent:* Asia (4,40,30,000 km^2)
  —*Smallest Continent:* Australia (76,87,120 km^2)
  —*Island Continents:* Antarctica and Australia
  —*Ice-covered Continent:* Antarctica

Table 6.3 Continents of the World

Name	*Area (km^2)*	*Approx. percentage of the World's Land*	*Approx. percentage of the World's Population*
Asia	4,40,30,000	29.5	58.6
Africa	2,97,85,000	20.0	12.5
North America	2,42,55,000	16.3	8.2
South America	1,77,98,000	11.8	5.6
Antarctica	1,33,38,500	9.6	—
Europe	1,04,98,000	6.2	9.1
Australia	76,87,120	5.2	3.2

Note: Australia with New Zealand, Tasmania, New Guinea and the Pacific Islands is also called 'Australasia'.

Mountains

- Mountains are elevated land masses with peak areas (summit) smaller than the base and of a height above 300 m or 1000 ft.
- Similar elevations below 300 m or 1000 ft are called hills.

Table 6.4 Important Mountain Ranges

Name	*Continent*
Himalaya-Karakoram	Asia
Andes	South America
Alps	Europe
Rockies	North America

Table 6.5 Principal Mountain Peaks

Name	*Continent*	*Country*	*Height (m)*	*Date of First Ascent*
Mt Everest	Asia	Nepal–Tibet	8848	29 May 1953
K-2 (Godwin Austen)	Asia	India	8611	31 July 1954
Kanchenjunga	Asia	Nepal–India	8598	25 May 1955
Lhotse	Asia	Nepal–China	8501	18 May 1956
Makalu	Asia	Tibet–Nepal	8481	15 May 1955
Dhaulagiri	Asia	Nepal	8172	13 May 1953
Nanga Parvat	Asia	India	8126	3 July 1953
Nanda Devi	Asia	India	7817	29 Aug 1960
Illampu	South America	Bolivia	7014	
McKingley	North America	Alaska	6194	
Mont Blanc	Europe	France	4810	

Table 6.6 Important Volcanic Mountains

Name	*Height (m)*	*Country*	*Location*
Ojos del Salado	7084	Argentina	Andes
Guallatiri	6060	Chile	Andes
Cotopaxi	5897	Ecuador	Andes
Lascar	5641	Chile	Andes
Tupungatito	5640	Chile	Andes
Popocatepeti	5451	Mexico	Altiplano de Mexico
Nevado del Ruiz	5400	Colombia	Andes
Sangay	5230	Ecuador	Andes

Table 6.7 Important Islands

Name	*Location*	*Area (km^2)*
Kalaalit Nunaat (Greenland)	North Atlantic Ocean	21,75,597 km^2
New Guinea	Southwest Pacific Ocean	8,20,033 km^2
Borneo	West-central Pacific Ocean	7,43,197 km^2
Malagasy (Madagascar)	Indian Ocean	5,87,042 km^2
Baffin	North Atlantic Ocean	4,76,068 km^2
Sumatra	Northest Indian Ocean (Indonesia)	4,73,605 km^2
New Zealand	South Pacific Ocean	2,70,000 km^2
Honshu	Western Pacific Ocean	2,30,316 km^2

Table 6.8 Largest Islands

Australia*	76,17,930 km^2
Greenland	21,75,600 km^2
New Guinea	7,92,500 km^2
Borneo	7,25,500 km^2
Madagascar	5,87,000 km^2
Baffin (Canada)	5,07,500 km^2
Sumatra (Indonesia)	4,27,300 km^2
Hanshu (Japan)	2,27,400 km^2
Great Britain (UK)	2,18,100 km^2
Victoria (Canada)	2,17,300 km^2
Ellesmere (Canada)	1,96,200 km^2
Celebes (Indonesia)	1,78,650 km^2
New Zealand South	1,51,000 km^2
Java (Indonesia)	1,26,700 km^2
New Zealand North	1,14,000 km^2
New Foundland (Canada)	1,08,900 km^2

*Australia (76,17,930 km^2) is more than 3 times the size of Greenland, the largest island. Australia is sometimes called 'The Island Continent' and sometimes accorded the role of 'Earth's largest island but smallest continent.'

Table 6.9 Largest Deserts

Sahara	91,00,000 km^2
Gobi	13,00,000 km^2
Patagonian	6,70,000 km^2
Rub'al Khali	6,50,000 km^2
Great Sandy	3,90,500 km^2
Great Victoria	3,90,500 km^2
Chihuanhuan	3,60,000 km^2
Takla Makan	3,60,000 km^2
Sonaran	3,10,000 km^2
Kwahari	2,60,000 km^2
Kyzyl Kum	2,60,000 km^2
Thar	2,60,000 km^2
Simpson	1,00,000 km^2
Mahave	52,000 km^2

HYDROSPHERE

- The hydrosphere is the mantle of water covering a greater part of the earth's surface.
- The oceans and seas comprise the hydrosphere.
- It is estimated that about 36,17,40,000 km^2 or 70.8% of the earth's surface is covered by water.
- *Largest Ocean:* The Pacific ocean comprises the largest part of the hydrosphere and occupies an area of about 16,62,40,000 km^2 or 35.25% of the earth's surface.

Table 6.10 Oceans

Name	*Area (km²)*	*Sea Area (%)*	*Depth*	
			Avg (m)	*Greatest (m)*
Pacific	16,62,40,000	45.7	4280	11,033
Atlantic	8,23,60,000	22.8	3926	9219
Indian	7,35,50,000	20.3	3963	8047
Arctic	1,39,80,000	3.9	1205	5441

Table 6.11 Important Seas

Name	*Area (km²)*	*Average Depth (m)*
South China Sea	29,74,600	5514
Malay	81,43,100	1200
Caribbean	25,15,900	7492
Mediterranean	25,10,000	4846
Bering	22,61,100	5121
Gulf of Mexico	15,07,600	4377
Sea of Okhotsk	13,92,100	3475
East China Sea	6,64,600	2999
Hudson Bay	7,30,100	259
Sea of Japan	10,12,900	3743
Andaman Sea	5,64,900	865
North Sea	5,75,300	661
Black Sea	5,07,900	2243
Red Sea	4,53,000	2246
Baltic	4,22,300	439
Gulf of St Lawrence	2,37,760	120
Gulf of California	1,62,000	810

Table 6.12 Important Natural Lakes

Name	*Location*	*Area (km²)*	*Length (km)*
Caspian (Also called the Caspian Sea)	Turkmenistan, Kazakhstan, Azerbaijan and Iran	3,71,000	1119
Superior	USA–Canada	82,100	616
Victoria	Uganda, Tanzania and Kenya	69,485	322
Aral	Kazakhstan and Uzbekistan	66,457	428
Huron	USA–Canada	59,596	397
Tanganyika	Tanzania–Zaire (Congo)	32,893	676
Baikal	Russia	31,500	636
Great Bear	Canada	31,300	373

Important Shipping Canals

- *Kiel Canal:* Between London and Baltic ports
- *Suez Canal:* Connects the Mediterranean Sea and the Red Sea
- *Panama Canal:* Links the Atlantic and the Pacific Ocean

Table 6.13 Important Shipping Canals

Name	*Location*	*Length (km)*
Beloye–More	Baltic Sea	227
Gotta	Sweden	185
Suez	Egypt	169
Volga–Moscow	Russia	129
Kiel	Germany	98
Volga–Don	Russia	97
Elbe–Trave	Germany	66
Panama	Central America	58
Manchester	England	57
Welland	Canada	44

Table 6.14 Principal Waterfalls

Name	*Location*	*Height (m)*
Angel	Venezuela	979
Yosemite	California	739
Southern Mardals Fossen	Norway	655
Tugela	South Africa	614
Cuqenam	Venezuela	610
Sutherland	New Zealand	580
Ribbon	California	491
Great Kamarang	Guyana	488
Northern Mardals Fossen	Norway	468

Major Rivers of the World

- *Largest River:* The Amazon in South America flowing into the South Atlantic ocean.
- Though, the Amazon river is 222 km shorter in length than the Nile, it is still considered the largest river because of greater flow of water and the highest river basin in the world.
- Longest River, the Nile in Africa, flowing into the Mediterranean sea.

Table 6.15 Important Rivers

River	*Location/Country*	*Length (km)*	*Source*	*Outflow Into*
Nile	Africa/Egypt	6670	Lake Victoria	Mediterranean
Missouri-Mississippi	NorthAmerica/US	6300	Red Rock Montana	Gulf of Mexico
Amazon	South America/Brazil	6448	Andes in Peru	Atlantic Ocean

(*Continued*)

River	*Location/Country*	*Length (km)*	*Source*	*Outflow Into*
Yangtze-Kiang	Asia/China	5490	Tibetan Plateau	China Sea (Pacific)
Hwang-Ho	Asia/China	4840	Tibet	Pacific Ocean
Yenisei	Asia/Siberia	5300	Mt Tannuola	Arctic Ocean
Lena	Europe/Russia	4800	Lake Baikal	Laptev Sea of Arctic Ocean
Niger	Africa/Nigeria	4800	Sierra Leone	Gulf of Guinea (Atlantic)
Congo	Africa/Zaire	4800	Confluence of Lualuba and Luapula	Atlantic
Ob	Asia/Siberia	4150	Altai Mts	Gulf of Ob (Pacific)
Indus	Asia/India and Pakistan	3180	Mt Kailash	Arabian sea
Brahmaputra	Asia/India	2960	Tibet	Bay of Bengal
Danube	Europe/Austria, Hungary, Czech, Slovakia and Yugoslavia	2820	Near Baden	Black Sea
Murray	Australia	3720	Alps	Indian Ocean
Volga	Asia/Russia	3700	Valdia Plateau (Moscow)	Caspian Sea
Amur	Asia/Siberia	4510	Pamirs	Pacific Ocean at the Sea of Okhotsk

THE WORLD WE LIVE IN

Countries

- The world comprises 193 (as on July 2011, the new country added is South Sudan) sovereign countries and 13 non-sovereign, separately administered territories, making a total of 206 countries.
- However, as per the membership within the United Nations system, these 206 States are categorized as:
  —193 member states of the United Nations.
  —2 states which are not UN member states but which are either a UN observer state or a member state of a UN specialized agency. These are:
    1. Vatican City
    2. Kosovo (claimed by Serbia)

  —9 other states. These are:
    1. Abkhazia (claimed by Georgia)
    2. Nagorno-Karabakh (claimed by Azerbaijan)
    3. Northern Cyprus (claimed by Cyprus)
    4. Palestine (claimed by Israel)
    5. Sahrawi Arab Democratic Republic (claimed by Morocco)

6. Somaliland (claimed by Somalia)
7. South Ossetia (claimed by Georgia)
8. Taiwan (claimed by China)
9. Transnistria (claimed by Maldova).

- Till the end of 1989, there were only 170 sovereign countries; then Namibia joined as the 171st country when it achieved independence in March 1990.
- However, the unification of North and South Yemen in May 1990 and East and West Germany in October 1990, brought the total number of sovereign countries to 169 at the end of 1990.
  —With the disintegration of former USSR towards the end of 1991 (which comprised 15 union Republics) the number of the countries in the world stood at 183.

Table 6.16 Countries, Their Capitals and Currencies

Country	*Capital*	*Currency*
Afghanistan	Kabul	Afghani
Albania	Tirana	Lek
Algeria	Algiers	Dinar
Andorra	Andorra la Vella	Euro
Angola	Luanda	New Kwanza
Antigua and Barbuda	Saint John's (Antigua)	East Caribbean Dollar
Argentina	Buenos Aires	Peso
Armenia	Yerevan	Dram
Australia	Canberra	Australlian Dollar
Austria	Vienna	Euro
Azerbaijan, Republic of	Baku (Baki)	Manat
Bahamas, The	Nassau	Bahamian Dollar
Bahrain	Al-Manama	Bahrain Dinar
Bangladesh	Dhaka	Taka
Barbados	Bridgetown	Barbados Dollar
Belarus	Minsk	Belorussian Rubel
Belgium	Brussels	Euro (formerly Belgian Franc)
Belize	Belmopan	Belize Dollar
Benin	Porto Novo (official capital); Contonu (Seat of govt)	CFA Franc
Bhutan	Thimphu	Ngultrum
Bolivia	La Paz (seat of govt); Sucre (legal capital and seat of judiciary)	Boliviano
Bosnia and Herzegovina	Sarajevo	Marka
Botswana	Gaborone	Pula
Brazil	Brasilia	Real
Brunei	Bandar Seri Begawan	Brunei Dollar
Bulgaria	Sofia	Lev

(*Continued*)

Country	*Capital*	*Currency*
Burkina Faso	Ouagadougou	CFA Franc
Burundi	Bujumbura	Brundi Franc
Cambodia	Phnom Penh	Riel
Cameroon	Yaounde	CFA Franc
Canada	Ottawa	Canadian Dollar
Cape Verde	Praia	Cape Verdean Escudo
Central African Republic	Bangui	CFA Franc
Chad	N'Djamena	CFA Franc
Chile	Santiago	Chilean Peso
China	Beijing	Yuan/Renminbi
Colombia	Santa Fe de Bagota	Colombian Peso
Comoros	Moroni	Franc
Congo, Dem. Republic of the	Kinshasa Brazzaville San	Congolese Franc CFA Franc
Congo, Republic of Costa Rica	Jose	Colon
Cote d'Ivoire	Yamoussoukro	CFA Franc
Croatia	Zagreb	Kuna
Cuba	Havana	Cuban Peso
Cyprus	Lefkosia (Nicosia)	Cyprus pound
Czech Republic	Prague	Koruna
Denmark	Copenhagen	Krone
Djibouti	Djibouti	Djibouti Franc
Dominica	Roseau	East Caribbean Dollar
Dominican Republic	Santo Domingo	Dominican Peso
East Timor	Dili	US Dollar
Ecuador	Quito	US Dollar
Egypt	Cairo	Egyptian Pound
EI Salvador	San Salvador	Colon, US Dollar
Equatorial Guinea	Malabo	CFA Franc
Eritrea	Asmara (Formerly Asmera)	Nakfa
Estonia	Tallinn	Kroon
Ethiopia	Addis Ababa	Birr
Fiji	Suva (Viti Levu)	Fiji Dollar
Finland	Helsinki	Euro (Formerly Marka)
France	Paris	Euro (Formely French Franc)
Gabon	Liberville	CFA Franc
Gambia, The	Banjul	Dalasi
Georgia	T'bilisi	Lari
Germany	Berlin	Euro (Formerly Deutsche Mark)
Ghana	Kumasi	Cedi
Greece	Athens	Euro (Foremerly Drachma)
Grenada	Saint George's	East Caribbean Dollar
Guatemala	Guatemala City	Quetzal
Guinea	Conakry	Gunean Franc

(*Continued*)

Country	*Capital*	*Currency*
Guinea-Bissau	Bissau	CFA Franc
Guyana	Georgetown	Guyanese Dollar
Haiti	Port-au-Prince	Gourde
Honduras	Tegucigalpa	Lempira
Hungary	Budapest	Forint
Iceland	Reykjavik	Icelandic Krona
India	New Delhi	Rupee
Indonesia	Jakarta	Rupiah
Iran	Tehran	Rial
Iraq	Baghdad	Dinar/US Dollar
Ireland	Dublin	Euro [Formerly Irish pound (punt)]
Israel	Jerusalem[1]	Shekel
Italy	Rome	Euro (Formerly Lira)
Jamaica	Kingston	Dinar
Japan	Tokyo	Yen
Jordan	Amman	Dinar
Kazakhstan	Astana[2]	Tenge
Kenya	Nairobi	Kenya Shilling
Kiribati	South Tarawa	Australian Dollar
Korea, North	Pyongyang	Won
Korea, South	Seoul	Won
Kuwait	Kuwait City	Kuwaiti Dinar
Kyrgyzstan	Bishkek	Som
Laos	Vientiane	New Kip
Latvia	Riga	Lat
Lebanon	Beirut	Lebanese Pound
Lesotho	Maseru	Loti
Liberia	Monrovia	Liberian Dollar
Libya	Tripoli	Libyan Dinar
Liechtenstein	Vaduz	Swiss Franc
Lithuania	Vilnius	Litas
Luxembourg	Luxembourg Ville	Euro (Formerly Luxembourg Franc)
Macedonia	Skopje[3]	Denar
Madagascar	Antananarivo	Ariary
Malawi	Lilongwe	Kwacha
Malaysia	Kuala Lumpur[4]	Ringgit
Maldives	Male	Rufiyaa
Mali	Bamako	CFA Franc
Malta	Valletta	Maltese Lira
Marshall Islands	Majuro	US Dollar
Mauritania	Nouakchott	Ouguiya

(*Continued*)

Country	*Capital*	*Currency*
Mexico	Mexico City (Distrito Federal)	Mexican Peso
Micronesia, Fed. States of	Palikir	US Dollar
Moldova	Chisinau	Leu
Monaco	Monaco Ville	Euro
Mongolia	Ulaanbaatar	Tughrik
Morocco	Rabat	Dirham
Montenegro	Padgorica	Euro
Mozambique	Maputo	Metical
Myanmar	Rangoon[5]	Kyat
Namibia	Windhoek	Namibian Dollar
Nauru	no official capital; govt offices in Yaren District	Australian Dollar
Nepal	Kathmandu	Napalese Rupee
Netherlands, The	Amsterdam; The Hague is the seat of govt	Euro
New Zealand	Wellington	New Zealand Dollar
Nicaragua	Managua	Gold Cordoba
Niger	Niamey	CFA Franc
Nigeria	Abuja	Naira
Norway	Oslo	Norwegian Krone
Oman	Muscat	Omani Rial
Pakistan	Islamabad	Pakistan Rupee
Palau	Koror	US Dollar
Panama	Panama City	Balboa, US Dollar
Papua New Guinea	Port Moresby	Kina
Paraguay	Asuncion	Guarani
Peru	Lima	Nuevo sol
Philippines, The	Manila	Peso
Poland	Warsaw	Zloty
Portugal	Lisbon	Euro (Formerly Escudo)
Puerto Rico	San Juan	US Dollar
Qatar	Doha	Qatari Riyal
Republic of South Sudan	Juba	Sudanese Pound
Romania	Bucharest	Leu
Russia	Moscow	Ruble
Rwanda	Kigali	Rwanda Franc
St. Kitts and Nevis	Basseterre	East Caribbean Dollar
St. Lucia	Castries	East Caribbean Dollar
St. Vincent and the Grenadines	Kingstown	East Caribbean Dollar
Samoa	Apia	Tala
San Marino	San Marino	Euro
tSao Tome and Principe	Sao Tome	Dobra
Saudi Arabia	Riyadh	Riyal

(*Continued*)

Country	*Capital*	*Currency*
Senegal	Dakar	CFA Franc
Serbia	Belgrade	Yugoslav new dinar
Seychelles	Victoria	Seychelles Rupee
Sierra Leone	Freetown	Leone
Singapore	Singapore	Singapore Dollar
Slovakia	Bratislava	Koruna
Slovenia	Ljubljana	Slovinian Tolar
Solomon Islands	Honiara	Soloman Islands Dollar
Somalia	Mogadishu	Somali Shilling
South Africa	Pretoria[6] (administrative)	Rand
Spain	Madrid	Euro (Formerly Peseta)
Sri Lanka	Colombo[7]	Sri Lanka Rupee
Sudan	Khartoum	Dinar
Suriname	Paramaribo	Surinamese Dollar
Swaziland	Mbabane[8]	Lilangeni
Sweden	Stockholm	Krona
Switzerland	Bern	Swiss Franc
Syria	Damascus	Syrian Pound
Taiwan	Taipei	Taiwan New Dollar
Tajikistan	Dushanbe	Somoni
Tanzania	Dar es Salaam[9]	Tanzanian Shilling
Thailand	Bangkok	Baht
Togo	Lome	CFA Franc
Tonga	Nuku'alofa	Pa'anga
Trinidad and Tobago	Port-of-Spain	Trinidad and Tabago Dollar
Tunisia	Tunis	Tunisian Dinar
Turkey	Ankara	Turkish New Lira (YTL)
Turkmenistan	Ashgabat	Manat
Tuvalu	Funafuti10	Australian Dollar
Uganda	Kampala	Ugandian new Shilling
Ukraine	Kiev (Kyyiv)	Hryvna
United Arab Emirates	Abu Dhabi	UAE Dirham
United Kingdom	London	Pound Sterling
United States	Washington, DC	US Dollar
Uruguay	Montevideo	Uruguay Peso
Uzbekistan	Tashkent(Toshkent)	Uzbekistani Som
Vanuatu	Port-Vila (Efate)	Vatu
Vatican City (Holy See)	Vatican City	Euro
Venezuela	Caracas	Bolivares
Vietnam	Hanoi	Dong
Yemen	Sanaa	Rial
Zambia	Lusaka	Kwacha
Zimbabwe	Harare	Zimbabwean Dollar

Note: 1. Israel proclaimed Jerusalem as its capital in 1950, but nearly all countries maintain their Embassies in Tel Aviv.; 2. The government moved from Almaty to Astana in December 1998.;

3. Macedonia is, the former Republic of Yugoslav; 4. Putrajaya is referred to as the administrative capital; 5. Regime refers to the capital as Yangon.; 6. Cape Town—legislative seat, Bloemfontein—judicial seat.; 7. Sri Jayewardenepura Kotte is the legistative capital; 8. Lobamba is the royal and legislative capital; 9. Legislative offices transferred to Dodoma, which is planned as the new national capital and 10. Administration offices are located in Vaiaku Village on Fongafale.

Important Lines and Boundaries

- *Durand Line:* It is the line demarcating the boundaries of India and Afghanistan. It was drawn up in 1893 by Sir Mortimer Durand. India recognizes the Durand Line but Afghanistan does not.
- *Hindenburg Line:* It is the boundary dividing Germany and Poland. The Germans marched to this line in 1917 during World War I.
- *Maginot Line:* A 320 km line of fortification built by France along its border with Germany before World War II, to protect against German Attack.
- *Mannerheim Line:* It is the line of fortification on the Russia—Finland border. Drawn up by General Mannerheim.
- *McMahon Line:* Drawn up by Sir Henry McMahon. It demarcates the frontier of India and China. China did not recognize this line and violated it in 1962.
- *Oder-Neisse Line:* It is the border between Poland and Germany running along the Oder and Neisse rivers; adopted at the Poland Conference (August 1945) after the World War II.
- *Radcliffe Line:* Drawn up by Sir Cyril Radcliffe, this line demarcates the boundary between India and Pakistan.
- *Siegfried Line:* the line of fortification drawn up by Germany on its border with France.
- *17th Parallel:* The 17th parallel defined the boundary between North and South Vietnam before the two were united.
- *24th Parallel:* Is the line which Pakistan claims for demarcation between India and Pakistan. This, however, is not recognized by India.
- *38th Parallel:* Is the parallel of latitude which separates North and South Korea.
- *49th Parallel:* The boundary between the US and Canada.

Table 6.17 Changed Names of Some Cities, States and Countries

Old Name	*New Name*
Abyssinia	Ethiopia
Angora	Ankara
Batavia	Jakarta
British Honduras	Belize
Bechuanaland	Botswana
Basutoland	Lesotho
Burma	Myanmar
Cape Canaveral	Cape Kennedy
Ceylon	Sri Lanka
Christina	Oslo
Congo	Zaire
Constantinople	Istanbul

(*Continued*)

Old Name	*New Name*
Dacca	Dhaka
Dahomey	Benin
Dutch East Indies	Indonesia
Dutch Guiana	Surinam
East Pakistan	Bangladesh
East Timor	Loro Sae
Egypt	United Arab Republic
Ellice Island	Tuvalu
Formosa	Taiwan
French West Africa	Mali
Gold Coast	Ghana
Greenland	Kalaallit Nunaat
Holland	The Netherlands
Kampuchea	Cambodia
Leopoldville	Kinshasa
Madagascar	Malagasy
Malaya	Malaysia
Manchukuo	Manchuria
Mesopotamia	Iraq
New Hebrides	Vanuatu
Nippon	Japan
Northern Rhodesia	Zambia
Nyasaland	Malawi
Peking	Beijing
Petrograd	Leningrad
Persia	Iran
Portuguese Guinea	Guinea Bissau
Rangoon	Yangon
Rhodesia	Zimbabwe
Saigon	Ho Chi Minh City
Salisbury	Harare
Sandwich Islands	Hawaiian Islands
Siam	Thailand
South West Africa	Namibia
Spanish Guinea	Equatorial Guinea
Stalingrad	Volgograd
Tanganyika and Zanzibar	Tanzania
Trucial Oman	United Arab Emirates
Upper Volta	Bourikina Fasso or Burkina Faso
West French Africa	Mauritania

Note: Zaire's National Conference on Democracy has decided in 1993 to rename the country 'Congo', thus, reverting to the name chosen by the Belgian colonizers.
To differentiate it from Congo-Brazzaville, Zaire's new name would be 'Congo-Kinshasa'.

Table 6.18 Distinctive Names of Countries/Towns—Geographical Epithets

Distinctive Name	*Country/Town/Port/River*
Britain of the South	New Zealand
The Battlefield of Europe	Belgium
City of the Golden Gate	San Francisco
City of Magnificent Distances	Washington D.C.
City of Popes	Rome
City of Seven Hills	Rome
City of Skyscrapers	New York
Cockpit of Europe	Belgium
Dark Continent	Africa
Dairy of Northern Europe	Denmark
Emerald Island	Ireland
Empire City	New York
Eternal City	Rome, Italy
Forbidden City	Lhasa (Tibet)
Garden of England	Kent
Gate of Tears	Babel-Mandab, Jerusalem
Granite City	Aberdeen (Scotland)
Great White Way	Broadway (New York)
Gift of Nile	Egypt
Gibraltar of the Indian Ocean	Aden
Herring Pond	Atlantic Ocean
Hermit Kingdom	Korea
Holy land	Palestine
Island of Cloves	Madagascar (Malagasy)
Island of Pearls	Bahrain
The Isle of Spring	Jamaica
Key to the Mediterranean	Gibraltar
Land of Cakes (or Oat Cakes)	Scotland
Land of the Flying Fish	Barbados
Land of the Golden Fleece	Australia
Land of the Golden Pagoda	Myanmar (Burma)
Land of Kangaroos	Australia
Land of Lilies	Canada
Land of the Midnight Sun	Norway
Land of Milk and Honey	Canaan
Land of Morning Calm	Korea
Land of the Rising Sun	Japan
Land of a Thousand Lakes	Finland
Land of Thunderbolt	Bhutan
Land of White Elephants	Thailand
Lady of Snow	Canada
Little Venice	Venezuela
Mother-in-Law of Europe	Denmark
Never, Never Land	Prairies (North Australia)

(*Continued*)

Distinctive Name	*Country/Town/Port/River*
Pearl of Antilles	Cuba
Playground of Europe	Switzerland
Pillars of Hercules	Straits of Gibraltar
Pearl of the Pacific	Guyayquil Port (Equador)
Powder Keg of Europe	Balkans
The Promised Land	Canaan
Quaker City	Philadelphia
Queen of the Arabian Sea	Kochi (India)
Queen of the Adriatic	Venice
Rich Coast	Costa Rica
Rich Port	Puerto Rico
Roof of the World	Pamir (Tibet)
The Sea of Mountains	British Columbia
Sorrow of China	River Hwang Ho
The Saw Mill of Europe	Sweden
Sick Man of Europe	Turkey
Sugar Bowl of the World	Cuba
The Storehouse of the World	Mexico
The Down Under	Australia
Venice of the North	Stockholm
Venice of the East	Bangkok (Thailand), Allepey (India)
Yellow River	Hwang Ho (China)
White City	Belgrade
Windy City	Chicago
White Man's Grave	Guinea Coast (West Africa)
Workshop of Europe	Belgium
World's Loneliest Island	Tristan Da Cunha
World's Bread Basket	Prairies of North America
The Spice Island of the West	Grenada
The Mother Colony of the West Indies	St. Kitts
City of Arabian Nights	Baghdad
Twin City	Budapest
The Imperial City	Rome
Golden City	Johannesburg
The Modern Babylon	London
Valley of Kings	Thebes

Table 6.19 Major Crops and Their Producers

Crop	*Main Producing Countries*
Coffee	Brazil, Colombia, Ivory Coast, Uganda, Guatemala, Indonesia, El Salvador and India
Cotton	Russia, US, China, India, Pakistan, Turkey, Brazil, Egypt, Mexico, Sudan, Nicaragua, Greece, Guatemala

(*Continued*)

Crop	*Main Producing Countries*
Wheat	Russia, US, Canada, Australia, Italy, Germany, Argentina, India, Pakistan
Rice	China, India, Japan, Myanmar (Burma), Vietnam, South Korea, Brazil, Philippines, US
Sugarcane	India, Brazil, Cuba, China, Mexico, Pakistan, Colombia, Australia, South Africa
Tea	India, China, Sri Lanka, Russia, Japan, Kenya, Turkey, Indonesia, Bangladesh, Argentina, Uganda
Other Crops	Countries
Barley	Russia, US, China, Canada, UK, India
Cloves	Tanzania
Cocoa	Brazil, Ghana, Nigeria, Colombia, Ivory Coast, Russia, Belgium
Groundnut	India, China
Jute	Bangladesh, India, China, Taiwan, Japan
Rubber	Malaysia, Indonesia, Thailand, Sri Lanka
Maize	US, China, Brazil, Argentina
Silk	Japan, China, Korea, India, Turkey
Tobacco	US, Russia, China, India, Egypt

Table 6.20 Important Minerals and Principal Producing Countries

Mineral	*Countries*
Aluminium	Jamaica, Surinam, France, Ghana, US, Russia, Canada, Germany, Norway, Hungary, India, Greenland
Asbestos	Canada, Zimbabwe, South Africa
Chromium	India, South Africa, Zimbabwe, Cuba
Coal	US, Russia, China, Germany, UK, France, Poland, Belgium, Australia, India
Copper	US, Russia, China, Germany, Zambia, Zaire, Canada, Spain, Mexico, Japan, Australia, India
Gold	South Africa, US, Australia, Canada
Graphite	Sri Lanka
Iron Ore	Russia, US, Australia, Canada, Sweden, France, Spain, India, China, Brazil
Lead	US, Russia, Spain, Germany, Belgium
Lignite	Germany, Russia
Magnesium	India, Russia, Mexico, Ivory Coast
Mercury	Italy, Spain, US
Mica	India
Nickel	Canada
Petroleum	Saudi Arabia, Kuwait, Iran, Iraq, Qatar, UAE, Libya, Algeria, Nigeria, Niger, Egypt, US, Russia, Indonesia
Silver	Canada, Russia, Mexico, US, Australia
Tin	Malaysia, Bolivia
Uranium	Zaire, South Africa, US, Canada, Germany, Czech, Slovakia, Russia, India
Thorium	India, Brazil, US
Zinc	Canada, Russia, Belgium and Germany

Table 6.21 Major Exporters of Minerals and Crops

Item Exported	*Chief Exporting Countries*
Aluminium	US
Coal	US
Coffee	Brazil
Copper	US
Gold	South Africa
Iron Ore	US
Jute	Bangladesh
Manganese	Russia
Mica	India
Rice	China
Rubber	Malaysia
Silver	Mexico
Sugar	Indonesia
Wheat	US
Wool	Australia

Table 6.22 Major Industries

Industry	*Chief Manufacturing Countries*
Iron and Steel	US, Russia, Japan, Germany, UK, France and India
Textiles (Cotton)	US, China, India, Japan, Russia, UK, Taiwan, Canada, Egypt, France, Italy
Textiles (woollens)	Russia, UK, Japan, Australia, India, France, Poland, Belgium, US, Czech, Slovakia, Germany, Bulgaria
Item Exported	Chief Exporting Countries
Chemicals	US, Germany, UK, Russia, Japan, Canada, Australia, India
Paper	US, Canada, Japan, UK, Germany, Sweden, Norway, Finland, Russia, India
Rubber	US, UK, Germany, France, Netherlands, Australia, Canada, Brazil, Indonesia, Sri Lanka

Table 6.23 Countries and Their Parliaments

Country	*Name of Parliament*
Afghanistan	Shora
Bangladesh	Jatiya Sangsad
Bhutan	Tsongdu
Bulgaria	Narodna Subranie
Myanmar (Burma)	Pyithu Hluttaw
Denmark	Folketing
Ethiopia	Shergo
Finland	Eduskusta
Germany	Bundestag (Lower House) Bundestrat (Upper House)

(*Continued*)

Country	*Name of Parliament*
Greenland	Landstraad
Iceland	Althing
India	Lok Sabha (Lower House) Rajya Sabha (Upper House)
Indonesia	Majlis
Iran	Majlis
Israel	Knesset
Japan	Diet
Malaysia	Dewan Rakyat and Dewan Negara
Maldives	Majlis
Mongolia	Great People's Khural
Nepal	National Panchayat
The Netherlands	The Staten General
Norway	Storting
Poland	Sejm
Spain	Cortes
Surinam	Staten
Swaziland	Liblandla
Sweden	Riksdaq
Switzerland	Federal Assembly

CHAPTER

7 INTERNATIONAL ORGANIZATIONS

UNITED NATIONS ORGANIZATION (UN)

- The UN is an association of sovereign states bound by a Charter (Constitution) to maintain international peace and security.
- It is the world's largest international organization; a successor to the League of Nations.
- *How the name United Nations was coined?* The US President, Franklin D. Roosevelt, used the name United Nations in the 'Declaration by United Nations' on 1 January 1942 during the Second World War, when representatives of 26 nations pledged support to continue fighting together against the Axis Powers.
- *UN Charter*: On 26 June 1945, the United Nations Charter (Constitution) was signed by the delegates of 49 countries at San Francisco (US).
- There were originally 50 nations invited to the San Francisco Conference.
- Poland did not attend because the composition of her new government was not announced until late for the conference.
- Therefore, the space was left for the signature of Poland, one of the original signatories of the UN Declaration.
- The generally recognized government in Poland was formed on 28 June 1945 and on 15 October 1945, Poland signed the Charter, thus becoming one of the original members.

Foundation Day of the UN

- The UN formally came into existence on 24 October 1945, when governments of China, France, the United Kingdom, the former USSR, the United States and a majority of other states ratified the UN Charter.
- 24 October is celebrated as the United Nations Day throughout the world.

First Regular Session of the UN

- The first regular session of the UN was held in London in January 1946 and Trygve Lie (Norway) was elected the first Secretary General of the UN.

Headquarters of the UN

- These are located on the First Avenue, UN Plaza, New York City, United States of America.

The UN Flag and the Emblem

- The UN General Assembly adopted the UN flag on 20 October 1947.
- The white UN emblem is superimposed on a light blue background.
- The emblem consists of the global map projected from the North Pole and embraced in twin olive branches (symbol of peace).
- The UN flag is not to be subordinated to any other flag in the world.
- The UN Emblem was approved on 7 October 1946.

Aims and Objectives

The main objectives of the UN are:

1. To maintain peace and security in the world.
2. To work together to remove poverty, disease and illiteracy and encourage respect for each other's rights of basic freedom.
3. To develop friendly relations among nations.
4. To be a centre to help nations achieve these common goals.

Membership of the UN

- *Admission of Members*: New members are admitted to the General Assembly on the recommendation of the Security Council and two-thirds of the members should vote in favour. Members are expelled or suspended in the same manner.
- *Permanent Members*: There are five permanent members of the Security Council: China, France, Russia, UK and US.
- *Veto*: A negative vote by a permanent member bars action by the Security Council and is called a veto. Each permanent member enjoys the power to veto.
- *Membership*: When the UN Charter was signed, there were only 50 members. As of 1 July 2009, the UN has 193 members. The following nations were admitted to the UN from 2000: Tuvalu, East Timor, Serbia, Switzerland, Montenegro. In 1994: Palau, a newly independent Pacific nation which had been under the trusteeship of the USA. South Sudan is the newest member of the UN.
- *Non-members*
  1. Switzerland Taiwan.
  2. In addition, several other small states like Nauru, Tonga, Vatican City are also not members of the UN.

Organization of the UN

The principal bodies of the UN are as follows:

1. The General Assembly
2. The Security Council
3. The Economic and Social Council
4. International Court of Justice
5. Trusteeship Council
6. Secretariat

- ***Quick Facts***
  —*Membership*: 193 member states
  —*Established*: 24 October 1945 (United Nations Day)
  —*Secretariat Staffing on 1st January 2014*: 50000 approx.

—*Current UN Peace Keeping Operations*: 16
—*Official Languages*: Arabic, Chinese, English, French, Russian, Spanish
—Nobel Prize 2001 was awarded equally between UN Secretary General Kofi Anan and the United Nations itself on 10 December 2001.

The General Assembly (GA)

- *Headquarters*: New York
- *Membership*: Consists of all member states of the UN. Each member can send five delegates but each nation has only one vote.
- *Functions*: All other UN bodies report to the General Assembly. It discusses and makes recommendations on any subject covered under the UN Charter except those with which the Security Council may be dealing.
- *Meetings*: The General Assembly meets every year in regular sessions beginning on the third Tuesday in September.

Security Council (SC)

- *Headquarters*: New York
- *Membership*: The Security Council has 15 members—five permanent members enjoying veto power. (i) China, (ii) France, (iii) Russia, (iv) UK and (v) US and 10 non-permanent elected members. The non-permanent members are elected by the General Assembly. They retire on rotation every two years.
- *Function*: The Security Council is responsible for international peace and security. Any nation, irrespective of its membership of the UN can put forth its problem before the Council. The Security Council can recommend peaceful solutions or if necessary, may order use of force to restore peace.

The Economic and Social Council

- *Headquarters*: New York
- *Membership*: Consists of representatives of 54 member-countries elected by a two-thirds majority in the General Assembly. One-third of the members are elected every year to serve for a period of three years and one-third of the members retire annually.
- *Functions*: The Economic and Social Council carries on the functions of the UN with regard to international economic, social, cultural, educational, health and related matters.

The International Court of Justice (ICJ)

- *Headquarters*: The Hague (Netherlands)
- *Membership*: Consists of 15 judges who are elected by the General Assembly and the Security Council for a term of nine years.
- *Functions*: It gives advisory opinion on legal matters to the bodies and special agencies of the UN and considers the legal disputes brought before them.
- Justice R. S. Pathak, Chief Justice of India, was elected judge of the ICJ on 18 April 1989.
- He became the third Indian on whom this honour has been bestowed.
- The other two were Mr Justice B. N. Rao and Mr Justice Nagendra Singh.

The Trusteeship Council

- *Headquarters*: New York
- *Membership*: There are five permanent members of the Security Council plus those nations who administer *Trust Territories*.

- *Functions*: To safeguard the interest of inhabitants of territories which are not yet fully self-governing and are governed by an administering country.

The Secretariat

- *Headed by*: A Secretary-General who is appointed by the General Assembly on the recommendation of the Security Council.
  Tenure: Five years and eligible for re-election after the term expires.
- *Functions*: It is the chief administrative office of the UN which coordinates and supervises the activities of the UN.

Secretary-Generals of the UN

1. Trygve Lie (Norway) 1946–52
2. Dag Hammarskjold (Sweden);s killed in an air crash) 1953–61
3. U. Thant (Myanmar) 1962–71
4. Dr Kurt Waldheim (Austria) 1972–81
5. Javier Perez De Cuellar (Peru) 1982–91 (two terms)
6. Dr Boutros Boutros-Ghali (Egypt) 1992–1997
7. Kofi Annan (Ghana) 1997–2007 (two terms)
8. Ban Ki-moon (South Korea) 2007–till date

Agencies Related to the United Nations

- Working in collaboration with the UN in various economic, social, scientific and technical fields are a group of inter-governmental organizations.
- These agencies are related to the UN through special agreements.

Table 7.1 Agencies Related to United Nations

S. No.	*Name of Agency*	*Abbreviation*	*Year of Establish-ment*	*Head-quarters*	*Purpose*
1.	International Labour Organization	ILO	1919	Geneva	To promote social justice, improve conditions and living standards of workers and promote economic stability
2.	International Atomic Energy Agency	IAEA	1957	Vienna	To promote peaceful uses of atomic energy
3.	Food and Agriculture Organization	FAO	1945	Rome	To raise nutritional levels, living standards, production and distribution of food and agricultural products, improve living conditions of rural population

(*Continued*)

S. No.	*Name of Agency*	*Abbreviation*	*Year of Establish-ment*	*Head-quarters*	*Purpose*
4.	United Nations Educational Scientific and Cultural Organization	UNESCO	1946	Paris	To promote collaboration among nations through education, science and culture in order to further justice, human rights and freedom
5.	World Health Organization	WHO	1948	Geneva	Attainment of highest possible level of health by all people
6.	International Bank for Reconstruction and Development	IBRD	1945	Washington	Development of economies of members by and Development facilitating investment of foreign capital and providing loans
7.	World Meteorological Organization	WMO	1950	Geneva	Promoting international exchange of weather reports and other weather related services
8.	Inter-governmental Maritime Consultative Organization	IMCO	1958	London	Promotes cooperation on technical matters, maritime safety, navigation and encourages anti-pollution measures
9.	United Nations International Children's Emergency Fund	UNICEF	1946	New York	Children's welfare all over the world
10.	General Agreement on Tariffs and Trade (from 1994 it is known as World Trade Organization)	GATT (WTO)	1948	Geneva	Treaty setting rules for world trade to reduce tariffs and eliminate other barriers to international trade
11.	United Nations Development Programme	UNDP	1965	New York	Help developing countries increase wealth producing capabilities of their natural and human resources

(*Continued*)

S. No.	*Name of Agency*	*Abbreviation*	*Year of Establish-ment*	*Head-quarters*	*Purpose*
12	United Nations Environment Programme	UNEP	1972	Nairobi	Promotes international cooperation in matters relating to human environment
13.	United Nations Population Fund	UNFPA	1969	New York	Promotes population related programmes
14.	United Nations High Commissioner	UNHCR	1951	Geneva	Provides international protection to for Refugees refugees
15.	United Nations Industrial Development Organization	UNIDO	1966	Vienna	Extends assistance to LDCs for development and modernisation of industries
16.	International Development Association	IDA	1960	Washington	An affiliate of the World Bank which aims to help underdeveloped countries raise living standards
17.	International Finance Corporation	IFC	1956	Washington	Promotes economic development by encouraging private enterprise in its member-countries
18.	International Monetary Fund	IMF	1945	Washington	Promotes international monetary cooperation and expansion of international trade
19.	International Civil Aviation Organization	ICAO	1947	Montreal	Promotes safety in international aviation and establishes international standards and regulations
20.	Universal Postal Union	UPU	1947	Berne	Improves various postal services and promotes international collaboration
21.	International Telecommuni-cation	ITU	1947	Geneva	Sets international regulations for radio, telegraph, telephone and space radio communications

(*Continued*)

S. No.	*Name of Agency*	*Abbreviation*	*Year of Establish-ment*	*Head-quarters*	*Purpose*
22.	International Fund for Agricultural Development	IFAD	1977	Rome	Finances agricultural projects to introduce, expand and improve food production and raise nutritional levels
23.	United Nations Conference on Trade and Development	UNCTAD	1964	Geneva	Promotes international trade with a view to accelerate economic growth of developing countries
24.	United Nations Institute for Training and Research	UNITAR	1965	New York	Provides high priority training and research projects to help facilitate the UN objectives of world peace and security and of economic and social progress
25.	United Nations Relief and Work Agency for Palestine Refugees	UNRWA	1949	New York	Provides food, health services, education and vocational training for those displaced in Arab–Israel wars

Changing Role of United Nations

- The work of the United Nations reached every corner of the globe.
- Although best known for peacekeeping, peacebuilding, conflict prevention and humanitarian assistance, there are many other ways the United Nations and its System (specialized agencies, funds and programmes) affect our lives and make the world a better place.
- The organization works on a broad range of fundamental issues, from sustainable development, environment and refugees protection, disaster relief, counter terrorism, disarmament and non-proliferation, to promoting democracy, human rights, governance, economic and social development and international health, clearing landmines, expanding food production and more, in order to achieve its goals and coordinate efforts for a safer world for this and future.

EUROPEAN UNION

- European Union (EU) evolved from European Community (EC).
- EU was established on 7 February 1992 and came into effect on 1 November 1993.

- The historical roots of EU lie in the second World War. The idea of European Integration was concieved to prevent such killing and destruction ever happening again. It was first proposed by the French foreign minister Robert Suhuman in a speech on 9 May 1950.
- This date, the 'birthday' of what is now the EU is celebrated annually as 'Europe Day'.
- The EU family of democratic European countries are committed to work together for peace and prosperity and no single state will replace the existing states.
- Its member states have set up common institution to which they delegate some of their sovereignty, so that the decisions on specific matters of joint interest can be made democratically at European level.
- The pooling of sovereignty is also called 'European Integration'.
- There are five EU institutions, each playing specific role:
  1. European Parliament (elected by the people of the member states)
  2. Council of the European Union (represents the governments of the member states)
  3. European Commission (driving force and executive body)
  4. Court of Justice (ensuring compliance with the law)
  5. Court of Auditors (controlling sound and lawful, management of the EU budget)
- These are flaunted by five important bodies:
  1. European Economic and Social Committee (expresses the opinions of organized civil society on economic and social issues)
  2. Committee of Regions (expresses the opinions of regional and local authorities)
  3. European Central Bank (responsible for monetary policy and managing the Euro)
  4. European Ombudsman (deals with citizens' complaints about maladministration by any EU institution or body)
  5. European Investment Bank (helps achieve EU objectives by financing investment projects)
- A number of agencies and other bodies complete the system.
- The rule of law is fundamental to the EU decisions and the procedures are based on the treaties which are agreed by all EU members.
- *Member States:* Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, lreland, ltaly, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.
  —Romania and Bulgaria became members in January 2007 which brought the EU's membership total to 27 countries.
  —Croatia became 28th member of the EU on 1 July 2013.
- *Membership Applicants*: Turkey, Iceland and former Yugoslav Republic of Macedonia, Montenegro and Serbia are the 5 candidate countries.
- Bosnia and Herzegovina and Albania are officially recognized as potential candidates.
- Kosova is also listed as potential candidate but European Commission does not list it as an independent country.

THE COMMONWEALTH

- The Commonwealth, originally called the British Commonwealth of Nations, is an association of sovereign and independent states which formally made up the British Empire.

- It came into being in 1947.
- *Constitution*: The Commonwealth has no written constitution. However, most of the member-countries have common constitutional features and they are bound together by common ideals and interest.
- *Purpose and Objectives*: Within the diversity, all members of Commonwealth hold certain common principles. It is by pursuing these ideals and principles that the commonwealth is able to influence international society for the benefit of mankind.
- *Membership*: There are 51 member-countries (South Africa joined as 51st member in May 1994) which include about a quarter of the world's people. Members of the commonwealth are represented in other commonwealth countries by diplomatic officers called *High Commissioners* (in the place of an *ambassador* representing Non Commonwealth countries).
- *Head of the Commonwealth*: The British monarch (Queen Elizabeth II) is the symbolic head. The other member-nations have their own heads of state but acknowledge the Queen as the head of the Commonwealth.
- *Secretary-General*: Kamlesh Sharma, an Indian diplomat became the Commonwealth Secretary General on 1 April 2008.

THE NON-ALIGNED MOVEMENT (NAM)

- *Founder-Members of NAM*
  1. Marshal Tito—President of former Yugoslavia
  2. Dr Sukarno—President of Indonesia
  3. G. A. Nasser—President of Egypt
  4. Pt Jawaharlal Nehru—first Prime Minister of India.
- The credit of evolving the concept of NAM goes to Pt. Nehru.
- *Established*: A conference of like-minded nations was held in April 1955 in Indonesia (Bandung) which became the forum for the birth of NAM.
- *Basic Principles of NAM*
  1. Mutual respect for each other's territorial integrity and sovereignity
  2. Mutual non-aggression
  3. Mutual non-interference in each other's affairs
  4. Equality and mutual benefit
  5. Peaceful coexistence
- These principles are collectively known as Panchsheel and are the basic guidelines for the functioning of the NAM.
- *Membership*: 118 (South Africa joined as 109th member in May 94)

SOUTH ASIAN ASSOCIATION FOR REGIONAL COOPERATION (SAARC)

- *Origin of SAARC*: The idea of the SAARC was first mooted in 1979 by the former Bangladesh President Zia-ur-Rahman during his visit to Sri Lanka.
- *Date of Formation*: 8 December 1985 at Dhaka.

- *Membership*
  1. Bhutan
  2. Bangladesh
  3. India
  4. The Maldives
  5. Pakistan
  6. Nepal
  7. Sri Lanka
- *Purpose*
  1. To promote the welfare of the people of South Asia
  2. To improve the security environment in the region
  3. To accelerate economic growth and cultural development
  4. To combat terrorism
- *Secretariat*: Kathmandu (Nepal)

OTHER WORLD ORGANIZATIONS

The European Economic Community (EEC)

- Also known as the European Common Market (ECM).
- *Established*: On 25 March 1957, with its headquarters at Brussels in Belgium. It was brought into existence by the Treaty of Rome on 25 March 1957 and started functioning on 1 January 1958.
- *Purpose*: To promote a common market and economic prosperity among member-countries and create a single market for free import and export among member-countries. The Treaty of Rome also guarantees certain rights to the citizens of all member-nations.
- *Members*: Initially signed by six countries: Belgium, France, Luxembourg, Netherlands, former Federal Republic of Germany and Italy. Later Britain, Ireland, Norway and Denmark joined but, Norway withdrew. With Greece, Spain and Portugal joining recently EEC now has 12 member-states (1993).

Caribbean Community (CARICOM)

- *Established*: On 1 August 1973 with its headquarters at Georgetown (Guyana). This organization was formed by the Caribbean Free Trade Association (CARIFTA).
- *Purpose*: Coordinates economic policies and development of member-states, formulates common external trade, tariff and policy and has programmes to aid the less developed member-countries.
- *Members*: Anguilla, Antigua, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Montserrta, St Kitts-Nevis, St Lucia, St Vincent, Trinidad and Tobago.

Organization of Petroleum Exporting Countries (OPEC)

- *Established*: OPEC is a permanent, intergovernmental organization created at the Baghdad Conference on 10–14 September 1960 by Iran, Iraq, Kuwait, Saudi Arabia and Venezuela with its headquarters at Geneva, Switzerland. The headquarters wer moved to Vienna in 1965. The international oil companies' announcement that they were reducing prices of Middle East Crude oil led to the formation of the OPEC.

- *Purpose*: To control production and pricing of crude oil.
- *Members*: Algeria, Angola, Ecuador, Gabon, Indonesia, Iran, Iraq, Kuwait, Libya, United Arab Emirates, Nigeria, Qatar, Saudi Arabia and Venezuela. Membership of OPEC is open to any country with substantial exports of crude petroleum. In September 1992, Ecuador suspended its membership, from December 1992–December 2007 and Iran said it would stay alone in the oil market.

Arab League (League of Arab States)

- *Established*: On 22 March 1945 with its headquarters at Cairo which were later shifted to Tunisia, Tunis in 1979 when Egypt's membership was suspended. After Iraq's invasion of Kuwait in August 1990, the headquarters were shifted from Tunisia to Cairo.
- *Purpose*: To foster unity particularly among Muslim nations and maintenance of Arab solidarity.
- *Members*: Algeria, Bahrain, Comoros, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, United Arab Emirates and Republic of Yemen.

European Free Trade Association (EFTA)

- *Established* in May 1960 with headquarters in Geneva.
- *Purpose*: Members agreed to remove all tariffs on trade of industrial goods between them and to aid the creation of a single West European market to help boost world trade. EFTA countries have free trade agreements with the EEC and there is now free trade between 16 West European countries.
- *Members*: Founder members were Austria, Denmark, Norway, Portugal, Sweden, Switzerland and the UK. Iceland joined in 1970. Denmark and the UK left the organization in December 1972. Now its members are Iceland, Liechtenstein, Norway and Switzerland.

Central Treaty Organization (CENTO)

- *Established*: In 1955 by a few West Asian countries with headquarters at Ankara, Turkey.
- *Purpose*: A defensive organization against Russian interference.
- *Members*: Until 1958, the organization was known as the Baghdad Pact which started with five member nations: (i) UK, (ii) Turkey, (iii) Iran, (iv) Pakistan and (v) Iraq (which withdrew in 1959). US support came in 1958.
  —Turkey, Iran and Pakistan withdrew in 1979 which spelled the end of the organization.

Benelux Economic Union

- *Established*: In 1958 with its headquarters in Brussels, Belgium.
- *Purpose*: Belgium, Netherlands and Luxembourg formed the Benelux Economic Union in 1958 for purposes of economic unity.
- *Members*: Belgium, Netherlands and Luxembourg.

North Atlantic Treaty Organization (NATO)

- *Established*: On 4 April 1949 with its headquarters in Brussels, Belgium.
- *Purpose*: The member countries promised to maintain and develop their individual and collective capacity to resist armed attack and consult each other if any of the member nations was threatened politically. They agreed that an armed attack against any of them would be countered by combined action.
- *Members*: The treaty was signed in 1949 by the representative of Belgium, Canada, Denmark, France, Iceland, Italy, Luxembourg, Netherlands, Norway, Portugal, the UK and USA. Greece and Turkey joined in 1952 and former West Germany and Spain in 1955 and 1982, respectively. The other members are Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithiana, Poland, Romania, Slovakia, Slovenia making up total 26 member countries.

The Group of 77

- *Established*: In 1964 under the auspices of the UN.
- *Purpose*: To defend the economic and trade interests of the developing world.
- *Members*: It now comprises 130 developing countries from Asia, Africa and Latin America.

South-East Asia Treaty Organization (SEATO)

- *Established*: On 8 September 1954 with its headquarters in Bangkok, Thailand.
- *Purpose*: To provide collective defence and economic cooperation in south-east Asia.
- *Members*: Australia, France, New Zealand, Pakistan, the Philippines, Thailand, the United Kingdom and US. Pakistan withdrew from the organization in 1973. SEATO was ultimately disbanded in 1977.

Colombo Plan

- *Established*: In 1950 with headquarters in Colombo.
- *Purpose*: To promote the development of newly independent Asian member-countries.
- *Members*: Started as a group of seven Commonwealth countries, it now has 26 member countries.

Organization of African Unity (OAU)

- *Established*: On 25 May 1963 with its headquarters at Addis Ababa (Ethopia).
- *Purpose*: To promote African unity and solidarity, put an end to colonialism in Africa and to coordinate the political, economic, defence, health, scientific and cultural policies of its members.
- *Members*: It consists of all 51 independent African countries except the white dominated states and territories of the South. It was disbanded on 9 July 2002 by its last chairperson, SA President Thabo Mbeki and replaced by African Union.

Organization of American States (OAS)

- *Established*: On 30 April 1948 with its headquarters in Washington DC. The OAS was formed at the Ninth Conference of American States in Bogota (Colombia).

- *Purpose*: To foster American solidarity and aid collaboration of member countries to protect their independence, sovereignty and boundaries. It has a membership now of nearly 35 nations of North and South America.
- Members 34 members participate actively as Cuba, a member state's participation has been suspended since 1962.

Organization for Economic Cooperation and Development (OECD)

- *Established*: On 30 September 1961 with its headquarters in Paris. The Organization for European Economic Cooperation (OEEC) became OECD in 1961 with the addition of non-European countries.
- *Purpose*: Seeks sustained economic growth, employment, higher standards of living and monetary stability in its member nations.
- *Members*: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korean, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Slocak Republic, Sweden, Switzerland, Turkey, UK, USA and Germany.

Association of South-East Asian Nations (ASEAN)

- *Established*: On 9 August 1967 with headquarters in Jakarta, Indonesia.
- *Purpose*: To accelerate economic progress and maintain economic stability in South-east Asia.
- *Members*: The organization was established in Thailand along with Malaysia and the Philippines. Indonesia, Singapore and Brunei joined in 1984. The ASEAN is headed by a secretary-general, who is elected on rotation in alphabetical order for a term of three years. The other member countries are Cambodia, Lao PDR, Malaysia, Myanmar and Vietnam.

Central American Common Market (CACM)

- *Established*: In 1960 with headquarters in Guatemala City.
- *Purpose*: Aims at Central American integration, equalization of import duties and charges and uniform control on foreign investment.
- *Members*: Costa Rica, EI Salvador, Guatemala, Honduras and Nicaragua.

The French Community

- *Established*: In 1958, it is an organization like the British Commonwealth which offers new institutions to the French, overseas territories based on the common idea of liberty, equality and fraternity.
- *Members*: French Republic, Central African Republic, Republic of Congo, Gabon, Senegal, Chad, Madagascar and Djibouti.

Interpol

- *Established*: In 1923, it is a 188-nation Police Commission which coordinates activities of member-nations with its headquarters in Paris.
- It shifted to Lyons after a terrorist bomb blast in 1986.

World Trade Organization (WTO)

- *Established*: On 1 January 1995 replacing the General Agreement on Tariffs and Trade (GATT).
- *Purpose*: It has come into effect with the backing of at least 85 founding members, including India. The WTO comes as the third economic pillar of worldwide dimensions with the World Bank and the International Monetary Fund (IMF). The WTO has powers to settle trade disputes between nations and to widen the principle of free trade to sectors such as the services and agriculture and covers more areas than GATT.

Asia-Pacific Economic Cooperation (APEC)

- *Established*: On 1 January 1989 on call for more effective economic cooperation across the Pacific Rim region by the Australian PM, Bob Howke.
- *Purpose*: APEC is a group of 21 Pacific Rim nations that seek to promote free trade and economic cooperation throughout Asia-Pacific region.

Group of Eight (G8)

- *Established*: In 1975 as G6 (France, Germany, Italy, Japan, UK and the US) with addition of Canada it became G7. With Russia joining the group it came to be known as G7 + 1 or G8. Interestingly, it does not has members such as China (2nd largest economy), Brazil (6th largest economy) and India (9th largest economy).
- *Purpose*: Since 2009 its major focus has been on global food supply.

Organization for the Prohibition of Chemical Weapons (OPCW)

- *Established*: On 29 April 1997 as an intergovernmental organization located in the Hague, Netherlands.
- *Purpose*: OPCW promotes and reifies the adherence to the chemical weapons convention that prohibits the use of chemical weapons and requires their destruction.

Amnesty International

- *Established*: On 28 May1961 with its headquarters in London by Peter Benenson, a British lawyer.
- *Purpose*: A worldwide organization that investigates violations of human rights. It campaigns for the release of all prisoners of conscience provided they have not used or advocated violence; fair and prompt trials for all prisoners, abolition of torture and capital punishment. It has more than 500000 members in 150 countries.

Red Cross

- *Established*: In 1863 by Jean Henri Dunant. In 1859, J. H. Dunant, a Swiss businessman travelling through Italy, witnessed the battle of Solferino, in which about 30000 soldiers were wounded or killed when France tried to free Italy from Austrian domination.
  - ——He organized relief work for the wounded soldiers and subsequently called for the formation of a permanent relief society for those wounded in war. Dunant's appeal had immediate results.

——An international conference took place in Geneva (Switzerland) in 1864 where 26 governments were represented. The conference led to the Geneva Convention and the emblem motto of Red Cross was adopted.

- *Red Cross Day*: World Red Cross and Red Crescent day is celebrated on 8 May the birthday of its founder, Henri Dunant.
- *Motto*: Charity in War.
- *Symbol*: Red Cross on a white background. It is the reverse of the flag of Switzerland.
- The Red Cross completed 131 years on 8 May 1993 and in its 126th year, it adopted the slogan:

'*125 years at work—and still developing.*'

- In the Middle-East, a Red Crescent replaces the Red Cross, while in Iran a lion or sun is used as the symbol.
- The organization was awarded the Noble Prize in 1917, 1944 and 1963.
- It has about 200 million members from 131 countries of the world.
- The International Committee of the Red Cross (ICRC) constitutes with the league of Red Cross societies, the International Red Cross.
- The League of Red Cross Societies was founded in 1929.

PART C

Chapter

8 EVERYDAY SCIENCE

BASIC INFORMATION

Systems of Measurements

- Scientists in different parts of the world have been using various systems of measurement, the most common among them are:
  1. C.G.S. System (Centimeter, Gram, Second)
  2. F.P.S. System (Foot, Pound, Second)
  3. M.K.S. (Metre, Kilogram, Second)
- However to avoid confusion in these systems and to have a uniform system of measurement, the French Academy of Sciences, devised the Metric System in 1791 which was later propagated in other European countries by Napolean.
- The Metric System is a decimal system in which different units for a physical quantity are related by powers of ten.
- The Metric System was adopted in India in 1957.

International System (SI)

- In 1960, the General Conference on Weights and Measures gave official status to a single practical system, the System International, that is, International System of Units, abbreviated as SI in all languages.
- The SI system is a modernized version of the metric system and has seven basic units. These units are defined as:

meter (m) [distance]	The metre is the length of the path travelled by light in vacuum during a time interval of 1/299 792 458 of a second.
kilogram (kg) [mass]	The kilogram is equal to the mass of the international prototype of the kilogram.
second (s) [time]	The second is the duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium 133 atom.
ampere (A) [electric current]	The ampere is that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section and placed 1 metre apart in vacuum, would produce between these conductors a force equal to 2×10^{-7} newton per metre of length.

kelvin (K) [temperature]	The kelvin is the fraction 1/273.16 of the thermodynamic temperature of the triple point of water.
mole (mol) [amount of substance]	The mole is the amount of substance of a system which contains as many elementary entities as there are atoms in 0.012 kilogram of carbon 12. When the mole is used, the elementary entities must be specified and may be atoms, molecules, ions, electrons, other particles or specified groups of such particles.
candela (cd) [intensity of light]	The candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540 × 1012 hertz and that has a radiant intensity in that direction of 1/683 watt per steradian.

Table 8.1 Seven Basic SI Units

Basic Unit	*Quantity (Unit of)*	*Symbol*	*Adopted in*
Metre	length	m	1960
Kilogram	mass	kg	1960
Second	time	s	1948
Kelvin	thermodynamic temperature	K	1967
Candela	luminous intensity	cd	1967
Mole	substance	mol	1971

Table 8.2 Common Derived Units

Quantity	*Definition of Quantity*	*SI Units*
Area	Square metre	m^2
Volume	Cubic metre	m^3
Density	Kilogram per cubic metre	kg/m^3
Speed	Distance per unit time (second)	m/s
Acceleration	Speed changed per unit of time	m/s^2
Force	Mass times acceleration of object kg	m/s^2
Pressure	Force per unit area	kg/ms^2
Energy	Force times distance travelled	kgm^2/s^2

Non-SI Units Used Along with International System

- There are certain units which are accepted for use with the SI. It includes units which are in continuous everyday use, in particular the traditional units of time and of angle, together with a few other units which have assumed increasing technical importance.
- There are also units which are currently accepted for use with the SI to satisfy the needs of commercial, legal and specialist scientific interests or are important for the interpretation of older texts.

Derived Units of the International System (SI)

- The term *derived unit* covers any algebraic combination of the base units but it is only the 22 combinations listed above that have approved special names.

Table 8.3 Important Derived Units and Their SI units

Derived Unit	*Measures*	*SI Units*
Hertz (Hz)	frequency	/s
Newton (N)	force	kg·(m/s^2)
Pascal (Pa)	pressure	N/m^2
Joule (J)	energy or work	N·m
Watt (W)	power	J/s
Coulomb (C)	electric charge	A·s
Volt (V)	electric potential	W/A
Farad (F)	electric capacitance	C/V
Ohm (Ù)	electric resistance	V/A
Siemens (S)	electric conductance	A/V
weber (Wb)	magnetic flux	V·s
tesla (T)	magnetic flux density	Wb/m^2
henry (H)	inductance	Wb/A
deg Celsius (°C)	temperature	K – 273.15
radian (rad)	plane angle	
steradian (sr)	solid angle	
lumen (lm)	luminous flux	cd·sr
lux (lx)	illuminance	lm/m^2
becquerel (Bq)	activity	/s
gray (Gy)	absorbed dose	J/kg
sievert (Sv)	dose equivalent	Gy·(multiplier)
katal (kat)	catalytic activity	mol/s

Number System

- There are two numeral systems in vogue, namely,
  1. The Arabic system
  2. The Roman system

Arabic Numerals

- The numerals which are now universally used in all our calculations are known as Hindu Arabic numerals.

Invention of Zero and The Hindu Arabic Numbers

- The Arabic numerals are said to have been invented by ancient Hindu mathematicians from whom the system was adopted by the Arabs. The Arabic system of numerals was used as early as fifth or sixth century before the birth of Christ BC. However, at the time zero was not used with these numbers.
- From the Arabs the system reached Europe to replace the Roman system around the 10th century where they were named Arabic numerals.

- The zero was also invented by the Hindus sometime around ad 876 Zero was indicated by a small circle which was called 'Shunya', the Sanskrit word for 'vacant'.
- The Arabic system of numerals was popularized by an Italian, Leonardo Fibonacci (about 1170–1240) who advocated its use in his book Book of the Abacus published in 1202.
- The word Digit used in reference to numbers is derived.
- from the Latin word digitus which means finger because most of the counting was done on fingers at that time.

Invention of the Decimal System

- The decimal system is also of Indian origin and can be traced in the scriptures (Yajurveda 1000 BC). It was however, popularized by a Flemish mathematician named Simon Stevin (1548–1620) in his book 'De Thiende' (The Tenth) published in 1585. Before this invention numbers less than one were represented as fractions.

Roman Numerals

- The Roman numerals were used by ancient Romans almost 2000 years ago. In this system letters of the English alphabet are converted into numbers and consists of seven basic symbols. They are,

  1. I 2. V 3. X 4. L 5. C 6. D md 7. M

- The numbers represented are 1, 5 and multiples of 5 and 10. There is no zero in this system. The system works on the following rules:
  — Repeating a letter repeats its value: XX = 20 (that is, 10 + 10)
  — A letter placed after one of the greater value adds thereto: VI = 5 + 1 = 6
  — A letter placed before another of greater value subtracts therefrom: 4 = IV (1 subtracted from V)
  — A dash over a number multiplies its value by thousand: $\overline{X} = 10 \times 1000 = 10000$

The system works as follows:

1	= I	
2	= II	
3	= III	
4	= IV	(One subtracted from X)
5	= V	
6	= VI	(V + 1)
7	= VII	(V + 1 + 1)
8	= VIII	V + 1 + 1 + 1)
9	= IX	(One subtracted from X)
10	= X	
19	= XIX	
27	= XXVII	
152	= CLII	

Mathematical Symbols

- *Equal to* (=): Robert Recorde invented the equal sign (=) in 1557. He suggested that two equal parallel lines were as equal as anything available.
- *Plus* (+) *and Minus* (–): The plus sign (+) was adopted from the Latin word *et* meaning *and*. The signs were used in the 15th century to indicate over weight or under weight of boxes of merchandise. For over weight they used the plus sign (+) and for under weight the minus sign (–).

The Prefixes of the SI

yotta	[Y]	1 000	000	000	000	000	000	000	000	= 10^24
zetta	[Z]	1 000	000	000	000	000	000	000	= 10^21	
exa	[X]	1 000	000	000	000	000	000	= 10^18		
peta	[P]	1 000	000	000	000	000	–10^15			
tera	[T]	1 000	000	000	000	= 10^12				
giga	[G]	1 000	000	000	*(a thousand millions = a billion)*					
mega	[M]	1 000	000	*(a million)*						
kilo	[K]	1 000	*(a thousand)*							
hecto	[H]	1 00	*(a hundred)*							
deca	[da]	1 0	*(tenth)*							
deci	[d]	0.1	*(a tenth)*							
centi	[c]	0.01	*(a hundred)*							
milli	[m]	0.001	*(a thousand)*							
micro	[µ]	0.000	001	*(a millionth)*						
nano	[n]	0.000	000	001	*(a thousand millionth)*					
pico	[P]	0.000	000	000	001	= 10^–12				
femto	[f]	0.000	000	000	000	001	= 10^–15			
atto	[a]	0.000	000	000	000	000	001	= 10^–18		
zepto	[z]	0 000	000	000	000	000	000	001		= 10^–21
yocto	[y]	0.000	000	000	000	000	000	000	001	= 10^–24

IMPORTANT LISTS

Table 8.4 Various Sciences

Acoustics	The study of sound and sound waves
Aerodynamics	The study of forces acting upon bodies in motion in the air (for example, aircraft, missiles, etc.)
Aeronautics	Concerned with all activities of aerial locomotion (art of flying)
Agronomy	The science of soil management and the production of field crops
Agrostology	The study of grasses
Anatomy	The science of the structure of the animal/human body learnt by dissection.

(*Continued*)

Anesthesiology	A branch of medicine concerned with administration of anesthetics and the condition of the patient while under anesthesia
Anthropology	The study of the origin and physical and cultural development of mankind
Archaeology	A scientific study of the material remains of the past as evidence of man's life, culture and history
Astronautics	A science dealing with space travel and space vehicles
Astrophysics	A branch of astronomy dealing with the physical nature of heavenly bodies
Astronomy	The science of heavenly bodies (planets)
Astrogeology	The study of structures and formation of rocks and minerals on other planets
Bacteriology	A branch of microbiology dealing with bacteria
Biology	The science of living organisms; subdivided into Botany and Zoology
Biophysics	The physics of the vital processes of living organisms
Botany	The science of the plant kingdom
Bryology	The study of mosses
Cardiology	A branch of medicine dealing with heart
Carpology	The study of fruits and seeds
Ceramics	The art of making objects from clay
Cetology	The study of acquatic mammals, especially whales
Chemistry	The study of elements, their behaviour and laws of their combination, etc.
Chorology	The study of geographical areas; plants and animal distribution
Cosmetology	The study of cosmetics and their use
Cosmology	The study of the universe—its origin, nature, structure and evolution
Craniology	The study of skulls (not to be confused with phrenology which is not a science)
Cryogenics	Concerned with the production, control and application of extremely low temperatures
Cytology	A branch of biology dealing with structure and function of cells
Cytopathology	The study of diseased cells
Dactylology	The study of fingerprints
Dermatology	A branch of medicine dealing with skin
Dietetics	The science of diet and nutrition
Ecology	The study of relationship between organisms and their environment
Entomology	Deals with study of insects
Endocrinology	The study of the body's hormone secreting glands (endocrine glands)
Etymology	A study of the origin and history of words
Genetics	A branch of biology dealing with heredity and the laws that govern it
Geology	A study of the chemical composition of the earth's crust
Gerontology	A branch of medicine studying the ageing process, problems and diseases
Gynecology	A branch of medicine dealing with female diseases of the reproductive system
Hematology	A branch of medicine studying blood and its disorders
Hematology	A branch of medicine dealing with the liver
Histology	The study of tissues

(*Continued*)

Horticulture	A branch of agricultural science dealing with flowers, fruits, vegetables, etc.
Hydrology	The science of water with reference to its occurrence and properties in the hydrosphere and atmosphere
Hygiene	A branch of medicine dealing with health and its preservation
Immunology	A branch of medicine dealing with the immune system of the body
Lithology	The study of the characteristics of rocks
Morphology	A biological study of external form and structure of living organisms and their parts
Mycology	Concerned with fungi and fungal diseases
Nephrology	A branch of medicine dealing with kidneys
Neuropathology	A branch of medicine dealing with changes produced by diseases in the nervous system
Obstetrics	A branch of medicine dealing with pregnancy, labour and child birth
Oncology	A branch of medicine dealing with tumours
Ophthalmology	A branch of medicine dealing with eyes and related diseases
Orology	The study of mountains
Ornithology	The science of birds
Orthopedics	A branch of medicine dealing with diagnosis and treatment of diseases of the skeletal system (bones)
Osteology	A study of bones
Pediatrics	A branch of medicine dealing with child diseases (infants)
Paleontology	The study of fossils and ancient life-forms
Parasitology	The science of parasites, especially those causing diseases
Pathology	A branch of medicine that deals with etiologies, mechanisms and manifestation of diseases
Pharmacology	A branch of medicine dealing with drugs, their chemistry, effects on body, etc.
Physiology	A study of the life processes of various organs of living organisms
Psychiatry	The study and treatment of mental and emotional disorders
Radiology	A branch of medical science dealing with the use of x-rays for diagnosis and treatment
Semiology	The science dealing with signs, sign language or system of signalling
Seismology	The study of earthquakes and related phenomena
Theology	The study of religions
Toxicology	A branch of pharmacology dealing with poisons and other toxic substances
Urology	The study of the physiology and pathology of the urogenital tract
Virology	The science that deals with viruses
Zoology	A branch of biology that deals with animal life
Zymology	A study that deals with the process of fermentation

Table 8.5 Scientific Instruments

Name of Instrument	*Use*
Altimeter	Measures altitude (used in aircraft)
Ammeter	Measures strength of electric current

(*Continued*)

Name of Instrument	*Use*
Anemometer	Measures force and velocity of wind and determines its direction
Audiometer	Measures intensity of sound
Barometer	Measures atmospheric pressure
Bolometer	Measures heat radiation
Calipers	Measure inner and outer diameters of solids
Calorimeter	Measures quantities of heat
Cardiogram (ECG)	Traces movements of the heart; recorded on a cardiograph
Chronometer	Determines longitude of a vessel at sea
Cytometer	Measures very low temperatures, usually below 0°C
Dynamo	Converts mechanical energy into electrical energy
Dynamometer	Measures electrical power
Electroencephalograph (EEC)	Records and interprets the electrical waves of the brain recorded on electroencephalograms
Electrometer	Measures very small, potential difference in electric current
Electroscope	Detects presence of an electric current
Endoscope	Examines internal organs of the body
Fathometer	Measures depth of the ocean
Flux meter	Measures magnetic flux
Galvanometer	Measures the electric current
Hydrometer	Measures the relative density of liquids
Hygrometer	Measures level of humidity
Hydrophone	Measures sound under water
Kymograph	Graphically records physiological movements (for example, blood pressure/heartbeat)
Lactometer	Measures the relative density of milk to determine purity (fat content)
Manometer	Measures the pressure of gases
Microphone	Converts sound waves into electrical signals
Microscope	To obtain a magnified view of small objects
Ohmmeter	Measures electrical resistance in ohms
Odometer	Measures the frequency of electromagnetic waves
Periscope	To view objects above sea level (used in submarines)
Polygraph	Instrument that simultaneously records changes in physiological processes such as heartbeat, blood pressure and respiration—used as a lie detector
Pyrometer	Measures very high temperature
Quadrant	Measures altitudes and angles in navigation and astronomy
Radar	Detects the direction and range of an approaching aeroplane by means of radiowaves (Radio, Angle, Detection and Range)
Refract meter	Measures refractive indices
Resistance Thermometer	An accurate type of thermometer in which temperature is measured by determining the electrical resistance of a coil of thin wire
Salinometer	Determines salinity of solutions
Sextant	Used by navigators to find the latitude of a place by measuring the elevation above the horizon of the sun or another star—also measures the height of distant objects

(*Continued*)

Name of Instrument	*Use*
Sphygmomanometer	Measures blood pressure
Stereoscope	Used to view two-dimensional pictures
Stethoscope	Used by doctors to hear and analyze heart and lung sounds
Stroboscope	Used to view rapidly moving objects
Tachometer	Determines speed, especially the rotational speed of a shaft (used in motor vehicles, aeroplanes and motor-boats)
Tachometer	Used to measure distances, elevations and bearings during survey
Galvanometer	Measures electric current
Telescope	Used to view distant objects in space
Theodolite	Measures horizontal and vertical angles
Tonometer	Measures the pitch of sound
Transponder	Used to receive a signal and transmit a reply immediately
Udometer	Rain gauge
Viscometer	Measures the viscosity of liquids
Voltmeter	Used to measure potential difference between two points
Wattmeter	Measures the power of an electric circuit
Wave meter	Measures the wavelength of a radiowave

Table 8.6 Scientific Inventions and Discoveries

Invention	*Inventor(s)*	*Country*	*Year*
Adding Machine	Pascal	France	1642
Airplane	Wright brothers	US	1903
Ballpoint Pen	C. Biro	Hungary	1888
Barometer	E. Torricelli	Italy	1643
Bicycle	K. Macmillan	Scotland	1839
Centigrade Scale	A. Celsius	France	1742
Cinematograph	Thomas Alva Edison	US	1891
Computer	Charles Babbage	Britain	1834
Cine Camera	Friese-Greene	Britain	1889
Cinema	A. L. and J. L. Lumiere	France	1895
Clock (mechanical)	Hsing and Ling-Tsan	China	1725
Clock (pendulum)	C. Hugyens	The Netherlands	1657
Diesel Engine	Rudolf Diesel	Germany	1892
Dynamite	Alfred Nobel	Sweden	1867
Dynamo	Michael Faraday	England	1831
Electric Iron	H. W. Seeley	US	1882
Electric Lamp	Thomas Alva Edison	US	1879
Electromagnet	W. Sturgeon	England	1823
Film (with sound)	Dr Lee de Forest	US	1923
Fountain Pen	LE Waterman	US	1884
Gas Lighting	William Murdoch	Scotland	1792
Gramophone	Thomas Alva Edison	US	1878

(*Continued*)

Invention	*Inventor(s)*	*Country*	*Year*
Jet Engine	Sir Frank Whittle	England	1937
Lift	E. G. Otis	US	1852
Locomotive	Richard Trevithick	England	1804
Machine Gun	Richard Gatling	US	1861
Match (safety)	J. E. Lundstrom	Sweden	1855
Microphone	Charles Wheatstone	England	1827
Microscope (compound)	Z. Janssen	The Netherlands	1590
Motor Car (petrol)	Karl Benz	Germany	1885
Motorcycle (tricycle)	Edward Butler	England	1884
Neon-Lamp	G. Claude	France	1910
Nylon	Dr W. H. Carothers	US	1937
Parachute	Louis Lenormand	France	1783
Photography (paper)	W. H. Fox Talbot	England	1841
Pneumatic Bicycle Tyre	J. B. Dunlop	Scotland	1888
Printing Press	J. Gutenberg	Germany	1450
Radar	Dr A. H. Taylor and L. C. Young	US	1922
Radium	Marie and Pierre Curie	France	1898
Rayon	Viscose Co.	US	1910
Razor (safety)	K. C. Gillette	US	1901
Razor (electric)	Col. J. Schick	US	1931
Refrigerator	J. Harrison and A. Catlin	Australia, US	1851
Revolver	Samuel Colt	US	1835
Rubber (vulcanized)	Charles Goodyear	US	1839
Rubber (waterproof)	Charles Macintosh	Scotland	1823
Safety Lamp	Sir Humphry Davy	England	1816
Safety Pin	W. Hunt	US	1849
Sewing Machine	B. Thimmonnier	France	1830
Scooter	G. Bradshaw	England	1919
Ship(steam)	J. C. Perier	France	1775
Ship (turbine)	Sir Charles Parsons	England	1894
Shorthand (modern)	Sir Isaac Pitman	England	1837
Spinning Frame	Sir Richard Arkwright	England	1769
Steam Engine (piston)	Thomas Newcomen	England	1705
Steam Engine	James Watt	Scotland	1782
Stainless Steel	Harry Brearley	England	1913
Submarine	D. Bushnell	US	1776
Tank	Sir Ernest Swington	England	1914
Telegraph Code	Samuel F. B. Morse	US	1837
Telephone	Alexander Graham Bell	US	1876
Telescope	Hans Lippershey	The Netherlands	1608
Television (successful demonstration)	John Logie Baird	Scotland	1926

(*Continued*)

Invention	*Inventor(s)*	*Country*	*Year*
Terylene	J. Whinfield and J. Dickson	England	1941
Thermometer	Galileo Galilei	Italy	1593
Tractor	Benjamin Holt	US	1900
Transistor	Bardeen, Shockley and Brattain	US	1947
Typewriter	C. Sholes	US	1867
Radio Valve	Sir J. A. Fleming	Britain	1904
Watch	A. L. Breguet	France	1791
X-ray	Wilhelm Roentgen	Germany	1895
Zip Fastener	W. L. Judson	US	1891

Table 8.7 Medical Discoveries

Discovery	*Made by*	*Country*	*Year*
Antibiotic(Penicillin)	Alexander Fleming	Scotland	1928
Antiseptic	Joseph Lister	Scotland	1867
Aspirin	Dr Felix Hoffmann	Germany	1899
Blood Circulation	William Harvey	Britain	1628
Blood Group	K. Landsteiner	Austria	1900–1902
Blood Transfusion	Jean-Baptiste Denys	France	1625
Cholera and TB Germs	Robert Koch	Germany	1883
Diphtheria Germs	Klebs and Loffler	Germany	1883–84
Electro cardiogram (ECG)	William Einthoven	Dutch	1903
Heart-Lung machine	John Heynsham Gibbon	US	1953
Hypodermic Syringe	Alexander Wood	Britain	1853
Heart Transplant	Christian Barnard	South Africa	1967
Kidney Machine	W. J. Kolf	The Netherlands	1944
Malaria Germs	A. Laveran	France	1880
Organ Transplant	John P. Merril	USA	1953
Scan (CAT)	Godfrey Hounsfield	England	1973
Sphygomomanometer	Scipione Riva-Rocci	Italy	1896
Stethoscope	Rene Laennec	France	1819
Thermometer (Clinical)	Sir Thomas Allbutt	England	1867
Ultrasound	Ian Donald	Ireland	1950
X-ray	W. Roentgen	Germany	1895

Table 8.8 Important Vaccines

Vaccine	*Developed by*	*Country*	*Year*
Small Pox	Edward Jenner	England	1796
Cholera	Louis Pasteur	France	1880
Diphtheria and Tetanus	Emil Adolf Von Behring and Shibasaburo Kitasato	Germany/Japan	1891

(*Continued*)

Vaccine	*Developed by*	*Country*	*Year*
TB Vaccine	Albert Calmette and Camille Guerin	France	1922
Polio Vaccine	Jonas E. Salk	US	1952
Oral Polio Vaccine	Albert Bruce Sabin	US	1955
Measles Vaccine	John F. Enders, Thomas peeble	US	1953
Rabies Vaccine	Louis Pasteur	France	1885
Typhus Vaccine	Charles Nicolle	France	1909

CHAPTER

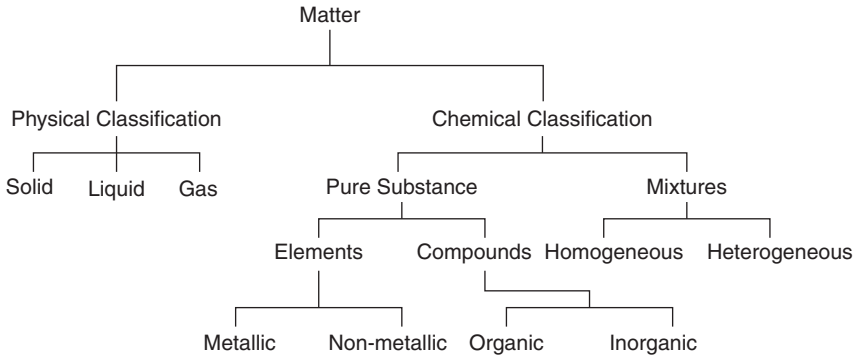
9 PHYSICS

FUNDAMENTALS OF PHYSICS

Mechanics

Matter

- Anything that occupies space and possesses weight is called matter. Matter or material substances consist of atoms and molecules. Atoms combine to form molecules of a substance.
- Matter can be perceived by one or more senses and possesses mass. Matter can neither be created nor destroyed; it can only be changed from one form to another.
- Matter exists in three states, solid, liquid and gas, each of which can change into one of the other according to changes in temperature and pressure.
- There is also a fourth state of matter, the ionized state called plasma. Though this state is not common on the earth, the sun and stars are in this state.
- Matter can be classified as shown in the figure.



Mass

- The SI unit of mass is kilogram. It is the measure of inertia possessed by a piece of matter, that is, quantity of matter in a body.
- Mass is not the same as weight, which is the force with which the earth attracts a body. Mass remains constant while the weight varies from place to place and is zero at the centre of the earth.

Weight

- Weight is the product of acceleration due to gravity and mass of the body. On the moon, a body will weigh much less than on the earth because the moon's surface gravity is only 1/6th of that of the earth.
- A pair of scales measure mass while a spring balance measures weight. Mass is measured in grams whereas weight is measured in dynes.

Density

- Density is mass per unit volume of a substance and is expressed in the S.I. unit as kg/m^3. Density of water is 1000 kg/m^3. Densities are expressed as Relative density, that is, density relative to water and sometimes called specific gravity.
- Ice floats on water because its weight is less than the weight of an equal volume of water.
- The Lactometer used to test purity (density) of milk is based on the principle that the greater density of a liquid, the lesser will be the immersion of an object.

Force

- That which makes a body change its state of rest or uniform motion in a straight line it causes objects to remain stationary to continue moving steadily or to move faster.
- *Centrifugal Force*: The force which appears to act on an object moving in a circular path.
- *Centripetal Force*: The force acting on a body constrained to move in a curved path. It acts inwards on an object moving in a circular path.
- *Illustration*: When a piece of stone tied to a thread is whirled you have to pull the thread inwards. This pull on the stone is called centripetal force and an equal and opposite force is exerted by the stone on the hand which is called centrifugal force.
- *Application*:
  —Curved rail tracks or curved roads are banked or raised on one side so that a fast moving train or vehicle leans inwards, thus providing required centripetal force to enable it to move round the curve.
  —A cyclist while turning round a curved road leans inwards so as to provide himself with the required centripetal force which enables him to take the turn.

Friction

- Friction is a force that resists the movement of one surface over another.
- Friction is very necessary because without it brakes would not work when applied; belts would not drive the wheels of a machinery, etc.
- Friction of moving parts causes wastage of energy and in such cases wheels, ball-bearings and lubricants, etc., are used to reduce friction.

Energy

- The capacity of doing work is called energy. It can exist in a number of forms. For example, mechanical, electrical, potential, chemical, kinetic, nuclear, etc.

- The energy possessed by a body owing to its position is called potential energy. For example, a wound up spring, a stretched rubber band, a bent bow or a reservoir of water.
- The energy possessed by a body due to its motion is called kinetic energy. For example, a bullet shot from a gun or water flowing in downstream.
- Energy is never lost or gained but only changes from one form to another.
- Energy can neither be created not be destroyed. This is known as Law of Conservation of Energy.

Surface Tension

- Surface tension is known to be due to intermolecular attraction in the liquid surface and these forces produce a skin effect on the surface. It is surface tension which causes water to climb up a narrow capillary phenomenon of capillary action.
- Rain drops are spherical due to surface tension. A needle may be made to float on water. This phenomenon is applicable to the capillary action of a blotting paper absorbing ink.
- The surface tension of a liquid decreases with increase in temperature and vanishes at the critical temperature.

Motion and Work

- *Motion*: Almost every event that takes place in the universe involves movement or motion of one kind or the other. Motion is the change of position of a body with respect to its surroundings.
- *Speed*: The rate of change of motion.
- *Velocity*: Commonly known as speed is the rate of change of motion in a particular direction and expressed in metres per second.
- *Acceleration*: The rate of change in velocity of a moving body expressed in metres per second square. Negative acceleration is called retardation.

Work

- When a force creates motion in a body it implies work has been done, that is, work is done by a moving force.
- It is equal to the product of the force and the distance it moves along its line of action.
- Power is the rate of doing work and Horsepower (hp) and watts are the units of power.

Elasticity

- A body that returns to its original shape and size on the removal of the deforming force after having deformed within elastic limit is called elastic.
- Contrary to the conception of elasticity in daily life, in physics it stands for opposition to change. Hence, the more rigid a body, the more elastic it is said to be. that is, why steel is more elastic than rubber.

Heat

- *Heat*: It is a form of energy which (i) raises temperature of matter; (ii) increases volume of matter and (iii) changes state and physical properties of matter and brings about chemical change
- *Latent Heat*: The heat required to change the state of a substance from solid to liquid or from liquid to gas without change in temperature.

- *Temperature*: The degree of heat of a body/substance which can be measured by various scales like Centigrade, Fahrenheit or Reaumur.

Evaporation

- Is the change of state from liquid to vapour and thereby results in cooling. Rate of evaporation is affected by wind, heat and surface area.
- *Illustration*: When alcohol is applied on the forehead of a person having high temperature, the temperature reduces because alcohol while evaporating draws the heat out of the body.

Transfer of Heat

- *Conductivity*: A property enjoyed by metals. The process of heat transfers without visible motion of the atoms or molecules from a region of higher temperature to that of lower temperature. It is the transmission of heat from molecule to molecule. Among metals, silver is the best conductor followed by copper.
- *Why are Metals Good Conductors?* In metals there are a large number of free electrons which transport major amount of heat and move from hotter part of the solid to the colder part transporting heat energy.
- *Illustration*: In winter a steel chair appears colder than a wooden chair because steel being a good conductor of heat when touched absorbs heat from the hand rapidly giving the feeling of coldness.
- Metals are good conductors while gas and air are poor conductors. Hence,
  —Two thin blankets are warmer as they enclose air in between a new quilt is warmer than an old one because it encloses more air.
  —Eskimos make double-walled ice houses and the air in between two ice walls does not allow heat to pass.
  —A thermos flask is made of double-walled glass bottles.

Radiation

- Transmission of heat from one point to another without heating the medium, that is, transmission of heat by means of waves without the help of a medium.
- Polished surfaces are the best radiators of heat. Therefore
  —The double-walled glass bottles used in a thermos flask have a silver coating—outside the inner wall and inside the outer wall.
  —White clothes are preferred in summer. On the other hand, radiation is greater from black surfaces which are very good absorbers of heat. Hence,
  —It is warmer on a cloudy night because the heat radiated by earth is obstructed and sent back to the atmosphere.

Convection

- It transmits the heat of heated matter, that is, by actual motion of the heated particles of a liquid or gas.
- Ventilators in a room are on the top portion of the walls because air after being heated rises upwards and passes through the ventilators and cold-air enters the room through doors and windows which are at lower levels.

Laws of Thermodynamics

- These laws show how heat energy can be passed from one body to another.
  1. *Zeroth Law*: No heat will flow between two bodies that are of the same temperature. In other words, a body's temperature does not depend on the material involved.
  2. *First Law*: Internal energy can be added to a body either by heating or doing work on it and conversely, if work is extracted from the body, its internal energy and hence its temperature will fall unless an equivalent amount of heat is supplied from outside.
  3. *Second Law*: Heat will not pass spontaneously from a cold body to a hotter body.
  4. *Third Law*: It is impossible to cool a body right down to absolute zero, that is, below –273.15°C.

Light

- Light is an electromagnetic radiation that has a wavelength in about the range of 380–780 nm and that may be perceived by the normal unaided human eye.
- It is a form of energy which travels in straight lines and causes the sensation of vision.
- If we interpose a small obstacle between the object and our eyes we are unable to see it. Formation of shadows is another proof of the fact that light travels in straight line.

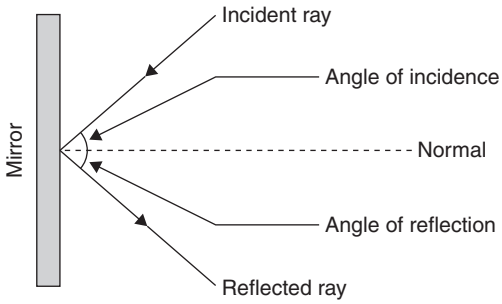
Composition

- In 1666, Isaac Newton passed a beam of light through a prism and found that it has seven colours. They are
  1. Violet
  2. Indigo
  3. Blue
  4. Green
  5. Yellow
  6. Orange
  7. Red
- The band of colours so formed is called a spectrum in which violet and red bands form the extremes.
- *Colour Visualization*: Different objects have different colours—they absorb or reflect different parts of the spectrum. Thus, a blue object absorbs the red, yellow and green parts of white light and reflects only the colour blue.
- The colour of an object depends upon the nature of light falling on it and also on the constituent colour of the incident light reflected by it.
- If all the colours are absorbed the object appears black. It all the colour constituents of light are reflected, it appears white.
  —A stick immersed in water appears bent.
  —A pond looks shallower than it really is as the rays start from rarer to denser medium, the rays bend towards the normal.
  —A diamond sparkles because when light enters a piece of diamond and the cut of its faces the light is totally refracted to various faces of the diamond, as diamond has a high refractive index.
  —A person looks shorter when he is standing in water and if we look at him from a side.
  —A stone lying at the bottom of pond appears to be at a higher point than it actually is.

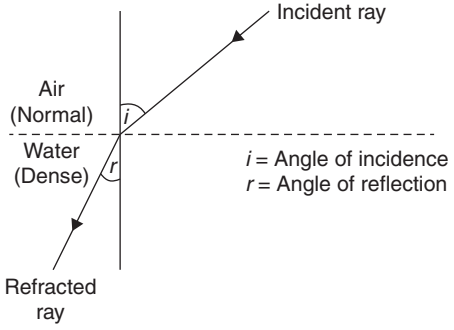
- Thus, we see objects because of the light they reflect. Most of the objects around us reflect only part of the light that is, incident upon them and it is the reflected part which gives the object its colour.
- When a rose is viewed in white light, it appears red and the leaves appear green, because the petals reflect the red part and the leaves green part. The remaining colours are absorbed.
- When the same rose is viewed in green light, the petals will appear black and the leaves green.
- In blue or yellow light both the petals and leaves will appear black.
- A white paper appears white because it reflects all the colours of light, whereas a print on it appears black because it absorbs all the colours.
- In red light green grass will appear black because it absorbs all colours except green and it would absorb the red rays of light falling on it.

Phenomenon of Light

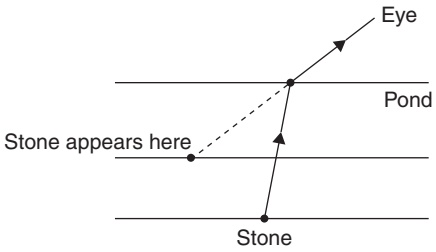
- *Reflection*: It is the 'bouncing back' of light rays. The simple law of reflection is that the angle between the incoming ray and the perpendicular to the surface is equal to the angle between the reflected ray and the same perpendicular.



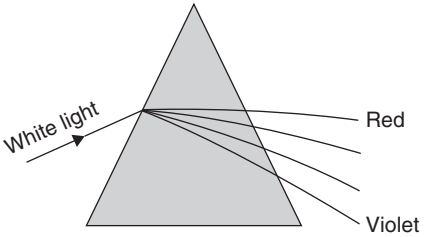
- *Refraction*: It is the sudden change of direction of light when passing from one transparent substance into another. For example, a ray of light passing from air into water bends towards the perpendicular.



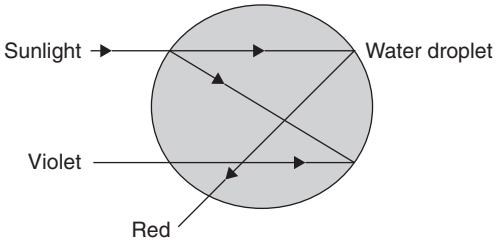
- The reason why stone at the bottom of the pond looks to be little raised up is because of refraction of ray of light as shown below.



- *Diffraction*: Diffraction is the spreading out of waves of light as it passes through a narrow aperture because light is a wave of motion. Hence, light rays emerging from a cinema machine spread wide on the screen.
- *Dispersion*: When white light is passed through glass prism, it is split into the colours of the spectrum. This is because each colour has its own wavelength which determines the angle at which light is refracted. Red and yellow waves are the longest and hence are the least refracted. Blue and violet rays are shortest and are the most refracted (See illustration).



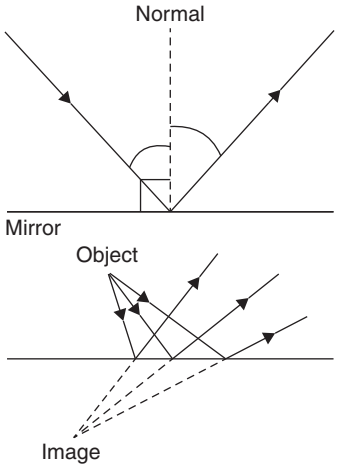
- *Rainbow*: The most spectacular illustration of dispersion is the rainbow. When the sun shines after a shower, a rainbow is seen in the sky opposite the sun. The colours of the rainbow are due to the dispersion of sunlight by water droplets suspended in the air.



- *Scattering*: A rough surface scatters light because each part of the surface reflects the light at different angles which is known as scattering of light.
- *Why Is the Sky Blue*? Violet and blue light have short wavelength and are scattered by the atmosphere ten times more than red light waves. While the red light with long wave length goes almost straight through the atmosphere, blue and violet are scattered by particles in the atmosphere. Thus we see a blue sky.
- *Absorption*: Some surfaces absorb more of the light falling on them than others. If light of all colours is absorbed, the eyes see black. A black surface absorbs more light than a white surface.

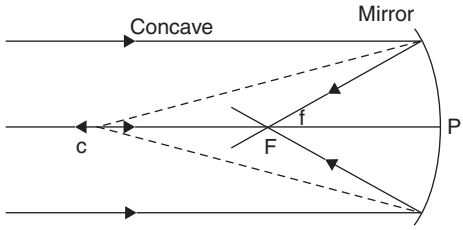
Mirrors

- *Plane Mirror*: Mirrors work on the principle of reflection of light. When a man stands in front of mirror, light from all parts of the body, light which is reflected from the body in the presence of a source of light is reflected from the mirror back to the eyes and a virtual image appears to be formed behind the mirror.

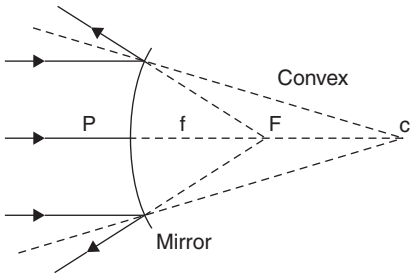


- *Some Important Definitions*
  —*Real Image*: It is one through which the rays of light actually pass and which can be formed on a screen.
  —*Virtual Image*: It is one through which the rays do not actually pass although they appear to come from it.
- A consequence of the laws of reflection is that, for a real object, the image produced by a plane mirror is virtual and its distance behind the mirror is the same as the object's distance in front of it.
  —*Uses of Plane Mirrors*: Optical level, sextant, kaleidoscope, periscope, telescope flat, dental mirror.
  —*Curved Mirrors*: There are two types of curved mirrors used for specific purposes, namely, concave and convex.

— *Concave Mirrors*: In concave mirrors the light rays are reflected so as to converge to a point called the focus of the mirror. A concave mirror can therefore, concentrate sun's radiation falling on it at one point. Hence, a concave mirror can be used as a burning glass and is used in solar cookers.



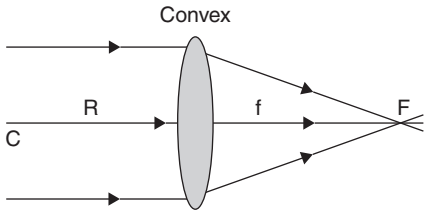
— *Convex Mirrors*: The virtual images produced by convex mirror are erect and smaller than the object. The convex mirror is therefore used as a rear-view mirror in vehicles as it has the advantage of a wide field of view.



— *Principal Axis*: It is a line through the centre of the mirror which passes through the centre of curvature.
— *Pole of a Mirror (P)*: It is where the principal axis meets the mirror.
— *Principal Focus (F)*: It is the point where parallel light close to the axis converges to a focus.
— *Focal Length (f)*: It is the distance from the principal focus to the pole of the mirror.
— *Centre of Curvature (c)*: It is the centre of curvature of the mirror surface.
— *Radius of Curvature*: It is the distance of the centre of curvature from the pole of the mirror.
— *Paraxial Ray*: It is one that lies close to the principal axis and may make a small angle with it.
— *Uses of Concave Mirrors*: Reflecting telescope, dental mirror, headlamp reflectors, shaving and make-up mirrors.
— *Uses of Convex Mirrors*: Safety viewers at dangerous corners, anti-shop-lifting devices, car wing mirrors.

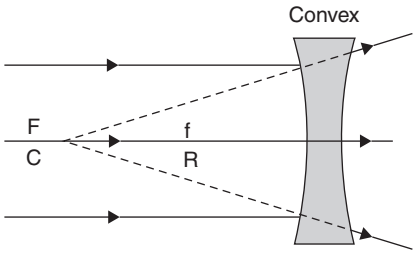
Lenses

- Lenses are used in all optical instruments like microscopes, telescopes, cameras, projectors, etc. Lenses are of the two types:
  1. *Convex or Converging Lens*: If a parallel beam of light is incident on a convex lens, all rays, after passing the lens, converge on a point called the principal focus. Convex lens surfaces have a real and therefore positive radius of curvature. It has a real and positive focal length.



  — *Uses of Convex Lenses*: Magnifying glasses, eye (variable focal length), glasses to correct for long sight, microscope, telescope objective, camera (single lens system), Projectors.

  2. *Concave or Diverging Lens*: In case of a concave lens, the rays of light spread out after passing through the lens. Concave lens su faces have a virtual and therefore, negative radius of curvature. It has a real and positive focal length.



  — *Uses of Concave Lenses*: Wide-angle spyhole in doors, glasses to correct for short sight, wide-angle lens on coach rear window, eye lens in Galilean telescope.

  — *Power of the Lens*: The strength of a lens is described in terms of either its focal length or its power. The power of a lens is defined as:

$$\text{Power of the lens} = \frac{1}{\text{focal lenght in metres}}$$

- Convex lenses have positive power while concave lenses have negative powers. The power of a meniscus lens depends on which face of the lens is the more sharply curved.

Sound

- Source of sound is always the vibrations of an object. It is transmitted in the form of waves with alternating increase and decrease in pressure.
- *Characteristics*: (i) Pitch or frequency; (ii) Loudness or intensity and (iii) Quality. On the basis of these characteristics sound can be recognized as we recognize a person from his voice.
- *Pitch*: Refers to the rate of vibration of sound and is measured in Hertz (Hz).
- *Loudness*: It is measured in decibels (db), a unit based on the weakest sound that can be detected by the human ear.

Phenomena Related to Sound

- *Diffraction*: Like light, sound waves spread as they move past an obstacle or through a narrow aperture. If the aperture is small, the sound waves spread out in all directions. Hence, sound can be heard round the corners of a corridor.
- *Reflection*: Deflection of sound waves into new directions by a surface is known as 'reflection of sound'.
- *Refraction*: is the change of direction of a sound wave on passing from one medium to another.
- *Echo*: Repetition of sound by reflection is known as echo.
- *Oscillation*: The term used to describe anything that vibrates.

Sound Waves and Music

- Sound is generated by a vibrating system setting up waves in the surrounding air.
- Musical sounds are produced by a vibration with a definite pitch often produced by a vibrating string (for example, sitar) or a vibrating column of air in a tube (for example, sehnai) which does not progress from one point to another but causes the string or column of air to vibrate as a whole with its characteristic frequency.

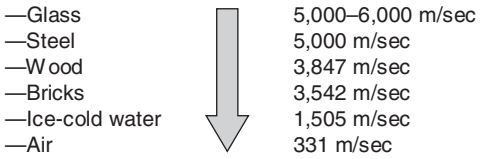
Ultrasonic and Supersonic Sounds

- Sounds of frequency higher than 20,000 Hz are known as *ultrasonic* and are inaudible.
- The human ear is normally sensitive to sounds whose frequencies are between 16 Hz and 20,000 Hz.
- The speed greater than the speed of sound is known as *supersonic*.
- The sound waves of frequency lower than 16 Hz are called *infrasonic*.

How Do Bats Fly at Night?

- Bats can fly in the dark because ultrasonic waves produced by them during flying are reflected back to them from the obstacles in their way and hence they can fly without difficulty.

Speed of Sound in Different Media



Speed of Sound

- The speed of sound depends upon the nature of the carrier media.
- In general the speed of sound refers to the speed at which sound travels in air at sea level.
- In dry air at 0°C the speed of sound is about 331 m/sec or 750 miles/h.
- The presence of water vapours in the air increases the speed of sound slightly.

Electricity

- It is a form of energy which is made from the charges that make up the atom—negatively-charged electrons and positively charged protons.

Electric Current

- Electric current is the rate of flow of an electrical charge. It flows from positive to negative.
- Batteries supply direct current (DC) and the mains supply alternating current (AC).
- The ratio and TV require DC and this is obtained from AC mains by means of a rectifier which converts AC into DC.

Heating Effect of Electricity

- When electricity is passed through thin metallic wires of high resistance, they become hot and glow. Metals like platinum or tungsten offer resistance to the passage of electric current. They become white, hot and glow and light is produced by the electric current. The filament of electric bulbs and heater elements is made of such metals which have high resistance.

Fuse Wire

- Fuse wire is made of material having low melting point. If it is inserted in an electric circuit, it will not allow excess electricity to flow through it. When current exceeds its limit, the fuse wire gets heated, melts and breaks the circuit.

Magnetic Effect of Electricity

- It is a phenomenon by which magnetic field is produced by an electric current. A linear current carrying conductor produces a circular magnetic field and a circular current (in a coil) produces a straight magnetic field at the centre of the circular coil.

Types of Electricity

- *Static Current*: It is the electricity produced by friction or rubbing between two dissimilar objects.
- Depending on the nature of the objects, one acquire a positive charge and the other negative charge because of transfer of electrons. For example, when a glass rod is rubbed with a silk cloth, some electrons from the rod are transferred to the silk cloth. Thus, by losing electrons the glass rod becomes positively charged and by gaining the number of electrons the silk acquires an equal negative charge.
- Similarly by rubbing an ebonite comb on hair a magnetic property is produced which can attract small pieces of paper.

- *Current Electricity*: It is the electricity which brings light and power to our homes. It is of two types:
  1. Alternating Current (A.C.) which regularly reverses its direction around the circuit.
  2. Direct Current (D.C.) travels without reversing its direction.

Household Wiring System

- In household wiring systems, the various electrical devices are connected in parallel across the power line, which consists of a pair of conductors, one 'hot' and the other 'neutral'. An additional 'ground' wire is included for safety.
- The maximum permissible current in a circuit is determined by the size of the wires and the maximum temperature they can tolerate. Protection against excessive current and the resulting fire hazard is provided by fuses or circuit breaker.

Magnetism

Magnets

- It is a substance which has the property of attracting pieces of iron, cobalt and nickel and when freely suspended it points towards north and south.
- The attracting power of a magnet appears to be concentrated at definite regions called poles.
- When a magnet is broken into pieces, each piece becomes an independent magnet. Two poles of the magnet have equal strength. Like poles repel and unlike poles attract each other.

Types of Magnets

1. *Artificial Magnets*: These magnets are created by artificial means.
2. *Lodestones*: Iron ore (minor) which we know as magnetite (iron oxide) has magnetic properties of attracting iron, cobalt and nickel. These are called Lodestones.

Types of Magnetic Substances

1. *Ferro-Magnets*: These are special substances which are strongly magnetized by relatively weak magnetic fields. Iron, nickel and cobalt are the familiar examples of this class.
2. *Paramagnetic Substances*: These substances when placed in a strong magnetic field get magnetized in the same sense as the external field. Aluminium, chromium, copper sulphate and liquid oxygen are familiar examples.
3. *Diamagnetic Substances*: These substances when placed in a magnetic field get weakly magnetized in a sense opposite to the applied field. Examples are bismuth, atimony, gold, water, alcohol and hydrogen.

Magnetic Induction

- When a piece of soft iron or steel is brought close to strong bar magnet it is magnetized.
- When an electric current is passed through an insulated copper wire coil the steel or soft iron placed in the coil becomes a magnet.
- This is due to the magnetic field which is produced in the coil. The electric bell works on the above mentioned principle.

Magnetic Field of Earth

- Earth has its own magnetic field also known as geomagnetic field is similar to the field produced by a huge magnet at its centre. It is a fact of some historical importance because of the role of magnetic compass in explorations of the planet.
- The shape of the Earth's magnetic field resembles that of a bar magnet of length one-fifth of the Earth's diameter buried at its center.
- The South Pole of the Earth's magnet is in the geographical North because it attracts the North Pole of the suspended magnet and vice versa. Thus, there is a magnetic S-pole near the geographical North and a magnetic N-pole near the geographical South.
- The positions of the Earth's magnetic poles are not well defined on the globe; they are spread over an area.
- The axis of Earth's magnet and the geographical axis do no coincide. The axis of the Earth's magnetic field is inclined at an angle of about 15º with the geographical axis.
- Due to this a freely suspended magnet makes an angle of about 15º with the geographical axis and points only approximately in the North-South directions at a place. In other words, a freely suspended magnet does not show exact geographical South and North because the magnetic axis and geographical axis of the Earth do not coincide.
- *Cause of Earth's Magnetism*: It is now believed that the Earth's magnetism is due to the magnetic effect of current which is flowing in the liquid core at the centre of the Earth. Thus, the Earth is a huge electromagnet.
- *Elements of Earth's Magnetic Field*: To understand the Earth's magnetic field at any place, we should know the following two quantities or elements: (i) Declination and (ii) Angle of dip (or Inclination).
- It is well known that the axis of the magnetic field is tipped with respect to the rotation axis of the Earth.
- Thus, true north (defined by the direction to the north rotational pole) does not coincide with magnetic north (defined by the direction to the north magnetic pole) and compass directions must be corrected by fixed amounts at given points on the surface of the Earth to yield true directions.
- *Angle of Dip at the Poles*: The magnetic lines of force at the poles of Earth are vertical due to which the magnetic needle becomes vertical. The angle of dip at the magnetic poles of Earth is 90º.
- *Angle of Dip at the Equator*: The lines of force around the magnetic equator of the Earth are perfectly horizontal. So the magnetic needle will become horizontal there. Thus, the angle of dip at the magnetic equator of the Earth will be 0º. The angle of dip varies from place to place.

IMPORTANT LAWS OF PHYSICS

Archimedes' Principle

- States that when a body is partially or totally immersed in a fluid, it experiences an upward thrust equal to the weight of the fluid displaced by it, that is, its apparent loss of weight is equal to the weight of liquid displaced.
- The principle was discovered in 3rd century B.C. by the Greek mathematician, Archimedes.

Avagadro's Law

- Equal volumes of all gases under the same conditions of temperature and pressure contain equal number of molecules.
- It was an inspired guess in 1811 by the Italian Scientist Amedeos Avagadro that turned out to be correct.

Newton's Laws (1642–1727)

- *Law of Gravitation*: Objects attract each other with a force directly proportional to the product of the masses of the objects and inversely proportional to the square of the distance between them. Hence, for objects on or near the earth, the mass of the earth is very much greater than the object and so the gravitational force between them makes objects fall towards the earth. that is, why lead and feather fall at the same rate in a vacuum.
- *Newton's First Law of Motion*: A body continues in its state of rest or of uniform motion in a straight line except in so far as it be compelled by external impressed forces to change that state. It is also called Law of Inerti§
- *Newton's Second Law of Motion*: The rate of change of momentum is proportional to the impressed force and takes place in the direction of the straight line in which the force acts. In other words 'Force is equal to mass multiplied by acceleration'.
- *Newton's Third Law of Motion*: To every action there is an equal and opposite reaction. This is the principle behind the recoil felt on pulling the trigger of a gun.
- *Newton's Law of Cooling*: The rate at which a body cools or loses its heat to its surroundings is proportional to the excess of mean temperature of the body over that of the surroundings, provided this temperature excess is not too large.

Coulomb's Law (1738–1806)

- The force between the two electric charges reduces to a quarter of its former value when the distance between them is doubled.
- The SI unit of the electrical charge, coulomb is named after Charles Augustin de Coulomb who established the law.

Stefan's Law (1835–1883)

- The total energy radiated from a black body is equal to the fourth power of its absolute temperature.

Pascal's Law (1623–1662)

- When pressure is applied to a fluid, the pressure change is transmitted to every part of the fluid without loss.
- Hydraulic machines like the hydraulic press work on this principle.
- Atmospheric pressure decreases with increase in height.
- The SI unit of pressure, pascal is named after Pascal who established this law.

Hooke's Law (1635–1703)

- States that the extension of a spring is proportional to the tension stretching it. Doubling of the tension results in the doubling of the amount of stretch.

Lenz's Law (1805–1865)

- States that when an electric current is induced by a change in magnetic field, the induced current is always in such a direction that its magnetic field opposes the change of field which causes the induction.

Dalton's Law (1766–1844)

- States that the total pressure of a mixture of gases (or vapours) is equal to the sum of the partial pressures of its components, that is, the sum of the pressures that each component would exert if it were present alone and occupied the same volume as the mixture.
- In 1803, Dalton formulated his atomic theory stating that matter is made up of particles or atoms which are not subdivided during chemical change.
- It said that atoms of the same chemical element are similar and equal in weight, that atoms of different elements have different properties and different weights and that chemical compounds are formed when atoms of different elements combine in simple proportions.

Faraday's Laws (1791–1867)

- *Law of Electrolysis*: The amount of chemical change during electrolysis is proportional to the charge passed. The masses of substances liberated or deposited by the same quantity of electric charge are proportional to their chemical equivalents.
- *Law of Electromagnetic Induction*: An electromagnetic flux is induced in a conductor when the magnetic field surrounding it changes. The magnitude of the electromagnetic flux is proportional to the rate of the change of the field. The direction of the induced electromagnetic flux depends on the orientation of the field.

Ohm's Law (1787–1854)

- States that the amount of current flows in an electric circuit is governed by the voltage of the battery or dynamo which powers it.
- In other words, the current through a conductor is directly proportional to the potential difference across the conductor and inversely proportional to its resistance.
- The SI unit of electrical resistance, the ohm is named after George Simon Ohm, who established this law.

FREQUENTLY ASKED QUESTIONS

Q. Why does a balloon filled with hydrogen rise in the air?

§ Weight of hydrogen is less than the weight of air displaced by it. In balloons hydrogen is normally filled because it is lighter than air.

Q. Why do we lean forward while climbing a hill?

§ In order to keep the vertical line passing through our centre of gravity always between our feet, which is essential to attain equilibrium or stability.

Q. Eskimos live in double-walled ice houses. Why?

§ Because the air in between two ice walls does not allow heat to pass.

Q. Curved rail tracks or curved roads are banked or raised on one side. Why?

§ Because a fast moving train or vehicle leans inwards while taking turn and the banked or raised track provides required centripetal force to enable it to move round the curve.

Q. How do bats fly in dark?

§ When bats fly they produce ultrasonic sound waves which are reflected back to them from the obstacles in their way and hence they can fly without difficulty.

Q. Water pipes often burst at hill stations on cold frosty nights. Why?

§ The temperature may fall below 0°C during cold frosty nights which converts the water inside the pipes into ice, resulting in an increase in volume. This exerts great force on the pipes and as a result, they burst.

Q. Why does smoke curl up in the air?

§ Smoke contains hot gases which being lighter in weight, follows a curved path because of the eddy currents that are set up in the air.

Q. Why does an electric bulb explode when it is broken?

§ The bulb encompasses partial vacuum and as it breaks, air rushes in causing a small explosion.

Q. Why does a man fall forward when he jumps out of a running train or bus?

§ He is in motion while in the train or bus. When he jumps out, his feet comes to rest while touching the ground but his upper portion which is still in motion propels him forward.

Q. Why is one's breath visible in winter but not in summer?

§ In winter, water vapour contained in the breath condenses into small droplets which become visible but in summer they are quickly evaporated and not seen.

Q. Why doesn't the electric filament in an electric bulb burn up?

§ Firstly, because it is made of tungsten which has a very high melting point (3410°C) whereas the temperature of the filament required to glow is only 2700°C. Secondly, oxygen is absent since the bulb is filled with an inert gas which does not help in burning.

Q. Why does blotting paper absorb ink?

§ Blotting paper has fine pores which act like capillaries. When a portion of blotting paper is brought in contact with ink, ink enters the pores due to surface tension (capillary action of liquids) and is absorbed.

Q. Why does a small ball of iron sink in water but a large ship float?

§ The weight of water displaced by an iron ball is less than its own weight, whereas water displaced by the immersed portion of a ship is equal to its weight (Archimedes' Principle).

Q. Why does ice float on water?

§ The weight of the ice block is equal to the weight of the liquid displaced by the immersed portion of the ice.

Q. A man with a load jumps from a high building. What will be the load experienced by him?

§ Zero, because while falling, both the man and the load are falling at the same acceleration that is, acceleration due to gravity.

Q. A piece of chalk when immersed in water, emits bubbles. Why?

§ Chalk consists of pores forming capillaries. When it is immersed in water, the water begins to rise in the capillaries and air present there is expelled in the form of bubbles.

Q. Why does a liquid remain hot or cold for a long time inside a thermos flask?

§ The presence of air, a poor conductor of heat, between the double glass wall of a thermos flask, keeps the liquid hot or cold inside a flask for a long time.

Q. Why does a ball bounce upon falling?

§ When a ball falls, it is temporarily deformed. Because of elasticity, the ball tends to regain its original shape for which it presses the ground and bounces up (Newton's Third Law of Motion).

Q. Why is standing in boats or double decker buses not allowed, particularly in the upper deck of buses?

§ On tilting the centre of gravity of the boat or bus is lowered and it is likely to overturn.

Q. Why is it recommended to add salt to water while boiling dal?

§ By addition of salt, the boiling point of water gets raised which helps in cooking the dal sooner.

Q. Why is the boiling point of sea water more than that of pure water?

§ Sea water contains salt and other impurities which cause an elevation in its boiling point.

Q. Why is it easier to spray water to which soap is added?

§ Addition of soap decreases the surface tension of water. The energy for spraying is directly proportional to surface tension.

Q. Which is more elastic, rubber or steel?

§ Steel is more elastic for the same stress produced compared with rubber.

Q. Why is the sky blue?

§ Violet and blue light have short waves which are scattered more than red light waves. While red light goes almost straight through the atmosphere, blue and violet light are scattered by particles in the atmosphere. Thus, we see a blue sky.

Q. Why does ink leak out of partially filled pen when taken to a higher altitude?

§ As we go up, the pressure and density of air goes on decreasing. A partially filled pen leaks when taken to a higher altitude because the pressure of air acting on the ink inside the tube of the pen is greater than the pressure of the air outside.

Q. On the moon, will the weight of a man be less or more than his weight on the earth?

§ The gravity of the moon is one-sixth that of the earth; hence the weight of a person on the surface of the moon will be one-sixth of his actual weight on earth.

Q. Why do some liquids burn while others do not?

§ A liquid burns if its molecules can combine with oxygen in the air with the production of heat. Hence, oil burns but water does not.

Q. Why can we see ourselves in a mirror?

§ We see objects when light rays from them reach our eyes. As mirrors have a shiny surface, the light rays are reflected back to us and enter our eyes.

Q. Why does a solid chunk of iron sink in water but float in mercury?

§ Because the density of iron is more than that of water but less than that of mercury.

Q. Why is a new quilt warmer than an old one?

§ In a new quilt the cotton is not compressed and as such it encloses more air which is bad conductor of heat. Therefore, it does not allow heat to pass.

Q. Why are white clothes more comfortable in summer than dark or black ones?

§ White clothes are good reflectors and bad absorbers of heat, whereas dark or black clothes are good absorbers of heat. Therefore, white clothes are more comfortable because they do not absorb heat from the sun rays.

Q. Why does a rose appear red and grass green in daylight?

§ Rose absorbs all the constituent colours of white light except red which is reflected to us. Similarly, grass absorbs all colours except green which is reflected to us.

Q. Why does a ship rise as it enters the sea from a river?

§ The density of sea water is high due to impurities and salts compared to river water. As a result, the upthrust produced by the sea water on the ship is more than that of river water.

Q. Why is cooking quicker in a pressure cooker?

§ As the pressure inside the cooker increases, the boiling point of water is raised, hence, the cooking process is quicker.

Q. When wood burns, it crackles. Explain?

§ Wood contains a complex mixture of gases and tar forming vapours trapped under its surface. These gases and tar vapours escape, making a crackling sound.

Q. Why do stars twinkle?

§ The light from a star reaches us after refraction as it passes through various layers of air. When the light passes through the earth's atmosphere, it is made to flicker by the hot and cold ripples of air and it appears as if the stars are twinkling.

Q. Why is it easier to roll a barrel than to pull it?

§ Because the rolling force of friction is less than the dynamic force of sliding friction.

Q. If a feather, a wooden ball and a steel ball fall simultaneously in a vacuum which one of these would fall faster?

§ All will fall at the same speed in vacuum because there will be no air resistance and the earth's gravity will exert a similar gravitational pull on all.

Q. When a man fires a gun, he is pushed back slightly. Why?

§ As the bullet leaves the nozzle of the gun's barrel with momentum in a forward direction as per Newton's Third Law of Motion, the ejection imparts to the gun an equal momentum in a backward direction.

Q. Ice wrapped in a blanket or saw dust does not melt quickly. Why?

§ Both wood and wool are bad conductors of heat. They do not permit heat rays to reach the ice easily.

Q. Why do we perspire on a hot day?

§ When the body temperature rises, the sweat glands are stimulated to secrete perspiration. It is nature's way to keep the body cool. During the process of evaporation of sweat, body heat is taken away, thus, giving a sense of coolness.

Q. Why does ice float on water but sink in alcohol?

§ Because ice is lighter than water it floats on it. However, ice is heavier than alcohol and therefore it sinks in alcohol.

Q. Why do we perspire before rains?

§ Before the rain falls, the atmosphere gets saturated with water vapour, as a result, the process of evaporation of sweat is delayed.

Q. Why does a thermometer kept in boiling water show no change in reading after 100°C?

§ The boiling point of water is 100°C. Once water starts boiling at this temperature, thermometer records no change in temperature. The quantity of heat supplied is being utilized as latent heat of evaporation to convert the water at boiling point into vapour.

Q. Why do we bring our hands close to the mouth while shouting across to someone far away?

§ By keeping hands close to mouth the sound is not allowed to spread (phenomenon of diffraction of sound) in all directions but is directed to a particular direction and becomes louder.

Q. Why does a corked bottle filled with water burst if left out on a frosty night?

§ Because of low temperature the water inside the bottle freezes. On freezing it expands, thereby its volume increases and pressure is exerted on the walls.

Q. Why is a small gap left at the joint between two rails?

§ To permit expansion of rails due to heat generated by friction of a moving train.

Q. Why cannot a copper wire be used to make elements in electric heater?

§ Copper melts at l08.3°C and forms a black powder on reacting with atmospheric oxygen. For heater elements a metal should have more resistance to produce heat.

Q. Why are water or mercury droplets always round when dropped on a clean glass?

§ The surface of a liquid is the seat of a special force as a result of which molecules on the surface are bound together to form something like a stretched membrane. They tend to compress the molecules below to the smallest possible volume which causes the drop to take a round shape as for a given mass the sphere has minimum volume.

Q. Why does an ordinary glass tumbler crack when very hot tea or milk is poured in it?

§ When a hot liquid is poured into a tumbler, the inner layer of the tumbler gets heated, it expands before the outer layer and an unequal expansion of both layers causes the tumbler to crack.

Q. Why is a compass used as an indicator of direction?

§ The magnetic needles of a compass under the influence of the earth's magnetic field lie in a north-south direction. Hence, we can identify direction.

Q. Why is water from a hand pump warm in winter and cold in summer?

§ In winter the outside temperature is lower than that of water flowing out of the pump and therefore, the water is warm. Whereas, in summer, the outside temperature is higher than the water of the pump and therefore, it feels cold.

Q. Why is a rainbow seen after a shower?

§ After a shower the clouds containing water droplets act like a prism through which the white light is dispersed producing a spectrum.

Q. Why does a swimming pool appear less deep than it actually is?

§ The rays of light coming from the bottom of the pool pass from a denser medium (water) to a rarer medium (air) and are refracted (bend away from the normal). When the rays return to the surface they form an image of the bottom of the pool at a point which is little above the real position.

Q. Why does moisture gather outside a tumbler containing cold water?

§ The water vapour in the air condenses on cooling and appears as droplets of water.

Q. Why does kerosene float on water?

§ Because the density of kerosene is less than that of water. For the same reason cream rises in milk and floats at the top.

Q. Why is the water in an open pond cool even on a hot summer day?

§ As the water evaporates from the open surface of a pond, heat is taken away in the process, leaving the surface cool.

Q. Why is it less difficult to cook rice or potatoes at higher altitudes?

§ Atmospheric pressure at higher altitudes is low and boils water below 100°C. The boiling point of water is directly proportional to the pressure on its surface.

Q. Why is it difficult to breathe at higher altitudes?

§ Because of low air pressure at higher altitudes the quantity of air is less and so also that of oxygen.

Q. Why are winter nights and summer nights warmer during cloudy weather than when the sky is clear?

§ Clouds being bad conductors of heat do not permit radiation of heat from land to escape into the sky. As this heat remains in the atmosphere, the cloudy nights are warmer.

Q. Why is a metal tyre heated before it is fixed on wooden wheels?

§ On heating, the metal tyre expands by which its circumference also increases. This makes fixing the wheel easier and thereafter cooling down shrinks it; thus fixing the tyre tightly.
more than that of river water.

Q. Why are fuses provided in electric installations?

§ A safety fuse is made of a wire of metal having a very low melting point. When excess current flows in, the wire gets heated, melts and breaks the circuit. By breaking the circuit it saves electric equipment or installations from damage by excessive flow of current.

Q. Why is it easier to lift a heavy object under water than in air?

§ Because when a body is immersed in water, it experiences an upward thrust (Archimedes' Principle) and loses weight equal to the weight of the water displaced by its immersed portion and hence, is easier to lift objects.

Q. If a highly pumped up bicycle tyre is left in the hot sunlight, it bursts. Why?

§ The air inside the tube increases in volume when heated up. As sufficient space for the expansion of the air is not available because the tube is already highly pumped, it may result in bursting of the tyre.

Q. What will be the colour of green grass in blue light?

§ Grass will appear dark in colour because it absorbs all other colours of the light except its own green colour. The blue light falling on grass will be absorbed by it and hence, it will appear dark in colour.

Q. Why do two eyes give better vision than one?

§ Because two eyes do not form exactly similar images and the fusion of these two dissimilar images in the brain gives three dimensions of the stereoscopic vision.

Q. Why is it easier to swim in the sea than in a river?

§ The density of sea water is higher; hence the upthrust is more than that of river water.

Q. Who will possibly learn swimming faster—a fat person or a thin person?

§ The fat person displaces more water which will help him float much more freely compared to a thin person.

Q. Why is a flash of lightening seen before thunder?

§ Because light travels faster than sound, it reaches the earth before the sound of thunder.

Q. Why cannot a petrol fire be extinguished by water?

§ Water, which is heavier than petrol, slips down permitting the petrol to rise to the surface and continue to burn. Besides, the existing temperature is so high that the water poured on the fire evaporates even before it can extinguish the fire. The latter is true if a small quantity of water is poured.

Q. Why does water remain cold in an earthen pot?

§ There are pores in an earthen pot which allow water to percolate to the outer surface. Here evaporation of water takes place thereby producing a cooling effect.

Q. Why do we place a wet cloth on the forehead of a patient suffering from high temperature?

§ Because of body's temperature, water evaporating from the wet cloth produces a cooling effect and brings the temperature down.

Q. When a needle is placed on a small piece of blotting paper which is placed on the surface of clean water, the blotting paper sinks after a few minutes but the needle floats. However, in a soap solution the needle sinks. Why?

§ The surface tension of clean water being higher than that of a soap solution, it can support the weight of a needle due to its surface tension. By addition of soap, the surface tension of water reduces, thereby resulting in the sinking of the needle.

Q. To prevent multiplication of mosquitoes, it is recommended to sprinkle oil in the ponds with stagnant water. Why?

§ Mosquitoes breed in stagnant water. The larvae of mosquitoes keep floating on the surface of water due to surface tension. However, when oil is sprinkled, the surface tension is lowered resulting in drowning and death of the larvae.

Q. Why does oil rise on a cloth tape of an oil lamp?

§ The pores in the cloth tape suck oil due to the capillary action of oil.

Q. Why are ventilators in a room always made near the roof?

§ The hot air being lighter in weight tends to rise above and escape from the ventilators at the top. This allows the cool air to come in the room to take its place.

Q. How does ink get filled in a fountain pen?

§ When the rubber tube of a fountain pen immersed in ink is pressed, the air inside the tube comes out and when the pressure is released the ink rushes in to fill the air space in the tube.

Q. Why are air coolers less effective during the rainy season?

§ During the rainy reason the atmospheric air is saturated with moisture. Therefore, the process of evaporation of water from the moist pads of the cooler slows down thereby not cooling the air blown out from the cooler.

Q. Why does grass gather more dew in nights than metallic objects such as stones?

§ Grass being a good radiator enables water vapour in the air to condense on it. Moreover, grass gives out water constantly (transpiration) which appears in the form of dew because the air near grass is saturated with water vapour and slows evaporation. Dew is formed on objects which are good radiators and bad conductors.

Q. If a lighted paper is introduced in a jar of carbon dioxide, its flame extinguishes. Why?

§ Because carbon dioxide does not help in burning. For burning, oxygen is required.

Q. Why does the mass of an iron rod increase on rusting?

§ Because rust is hydrated ferric oxide which adds to the mass of the iron rod. The process of rusting involves addition of hydrogen and oxygen elements to iron.

Q. Why does milk curdle?

§ Lactose (milk sugar) content of milk undergoes fermentation and changes into lactic acid which on reacting with milk protein (caesin), forms curd.

Q. Why does hard water not lather soap profusely?

§ Hard water contains sulphates and chlorides of magnesium and calcium which forms an insoluble compound with soap. Therefore, soap does not lather with hard water.

Q. Why is it dangerous to have charcoal fire burning in a closed room?

§ When charcoal burns it produces carbon monoxide which is suffocating and can cause death.

Q. Why is it dangerous to sleep under trees at night?

§ Plants respire at night and give out carbon dioxide which reduces the oxygen content of air required for breathing.

Q. Why does ENO's salt effervesce on addition of water?

§ It contains tartaric acid and sodium bicarbonate. On adding water, carbon dioxide is produced which when released into water causes effervescence.

Q. Why does milk turn sour?

§ The microbes react with milk and grow. They turn lactose into lactic acid which is sour in taste.

Chapter

10 CHEMISTRY

FUNDAMENTALS OF CHEMISTRY

Elements

- Everything in the universe, living or non-living, is made of a combination of a few basic substances called elements.
- An element is the simplest form of matter composed of atoms having identical number of protons in each nucleus.
- An atom is the smallest fragment of an element that can take part in a chemical action.
- The theory that all matter is made up of small particles (atoms) was put forward by John Dalton. He defined the atom as the smallest neutral particle of matter which may have independent existence. It consists of a central nucleus (made up of protons which are positively charged and neutrons which are neutral particles) surrounded by orbiting electrons.
- Atoms of different elements differ from one another in the number of protons and neutrons in the nucleus and the number of electrons surrounding the nucleus.
- The number of electrons is however, always equal to the number of protons which is known as the elements' atomic number.
- *Periodic Table*: The chemical elements can be arranged in order of increasing atomic number in such a way that elements with similar properties appear together. Such an arrangement is called a periodic table.
  - — Lightest (simplest) element (naturally occurring)—Hydrogen (Element 1)
  - — Most complex element (naturally occurring)—Uranium (Element 92)
  - — Commonest element (lithosphere)—Oxygen
  - — Commonest element (atmosphere)—Nitrogen
  - — Commonest element (universe)—Hydrogen
  - — Rarest element—Astatine
  - — Lightest element (metal)—Lithium
  - — Heaviest element (gas)—Radon
  - — Lightest element (gas)—Hydrogen
- Hydrogen has atomic number 1, with 1 proton and 1 electron. Uranium, the heaviest naturally occurring element has atomic number 92, having 92 protons, 92 electrons and 146 neutrons.
- All elements heavier than uranium are man-made and are produced in nuclear reactors or accelerators or isolated from debris of atomic explosions (transuranic).

The new elements are:

- The Russian scientist Dimitri Mendeleev devised the periodic table in 1869. At that time there were only 59 elements in it but had 33 empty spaces that implied that there were elements still to be discovered.
- Dimitri gave these still-hypothetical elements names like 'ekasilicon,' 'ekaaluminum' and 'ekaboron,' based on their expected similarities to known substances; the spaces were filled by germanium, gallium and scandium, respectively. ('Eka-' is a Sanskrit prefix meaning 'one,' so you can think of the names as silicon 1, aluminum 1 and so on.)
- By year 1939, all of Mendeleev's boxes had been filled in; the last one was 'ekacesium,' now called francium.
- There are around 118 known elements, out of which 92 are naturally occurring and 26 are man-made elements, created by nuclear bombardment.
- The man-made elements are known as transuranic. Neptunium (Element 93) was the first such element discovered in 1940.
- Since Lawrencium (Lr) in 1961, the following new elements have been discovered:
  1. Rutherfordium (Rf) Atomic No. 104
  2. Dubnium (Db) Atomic No. 105
  3. Seaborgium (Sg) Atomic No. 106
  4. Bohrium (Bh) Atomic No. 107
  5. Hassium (Hs) Atomic No. 108
  6. Meitnerium (Mt) Atomic No. 109
  7. Darmstadtium (Ds) Atomic No. 110
  8. Roentgenium (Rg) Atomic No. 111
  9. Copernicium (Cr) Atomic No. 112
  10. Flerovium (Fl) Atomic No. 114
  11. Livermorium (Lv) Atomic No. 116.
- *Four elements*: Ununtrium (Element 113), Ununpentium (Element 115); Ununseptium (Element 117) and Ununoctium (Element 118) are still unconfirmed discoveries.
- Russian scientists had claimed the discovery of element 115 back in 2003 but the International Union of Pure and Applied Chemistry. Chemistry's equivalent of the International Astronomical Union which famously demoted Pluto from planet status in 2006 wouldn't acknowledge it without a confirming experiment from another team. The Helmholtz Center's work must still be reviewed by both the I.U.P.A.C. and the International Union of Pure and Applied Physics but ununpentium is now a step closer to inclusion on the periodic table. If that happens, the International Union will assign it a permanent, official name.
- I.U.P.A.C. has already signed off on element 116 (livermorium), element 117 (ununseptium) and element 118 (ununoctium), although the latter two haven't been assigned permanent names yet. Ununoctium's half life is just 0.89 milliseconds.

METALS AND NON-METALS

- Elements are classified in two main classes are (i) Metals (for example, lead, gold, mercury, etc.) and (ii) Non-metals (for example, chlorine, bromine, carbon, etc.)
- Some elements behave chemically both as metals and non-metals are called metaloids, for example, boron, silicon, germanium and antimony.
- *Nobel Gases*: There are also some elements which are neither metals nor non-metals. These elements are called noble gases and are present in the atmosphere as helium, argon, neon, krypton, radon and xenon.

Metals

- There are two types of elements—metals and non-metals. About 80% of known elements are metals.

- Elements which are hard, ductile, brittle and malleable; possess lustre and conduct heat and electricity are termed metals. All metals are solids except mercury and gallium which are liquids at room temperature. Metals usually have high melting and boiling points.

Chemical Nature of Metals

- Usually metals have the tendency to lose electrons and while reacting with acids, usually replace hydrogen in dilute non-oxidizing acids like hydrochloric acid (HCl) and sulphuric acid (H_2SO_4).
- Exceptions are copper, silver and gold. Chlorides of metals are true salts and oxides of metals are usually basic. Hydrides of metals are ionic, unstable and reactive.
- Although all the metals are reactive, that is, they are acted upon by common reagents like oxygen (air), hydrogen, halogens, sulphur, water, acids, etc., the extent of reaction is different in the case of each metal.
- Only gold, platinum and silver are not affected by air and water under ordinary conditions and are known as free metals.
- Various compounds of metal called minerals are found in nature and can be mined.
- The mineral from which metal can be extracted economically is called ore and the process of extraction of metals from their ores is called metallurgy which involves:
  - —*Calcination*: The process of heating the concentrated ore in the absence of air.
  - —*Roasting*: The process of heating the ore in excess air.
  - —*Smelting*: The process by which roasted ore is mixed with coke and heated in a furnace to obtain free metal.

Steel and Iron

- Steel is a form of iron. To make steel from iron, the carbon content is bought down from 5% to 0.5–1.5%.
- *Heat Treatment of Steel*
  - —*Quenching*: If steel is heated to bright redness and then suddenly cooled in water or oil it becomes extraordinarily hard and brittle.
  - —*Tempering*: By controlled heating (250–325°C) of quenched steel its brittleness can be removed without affecting its hardness.
  - —*Annealing*: Steel is heated to a temperature well below red hot and then cooled turns it soft and the process is called annealing.

Rusting of Iron

- Majority of metals occur in nature in the combined form and are extracted from their ores.
- When these metals are exposed to atmospheric conditions they have a tendency to return to their original form. This change is called corrosion of metals and in the case of iron it is known as rusting.
- Rusting consists of the formation of hydrated ferric oxide. For rusting water and oxygen are essential in the absence of water or electrolyte rusting does not occur.
- The process involves addition of hydrogen and oxygen elements and it is found that mass of an iron rod increases by rusting. Rusting is prevented by coating the surface of iron with metals or non-metals or by alloying. The coating of another metal is known as electroplating or hot dipping.

- In electroplating chromium or nickel is used. When a coat of zinc is applied on an iron surface by the hot-dipping process it is known as galvanizing.

Non-metals

- Non-metals are electro-negative elements which have a tendency to gain one or more electrons to form negative ions called anions. All non-metals generally exist as powders or gases, except bromine which is liquid under normal conditions.
- Non-metals are non-lustrous and are bad conductors of heat and electricity. They cannot be hammered into sheets or drawn into wires like metals. The melting point of non-metals is lower than that of metals.

ALLOYS

Alloys are homogeneous mixtures of two or more metals and non-metals and have more commercial utility than some of the constituent elements. The following table lists some of the commercially important alloys.

Alloys of Some Important Elements

Aluminum Alloys

1. AA-8000: used for building wire
2. Al-Li (aluminum, lithium, sometimes mercury)
3. Alnico (aluminum, nickel, copper)
4. Duralumin (copper, aluminum)
5. Magnalium (aluminum, 5% magnesium)
6. Magnox (magnesium oxide, aluminum)
7. Nambe (aluminum plus seven other unspecified metals
8. Silumin (aluminum, silicon)
9. Zamak (zinc, aluminum, magnesium, copper)
10. Aluminum forms other complex alloys with magnesium, manganese and platinum

Bismuth Alloys

1. Wood's metal (bismuth, lead, tin, cadmium)
2. Rose metal (bismuth, lead, tin)
3. Field's metal
4. Cerrobend

Cobalt Alloys

1. Stellite (cobalt, chromium, tungsten or molybdenum, carbon)
2. Talonite (cobalt, chromium)
3. Ultimet (cobalt, chromium, nickel, molybdenum, iron, tungsten)

Copper Alloys

1. Beryllium copper (copper, beryllium)
2. Billon (copper, silver)
3. Brass (copper, zinc) [Calamine brass (copper, zinc); Chinese silver (copper, zinc); Dutch metal (copper, zinc); Gilding metal (copper, zinc); Muntz metal (copper, zinc); Pinchbeck (copper, zinc); Prince's metal (copper, zinc); Tombac (copper, zinc)]
4. Bronze (copper, tin, aluminum or any other element) [Aluminum bronze (copper, aluminum); Arsenical bronze (copper, arsenic); Bell metal (copper, tin); Florentine bronze (copper, aluminum or tin); Glucydur (beryllium, copper, iron); Guanin (likely a manganese bronze of copper, manganese, with iron sulfides and other sulfides); Gunmetal (copper, tin, zinc); Phosphor bronze (copper, tin and phosphorus); Ormolu (Gilt Bronze) (copper, zinc); Speculum metal (copper, tin)]
5. Constantan (copper, nickel)
6. Copper-tungsten (copper, tungsten)
7. Corinthian bronze (copper, gold, silver)

8. Cunife (copper, nickel, iron)
9. Cupronickel (copper, nickel)
10. Cymbal alloys (Bell metal) (copper, tin)
11. Devarda's alloy (copper, aluminum, zinc)
12. Electrum (copper, gold, silver)
13. Hepatizon (copper, gold, silver)
14. Heusler alloy (copper, manganese, tin)
15. Manganin (copper, manganese, nickel)
16. Nickel silver (copper, nickel)
17. Nordic gold (copper, aluminum, zinc, tin)
18. Shakudo (copper, gold)
19. Tumbaga (copper, gold)

Gallium Alloys

Galinstan (gallium, indium, tin)

Gold Alloys

1. Electrum (gold, silver, copper)
2. Tumbaga (gold, copper)
3. Rose gold (gold, copper)
4. White gold (gold, nickel, palladium or platinum)

Indium Alloys

Field's metal (indium, bismuth, tin)

Iron or Ferrous Alloys

1. Steel (carbon) [Stainless steel (chromium, nickel); {AL-6XN; Alloy 20; Celestrium; Marine grade stainless; Martensitic stainless steel; Surgical stainless steel (chromium, molybdenum, nickel)}; Silicon steel (silicon); Tool steel (tungsten or manganese); Bulat steel; Chromoly (chromium, molybdenum); Crucible steel; Damascus steel; High speed steel; Maraging steel; Wootz steel]
2. Iron [Anthracite iron (carbon); Cast iron (carbon); Pig iron (carbon); Wrought iron (carbon)]
3. Fernico (nickel, cobalt)
4. Elinvar (nickel, chromium)
5. Invar (nickel)
6. Kovar (cobalt)
7. Spiegeleisen (manganese, carbon, silicon)
8. Ferroalloys [Ferroboronl; Ferrochrome (chromium); Ferromagnesium; Ferromanganese; Ferromolybdenum; Ferronickel; Ferrophosphorus; Ferrotitanium; Ferrovanadium; Ferrosilicon]

Lead Alloys

1. Antimonial lead (lead, antimony)
2. Molybdochalkos (lead, copper)
3. Solder (lead, tin)
4. Terne (lead, tin)
5. Type metal (lead, tin, antimony)

Magnesium Alloys

1. Magnox (magnesium, aluminum)
2. T-Mg-Al-Zn (Bergman phase)
3. Elektron

Mercury Alloys

Amalgam (mercury with just about any metal except platinum)

Nickel Alloys

1. Alumel (nickel, manganese, aluminum,s ilicon)
2. Chromel (nickel, chromium)
3. Cupronickel (nickel, bronze, copper)
4. German silver (nickel, copper, zinc)
5. Hastelloy (nickel, molybdenum, chromium, sometimes tungsten)
6. Inconel (nickel, chromium, iron)
7. Monel metal (copper, nickel, iron, manganese)
8. Mu-metal (nickel, iron)
9. Ni-C (nickel, carbon)
10. Nichrome (chromium, iron, nickel)
11. Nicrosil (nickel, chromium, silicon, magnesium)
12. Nisil (nickel, silicon)
13. Nitinol (nickel, titanium, shape memorya lloy)

Potassium Alloys

1. KLi (potassium, lithium)
2. NaK (sodium, potassium)

Rare Earth Alloys

Mischmetal (various rare earths)

Silver Alloys

1. Argentium sterling silver (silver, copper, germanium)
2. Billon (copper or copper bronze, sometimes with silver)
3. Britannia silver (silver, copper)
4. Electrum (silver, gold)
5. Goloid (silver, copper, gold)
6. Platinum sterling (silver, platinum)
7. Shibuichi (silver, copper)
8. Sterling silver (silver, copper)

Tin Alloys

1. Britannium (tin, copper, antimony)
2. Pewter (tin, lead, copper)
3. Solder (tin, lead, antimony)

Titanium Alloys

1. Beta C (titanium, vanadium, chromium, other metals)
2. 6al-4v (titanium, aluminum, vanadium)

Uranium Alloys

1. Staballoy (depleted uranium with titanium or molybdenum)
2. Uranium may also be alloyed with plutonium

Zinc Alloys

1. Brass (zinc, copper)
2. Zamak (zinc, aluminum, magnesium, copper)

Zirconium Alloys

Zircaloy (zirconium and tin, sometimes with niobium, chromium, iron, nickel)

Table 10.1 Important Alloys and Their Uses

Alloy	*Composition*	*Commercial Utility*
Babbitt Metal	Tin = 91%, Antimony = 7% Copper = 3%	Used in bearings because of its low measure of friction with steel
Bell Metal	Copper 77%, Tin = 23%	Casting of bells
Monel	Nickel = 60%, Copper = 33%, Iron = 7%	Corrosion-resistant containers
Magnalium	Aluminium = 85–99%; Magnesium = 1–15%	Used in making balance beams and light instruments
Duralumin	Aluminium = 95%, Copper = 4%, Magnesium <1%, Manganese = 0.5%	Used in the production of airships, pressure cookers, railroad cars and machinery because of its high strength and resistance to corrosion.
Bronze	Copper = 75–90%, Tin (Sn) = 10–25%	Utensils, coins, medals and statues, heavy gears, tools electrical hardware
Phosphor Bronze	Bronze with a small amount of Phosphorous	Springs (normal and electrical) and Boat propellers.
Aluminium Bronze	Copper = 88–90% Aluminium = 10–12%	In the manufacture of utensils, decorative articles like photo frames, coins and jewellery
Brass	Copper = 60–80% Zinc = 20–40%	Utensils, inexpensive jewellery, hose nozzles and couplings, standing dies, condenser sheets and cartridges
Gun metal	Copper = 85-90%, Tin = 8–12% Zinc = 1–3%	Guns, gears, castings

(*Continued*)

Alloy	*Composition*	*Commercial Utility*
Coinage Alloy	Copper = 75%, Nickel = 25%	In the making of coins also known as 'Coin Metal'
Solder	Lead = 50%, Tin = 50%	For soldering joining two metals to each other
Stainless steel	Iron = 73%, Carbon = 1% Chromium= 18%, Nickel= 8%	In the manufacture of utensils, automobile parts, cycle parts, cutlery
Invar	Iron (Fe) = 63%, Carbon = 1% Nickel (Ni) = 36%	In the manufacture of meter scales measuring tapes, pendulum rods
Duriron	Iron = 84.7%, Carbon = 0.8% Silicon = 14.5%	Laboratory plumbing
Tungsten steel	Iron= 75–81%, Tungsten = 14–20%, Chromium = 4%, Carbon = 1%	For making high speed cutting tools
Sterling silver	Silver = 92.5%, Copper 7.5%	Jewellery, art objects etc.
Type Metal	Lead = 75-90%, Antimony = 2–18% Tin in trace quantities.	Used to make type characters for printing; also used for making decorative objects like statuettes and candlesticks.

MINERALS

- Minerals are naturally occurring chemical compounds of fixed composition and characteristic, physical form and properties. A few minerals consist of only one element. For example, graphite and diamond (both forms of carbon), sulphur and gold.
- Most minerals, however are a combination of two or more elements as in halite or rock salt (NaCl). The most common group of minerals are Silicates, oxides, sulphides, halides, carbonate.
- Minerals are of two types, namely, metallic or ore and non-metallic, for example, carbon, sulphur, etc. (See table)

Table 10.2 Common Minerals

Name of the Mineral	*Composition*	*Commercial Utility*
Albite	Sodium aluminium silicate	Glass, ceramics
Anhydrite	Calcium sulphate	Cement, fertilizers, chemicals
Anorthite	Calcium aluminium silicate	Glass, ceramics
Apatite	Calcium phosphate flour-phosphate or chlorophosphate	Phosphate, Fertilizers, gemstones

(*Continued*)

Name of the Mineral	*Composition*	*Commercial Utility*
Aragonite	Calcium carbonate	Essential for replication of reef conditions in aquariums
Azurite	Copper carbonate	Source of copper
Bauxite	Hydrated aluminium oxide	Source of aluminium
Calcite	Calcium carbonate	Cement, plaster, paint glass, fertilizers
Calamine	Zinc carbonate	Source of zinc
Cassiterite	Tin oxide or Tinstone	Source of tin
Cerussite	Lead carbonate	Source of lead
Chalcocite	Copper sulphite	Source of copper
Cinnabar	Mercuric sulphite	Source of mercury
Dolomite	Calcium magnesium carbonate	Cement and building stone (marble)
Fluorite	Calcium fluoride	Glass, enamel
Galena	Lead sulphide	Source of lead (main ore)
Gypsum	Hydrated calcium sulphate	Plaster of Paris, glass, fertilizer
Halite	Sodium chloride	Source of common salt
Haematite	Ferric oxide	Important source of iron
Kaolinite	Hydrated aluminium silicate	Porcelain tiles, filters, earthenware
Malachite	Copper carbonate	Source of copper
Mircocline	Potassium aluminium silicate	Glass, ceramics
Pyrite	Iron sulphite	Source of sulphur
Quartz	Silica	Abrasives, cement, glass, electronic equipment
Rutile	Titanium oxide	Source of titanium
Talc	Magnesium silicate	Talcum powder, asbestos
Topaz	Hydrous aluminium flourosilicate	Gemstones

CHEMICAL COMPOUNDS

- The atoms of an element, the smallest component seldom exist singly. They usually join up with atoms of other elements to form a molecule of a compound. For example, two atoms of oxygen combine to form a molecule of oxygen written as O_2, O being the symbol of oxygen and 2 the number of atoms combined.
- In the formulation of a compound, 2 atoms of iron (Fe), for example, may combine with 3 atoms of oxygen to form a molecule of ferric oxide (Fe_2O_3).
- It has been estimated that there are 40,40,000 described compounds of which 63,000 are in common use.

Chemical Reaction and Chemical Change

- Chemical change happens everywhere all the time, for example, when coal burns, when iron rusts, when beer ferments, when concrete and cement set or when food is digested to give energy, etc.
- When coal burns, carbon and hydrogen compounds within it combine with the oxygen of the air to form carbon dioxide (CO_2) and water vapours.
- Thus original constituent chemicals called reactants are converted into different substances called products which have different properties.

Characteristics of Chemical Change

1. As seen above, in a chemical change the resultant product has different properties as against that of the reactants.
2. *Conservation of Mass*: For matter can neither be created nor destroyed during a chemical reaction. In the above example the mass of coal and oxygen which combine during combustion is exactly equal to the mass of carbon dioxide, water vapour and ash produced.
3. When substances are formed in different ways, that is, by different chemical reactions, it always has the same composition. In carbon dioxide (CO_2), for example, no matter how it is formed, carbon (C) and oxygen (O) are always in the ratio of 3:8 by mass.
4. In a chemical reaction, energy is given out or absorbed. For example, When coal burns in air, energy in the form of heat and light is given out. On the other hand, when carbon and sulphur are made to combine, heat is absorbed in this process.

Chemical Equation

- Chemical change can be represented by an equation, for example, the combustion of carbon (C) in oxygen (O) to form carbon dioxide (CO_2) can be shown as:

$$C + O_2 \rightarrow CO_2$$

- The subscripts show that there are two atoms in an oxygen molecule.
- When hydrogen (H) and chlorine (Cl) react to form hydrogen chloride, the equation will be

$$H_2 + Cl_2 \rightarrow 2\ HCl$$

- Note that two must be added before HCl on the right to balance the equation. The equation shows that one molecule containing two hydrogen atoms plus one molecule containing two chloride atoms react to form two molecules of hydrogen chloride.

Acid-base Reaction: One of the most common chemical reactions is double decomposition, a process in which two compounds react together to form two new compounds. For example, Magnesium sulphate ($MgSO_4$) reacts with the solution of caustic soda (NaOH) to form sodium sulphate (Na_2SO_4) and antacid magnesium hydroxide ($Mg(OH)_2$)

$$MgSO_4 + 2NaOH \rightarrow Na_2SO_4 + Mg(OH)_2$$

Oxidation and Reduction: Another common chemical reaction is oxidation. Originally it meant combination of a substance with oxygen. However, now the term covers all analogous reactions in which substances combine with other elements and lose electrons in the process.

- Oxidation is always accompanied simultaneously with reduction in which electrons are gained.

E .g. Action of hydrogen (H_2) with copper oxide (CuO)

$$CuO + H_2 \rightarrow Cu + H_2O$$

- The oxide (CuO) is reduced to copper (Cu), the copper gains electrons in the reduction.
- Chemical reactions may take place either slowly—for example, rusting—or quickly as in an explosion.
- Rate of chemical reaction can he greatly increased by the presence of a *catalyst*—a substance which influences the reaction but does not change with it.

Air

- Is a colourless and tasteless gaseous mixture of nitrogen (78%), oxygen (21%) with lesser amounts (say traces) of argon. carbon dioxide, neon, helium, ozone and other gases.
- Air also contains water vapour and pollutants enveloping the earth. Being a mixture (not compound) its composition varies from one place to another.
- Its constituents can be separated and it can be prepared by mixing oxygen and nitrogen. Air is a bad conductor of heat.
- Of its constituents, oxygen helps in burning of substances and respiration and nitrogen dilutes the action of oxygen.
- Carbon dioxide is added to the atmosphere through burning and also through respiration and water vapour is formed during evaporation from the sea, rivers, ponds, etc.

Water Vapour in the Air: Air contains about 0.4% of water vapour.

- If we place a glass containing ice cubes in the open air, the outer surface of the glass gets covered with water droplets. This is due to the condensation of water vapour, from the atmospheric air on the cooler surface of the glass.

Carbon Dioxide: Air contains about 0.03% carbon dioxide.

- If we place lime water in the open air, it turns milky due to absorption of carbon dioxide from the air.

Water

- Water was shown by Cavendish, in the eighteenth century, to be a chemical compound.
- It consists of hydrogen and oxygen in the ratio of 2:1 by volume and 1:8 by mass. Hence, when an electric current is passed through acidified or alkaline water for every one volume of oxygen two volumes of hydrogen evolve.
- Water can be prepared by combining oxygen and hydrogen with the help of an electric current where for every one part of hydrogen, 8 parts of oxygen are required. Boiling point of water is 100°C and freezing point is 0°C.

Hard and Soft Water

Hard Water: Does not produce lather with soap.

Soft Water: Produces lather with soap very easily.

Hardness of water is of two types:

1. *Temporary hardness* is due to the bicarbonates of calcium and magnesium. It can be removed by (a) boiling or (b) addition of lime.
2. *Permanent hardness* is due to the sulphates and chlorides of calcium and magnesium. It can be removed by (a) addition of washing soda or (b) distillation.

Rain Water: It is the purest form of water since it is condensed water vapour of the air. It is soft water because it does not contain salts like bicarbonates, sulphates and chlorides of calcium and magnesium.

River Water: By flowing over the earth's surface carries with it soluble minerals of earth and becomes hard water and also contains several pollutants.

Important Gases

Oxygen: Is a colourless, odourless and tasteless gas, sparingly soluble in water and slightly heavier than air. It does not burn itself but helps in burning of other substances. It is found in abundance in the earth both in the free state and combined state with other elements.

- Oxygen can be prepared in a laboratory by heating potassium chlorate and manganese dioxide together. It can also be obtained in small quantities by heating oxides or salts rich in oxygen. Oxygen can be separated from the air by passing an electric current through water.
- It is essential for plant and animal respiration and for nearly all kinds of combustion.

Atomic No. 8	Relative atomic mass: 15.999
Melting point: –218.4°C	Boiling point: –183.0°C
Density at 0°C = 1.329 kg/m^3	Valency: 2

Hydrogen: Is a colourless, highly flammable gaseous element, the lightest of all substances known and in most abundant supply in the universe. In the free state it occurs in volcanic gases.

- Hydrogen burns with a pale blue flame but does not help combustion and is slightly soluble in water. It is used in the manufacture of vanaspati ghee, alcohol and ammonia.
- Hydrogen can he obtained from water, acids and alkalies. In a laboratory it is prepared by the action of dilute sulphuric acid on commercial zinc.

Atomic No. 1	Relative atomic mass: 1.008
Melting point: –259.14°C	Boiling point: –252.5°C
Density: 0.08988 kg/m^3	Valency: 1

Nitrogen: A colourless, tasteless and odourless gas constituting nearly four-fifths of the air by volume. It is an almost inert diatomic gas, neither combustible nor helping combustion. Slightly soluble in water.

- In a laboratory it can be prepared by heating ammonium nitrite. On a large scale it can be obtained from air. Air is liquefied first and then evaporated, nitrogen evaporates first, leaving oxygen. Nitrogen is used to manufacture nitric acid, ammonia and fertilizers.

Atomic No. 7	Relative atomic mass: 14,007
Melting point: –209.86°C	Boiling point: –195°C
Valencies: 3 and 5	

Carbon Dioxide: A colourless, odourless, incombustible gas formed during respiration, combustion and organic decomposition and is heavier than air.

- Carbon dioxide is acidic and turns lime water milky. It is used in food refrigeration, carbonated beverages, fire extinguishers, etc.
- Carbon dioxide is prepared by the action of dilute acids on carbonates or by fermentation of sugar. In a laboratory it can be prepared by treating marble pieces with dilute hydrochloric acid.

Table 10.3 Other Useful Gases

Name	*Use*
Acetylene, ethylene	To produce a hot flame for welding/cutting
Ammonia	Fertilizer, synthetic fibres, refrigeration
Butane	Cigarette, lighters/domestic fuel
CS gas	Tear gas used in riots
Cyanogen	Welding, chemical weapons, rocket propellant
Ether	Anaesthetic and industrial processes
Ethylene	Plastics
Helium	Fluorescent tubes, laser, balloons
Krypton	Flourescent tubes, high speed photography
Laughing gas (Nitrous oxide)	Mild anaesthetic
Methane	To make chloroform
Neon	Illuminated signs
Propane	Fuel and refrigerant
Radon	Radiotherapy, atomic research
Xenon	Flash lamps and lasers

Table 10.4 Natural Acids

Name	*Source*
Acetic acid	Vinegar
Amino acid	Proteins
Ascorbic acid	Vitamin C
Citric acid	Lemon/citrus fruit
Hydrochloric acid	Digestive juices
Lactic acid	Milk
Malic acid	Unripe apples/fruits
Tannic acid	Tea
Uric acid	Urine

INDUSTRIAL CHEMISTRY

Soaps

- Soaps are the alkali salts of higher fatty acids. Washing soap is, sodium salt of strearic acid and toilet soap is potassium salt of oleic acid. These soaps contain a charged $COONa^+$ end and a hydrocarbon end C_nH_{2n+1}.
- The charged end has a tendency to interact with polar substances like water and fibre, while the hydrocarbon part interacts with non-polar material like oil.

Cleansing Action of Soaps: It is based on a surface phenomenon. Oil coats the surface of objects (for example, fibre) involving weak interactions between the polar fibres and the non-polar oil.

- When clothes are soaked with water containing soap then the polar end of the soap orients towards oil.
- The stronger interaction between the charged end of soap and water overweighs the weak interaction between the fibre and oil. Thus the interfacial contact between the oil (dirt etc.) and the fibre (or any other object) is reduced and oil separates in the form of droplets.

Glass

- Glass is a mixture of an alkali silicate with the silicate of a base, that is, silica, sodium silicate (Na_2SiO_3) and calcium or lead silicate.
- The selected materials, that is, sand (silica), soda ash (sodium carbonate) and lime stone (calcium carbonate) are mixed in the required proportion and broken pieces of previously made glass known as 'cullet' are added.
- These help in easier fusion of the mixture. The mixture is heated up to a temperature of 1400°C in a rotary furnace.
- When the mass is completely mixed and melted, the glass is made in various shapes by blowing and moulding.

Cement

- Materials required to manufacture cement are calcium carbonate (limestone, chalk, etc.) aluminium silicate (clay) and a small qantity of gypsum ($CaSO_4.2H_2O$).
- The best cement is Portland cement, the average composition of which is CaO (63%); Fe_2O_3 (3%); MgO (1.5%); Akali (0.5%); SiO_2 (21%); SO_3 (1.5%); $A1_2O_3$ (7%).
- The raw materials are first crushed and mixed together and ground to a fine powder. The powder is then fed in a kiln (Temperature: 1890 K). At this temperature calcium oxide (from limestone) combines the aluminium silicate to form calcium silicate and aluminate. The resultant mixture is mixed with 2–3% gypsum and ground to form cement.

Coal

- Coal originates from the remains of trees, bushes, ferns, mosses and other forms of plant life that flourished in swamps and marshes millions of years ago.
- Important products are derived from coal by a process called pyrolysis—heating of coal in the absence of air which produces *coke* (residue) and volatile matter such as coal gas and a liquid known as coal tar.

ORGANIC CHEMISTRY

Carbon Compounds

- Until 1828 scientists believed that organic compounds occur only in living organisms, things that were or had been alive. Therefore, study of those compounds became known as organic chemistry.

- This was based on the so-called vitalist theory, that is, to produce organic compounds, vital energy is required.
- However, the vital force theory was disapproved when in 1828, the German chemist, Friedrich Wohler, prepared an organic compound Urea in his laboratory by evaporating a solution of inorganic compound ammonium cyanide:

NH_4CNO	$CO(NH_2)_2$
Ammonium cyanide	*Urea*
(inorganic compound)	(organic compound)

- Therefore, now organic chemistry is the study of carbon compounds.

Organic and Inorganic Compounds

- Most organic compounds can be burned while most inorganic compounds cannot.
- Most organic compounds are gases, volatile liquids and solids, with relatively low melting points and most inorganic compounds are solids with high melting points.
- While most organic compounds are insoluble in water, a great majority of inorganic compounds are soluble.

Carbon

- Found in abundance, carbon ranks twelfth among the elements in the earth's crust but in importance it ranks first.
- It is a unique element which readily combines with itself to form large molecules of carbon atoms linked in long chains (rings).
- In all there are more than a million such combinations.

Different forms of Carbon: Different forms of carbon are— (a) diamond; (b) graphite; (c) charcoal; (d) lamp black; (e) coke; (f) gas carbon; (g) coal and (h) animal charcoal.

Allotropic forms of Carbon: When a substance exists in different crystalline modifications the phenomenon is called allotropy and different distinct forms of the substance are called allotropes.

- Carbon shows allotropy because it exists in different forms. There are two allotropic forms of carbon, namely, (i) Diamond and (ii) Graphite.
- Coke, charcoal, lamp black, etc., were thought to be amorphous forms (without definite shape) of carbon but it is now known that all the amorphous carbons contain microcrystals of graphite.
- Though these allotropes of carbon have different crystal structures and different physical properties, their chemical symbol is the same and show similar chemical properties. Both diamond and graphite have symbol 'C'.
- Both give off carbon dioxide when strongly heated in the presence of oxygen:

$$C\ (diamond) + O_2\ (gas) \rightarrow CO_2\ (gas)$$
$$C\ (graphite) + O_2\ (gas) \rightarrow CO_2\ (gas)$$

Diamond: Is the hardest substance found in natural form. Its name is derived from the Greek word *'adamas'* which means invincible or adamant. It is the purest form of

carbon. It does not allow heat or electricity to pass through. It is inert as it resists action of chemicals but gives out CO_2 when strongly burnt in air. It is insoluble in all solvents.

- Since 1955 diamonds are also prepared synthetically from carbon compounds at high temperature and very high pressure.
- The transparent form of the diamond is used as gems while dark coloured diamonds are used for making cutting-tools.
- The *Koh-i-Noor* is the world's most precious and famous diamond mined in India but was taken away by the British. The Cullinan found in 1905 in South Africa is the largest diamond in the world weighing 570 grams and 2.850 carats.

Graphite: The name graphite is derived from the Greek word graphein that means 'to write'. This suggests that this substance has been used to make lead pencils since ancient times.

- Graphite is dark grey, an opaque solid with a soapy touch and has a metallic shine. It is a good conductor of electricity and heat. It does not undergo any change when mixed with acids or alkalies. However, when heated with nitric acid graphite acid is formed.
- Graphite is used as a lubricant in paints for making electrodes and lead pencils.
- Pure graphite is manufactured by heating coke in an electric furnace to a temperature of about 2500°C in the absence of air.

Petroleum

- Is a mixture of hydrocarbons believed to have originated from bacterial decomposition of animal and vegetable fats under high pressure and atmospheric temperature?
- It is converted into a variety of products by *Fractional Distillation* based on the principle that lower hydrocarbons boil at a lower temperature than the higher ones.

Table 10.5 Products Obtained from Petroleum

S. No	*Fraction*	*Distillation Temperature Range (K)*	*Approx. %*	*Uses*
1.	Gaseous hydrocarbons	<293	3	As fuel and for gasoline and rubber manufacture
2.	Light distillates—Petroleum ether Petrol or gasoline Kerosene oil	293–363 343–473 450–560	3 32 18	As solvent in varnish, dry cleaning Motor fuel Fuel and illuminant
3.	Intermediate distillates—Gas oil, diesel or heavy oil	525–673	20	Fuel
4.	Heavy distillates—Lubricating oils, gaseous and petroleum jelly Paraffin (wax)	>673	— —	Used as a Lubricant, in toilet goods ointments Candles, boot polish, etc.
5.	Residue—Asphalt, petroleum coke (Bitumen and coke)	Residue	40	Fuel for making electrodes

Liquefied Petroleum Gas (LPG)

- Domestic gas also known as LPG or bottled gas or liquefied petroleum gas is a by-product of petroleum refining and also obtained from natural gas. It is a mixture of hydrocarbons such as propane, butane and pentane.
- These gases can be liquefied under moderate pressure at normal temperature. Because of low boiling point (–44°C) these gases are stored under pressure to keep in a liquid state in gas cylinders.
- Therefore cooking gas cylinders contain the mixture of these gases in liquid form.

Synthetic Rubber

- Produced by polymerization of certain hydrocarbons, namely, (i) Neoprene—a polymer of chloroprene; (ii) BUNA-S—a polymer of styrene and butadiene and (iii) BUNA-N—a polymer of butadiene and acrylonitrile.
- Rubber is made hard by vulcanization, a process of heating rubber with sulphur.

Synthetic Fibre

Nylon: was the first synthetic fibre made as a result of research begun in 1928. It is a polyamide made by polymerizing adipic acid and hexamethylene diamine.

Terylene: Discovered in 1943. Produced from terephthalic acid and ethylene glycol.

Plastics: There are certain synthetic materials which are neither rubber nor fiber but are used as a substitute. These are called plastics.

- Plastics are also polymers. The raw material is basically a polymer of acetylene, the common gas used for welding.
- The polymer is obtained by treating acetylene gas under pressure in presence of a catalyst. The result is a long-chain molecule.

RADIOACTIVITY

- A phenomenon of spontaneous disintegration, first observed in certain naturally occurring heavy elements like radium, actinium, uranium, thorium, etc., with the emission of alpha, beta and gamma rays.
- It is the property of the nuclide to disintegrate in which a transformation takes place of a relatively unstable nuclide to relatively stable nuclide accompanied with the emission of particles or electromagnetic radiation.
- The nuclide that decays is said to be radioactive.

Discovery of Radioactivity: The phenomenon was accidentally discovered in 1896 by French physicist Henry de Becquerel. He observed that uranium mineral gave off invisible radiation. He termed this property of uranium radioactivity. Later Pierre and Madam Curie showed similar phenomenon in other metals like poeonium, francium and radium.

Radioactive Emissions

Sub-atomic Particles (Radiation)

1. *Alpha (α) particles*: A positively charged helium atom which has very little penetrating power. They can be absorbed by a sheet of paper or stopped by aluminum foil.

2. *Beta (β) particles*: A negatively charged light particle. Its penetrating power is greater than that of alpha-ray.

Penetrating Particles (Radiation): Also called Gamma (γ) emission. These are electromagnetic radiations of low wavelength, high frequency and high energy. Their penetrating power is very great as they can pass through several centimeter of lead.

X-rays

- X-rays are a form of penetrating electromagnetic radiation similar to light but of shorter wavelength and capable of penetrating solids.
- X-rays are produced when cathode rays fall on anti-cathodes (a metal of high atomic mass like tungsten).

X-ray Photographs: X-ray passes through considerable thickness of matter without being entirely absorbed. although a fraction of the original radiation is always lost.

- Dense materials such as metal and bone, absorb X-rays more strongly than materials such as wood or flesh. Therefore, it is possible to produce X-ray photographs for use in medical diagnosis.

Nuclear Reaction and Atomic Energy

- *Nuclear Reaction:* A nuclear reaction is one in which a nucleus bombarded with an elementary particle (like neutron, proton etc.) or with another nucleus to produce other products in a very short time span. The first nuclear reaction was discovered by *Rutherford* in 1919 when he bombarded nitrogen with alpha particles.
- *Nuclear Fission:* Nuclear fission is the fragmentation of a large nucleus into two smaller nuclei and the liberation of large amount of energy. In 1939 the German scientists Otto Hahn and F. Steersman observed that when uranium was bombarded with slow neutrons, then two smaller products were obtained with a tremendous amount of heat. The splitting of uranium was called nuclear fission

  Types of Nuclear Fission:

  1. *Controlled Nuclear Fission*: Carried out in nuclear reactors in which rate of fission reaction is reduced and energy produced can be used for constructive purposes;
  2. *Uncontrolled Nuclear Fission*: In an atom bomb uncontrolled fission takes place. A very large amount of heat is produced and the process continues until the entire amount of fissionable material is exhausted.
- *First Atom Bomb:* On 6 August 1945, an atom bomb was dropped on Hiroshima city in Japan. The second bomb was dropped on Nagasaki, another city of Japan on 9 August 1945. The bomb was made of plutonium-239.
- *Nuclear Fusion:* ***It*** is a nuclear reaction in which lighter nuclei fuse to form a nucleus of greater mass. In this reaction also an enormous amount of heat is produced. By carrying on nuclear fusion under controlled conditions, the large amount of energy could be made available for useful purpose.
- *Atomic Energy (Nuclear Energy):* Energy produced by nuclear fission or nuclear fusion is called nuclear energy or atomic energy. In nuclear reactions there is loss of mass. This mass is converted into energy. It can be transformed into electrical and mechanical energy which can be used for various peaceful purposes.

IMPORTANT LAWS OF CHEMISTRY

Beer's Law

- States that in photo chemistry the proportion of light absorbed by a solution depends on the thickness of the absorbing layer and on the concentration of the absorbing substance in the solution.

Boyle's Law

- States that the volume (V) of a given mass of gas at a constant temperature is inversely proportional to its pressure (p), that is, pV = constant.
- This means that if a gas is compressed threefold its volume is reduced by two-thirds.
- Boyle (1627–90) was the first to define an element as a substance that cannot be broken down into something simpler by a chemical process.

Charle's Law

- States that under constant pressure the volume of a fixed mass of gas varies directly with its absolute temperature.
- The absolute temperature is that measured from absolute zero, about −273° on the Celsius scale.
- In other words, the pressure of a gas increases by 1/273 of its volume at 0°C for every 1°C rise in temperature.
- In other words, if the pressure of a gas remains constant, the volume of a gas increases by 1/273 of its volume at 0°C for every 1°C rise in temperature.
- Alternatively, at constant pressure the volume of a given mass of gas is directly proportional to the absolute temperature.
- The principle was formulated by the French scientist, Jacques Alexandre Charles.

Faraday's Law of Electrolysis

- States that (i) The amount of decomposition during electrolysis is proportional to the quantity of current passed and (ii) For the same quantity of electricity passed through different solutions, the extent of decomposition is proportional to the chemical equivalent of the element or group liberated.
- The law was formulated by an English chemist, Michael Faraday (1791–1867).

Gay-Lussac's Law

- *Law of Gaseous Volume*: States that when gases combine chemically, the volumes of the reactive gases and gaseous products are in simple proportion at the same temperature and pressure. In other words, when gases combine they do so in volumes which are in a simple ratio to each other and to that of the product, if it is also gaseous. For example, One volume of nitrogen combines with three volumes of hydrogen to form two volumes of Ammonia.
- *Law of Thermal Expansion*: It states that at constant pressure all gases expanded by the same amount for the same increase in temperature. These laws were formulated by a French chemist, Joseph Lois Gay-Lussac (1778–1850).

Hess' Law

- States that the heat exchange in a chemical reaction is the same, no matter whether the reaction takes place in one stage or more.
- The principle was formulated by a German chemist Henri Hess (1802–50).

Graham's Law of Diffusion

- States that the rate at which two gases diffuse is inversely proportional to their densities.
- It means that the lighter the gas, the faster it will diffuse through any medium.
- The law was defined by a Scottish chemist, Thomas Graham (1805–60).

Henry's Law

- States that the mass of a gas which is dissolved in a given volume of liquid at constant temperature is directly proportional to the pressure of the gas.
- It applies to gases that do not react with the liquid (solvent).
- The principle was formulated in 1803 by the British chemist William Henry.

Lambert's Law

- States that layers of equal thickness of homogeneous material, for example, coloured filter), absorb equal proportion of light.

Raoult's Law

- States that the lowering of the vapour pressure of a solvent by a solute (dissolved substance) is proportional to the MOLE fraction of the solute, the proportion of solute molecules to the total number of molecules, solute and solvent present.
- Since the lowering of vapour pressure causes an elevation of the boiling point and a depression of the freezing point, it is used to determine the molecular mass of a solute.
- The law is named after the French chemist, Francois Marie Raoult (1840–1901).

Law of Conservation of Mass and Matter

- Matter can neither be created nor destroyed.
- The sum total of mass or matter for a system always remains constant without any increase or decrease in quantity.

IMPORTANT CHEMICAL PROCESSES

- *Bessemer Process*: It is a method of converting pig iron to steel by blowing air through the molten metals to oxidize impurities such as carbon, silicon, phosphorus and manganese normally present in pig iron.
- *Clemmensen Reduction*: It is a process used to convert aldehydes and ketones to the corresponding hydrocarbons by heating with amalgamated zinc and hydrochloric acid.
- *Gattermann Reaction*: It is a process used to convert an aromatic amine into the corresponding halogen derivative through diazonium salt formation using copper as a catalyst.

- *Haber Process*: An industrial process of producing ammonia by the reaction of nitrogen with hydrogen in the presence of a catalyst.
- *Kolbe Reaction*: It is used for the preparation of saturated or unsaturated hydrocarbons by the electrolysis of solutions of the alkali salts of aliphatic carboxylic acids.
- *Solvay Process*: It is a process of snaking sodium carbonate from calcium carbonate and sodium chloride in large scale. The process involves heating of calcium carbonate to give calcium oxide and carbon dioxide which is bubbled into a solution of sodium chloride in ammonia. Sodium hydrogen carbonate is precipitated which on heating gives sodium carbonate.
- *Bayer Process*: A process used to extract aluminium oxide Al_2O_3 or aluminia by treating powdered bauxite with hot caustic soda solution under pressure. The process was developed by German chemist, Karl Joseph Bayer in 1888.
- *Bergius Process*: A process for making lubricants and synthetic fuel for example, petrol, from coal by heating a mixture of powdered coal and heavy oil or tar with hydrogen under pressure in the presence of a catalyst (iron, tin or lead). The process was developed by German chemist, Friedrich Bergius, who shared the 1931 Nobel Prize.
- *Bosch Process*: A process used to make industrial hydrogen by passing steam over white-hot coke to produce water gas (a mixture of carbon monoxide and hydrogen) which in the presence of a catalyst (a metal oxide) reacts with more steam to liberate hydrogen and carbon dioxide. The process is named after the German chemist, Carl Bosch (1874–1940).
- *Down Process*: It is a process of making sodium metal by electrolysis of molten sodium chloride. The molten sodium and calcium formed at the cathode are separated.
- *Frasch Process*: It is used to extract sulphur from subterranean deposits in which superheated water is forced down the deposits which melts the sulphur under the ground. Molten sulphur is collected by forcing compressed air from another side. The process was developed by German chemist, Herman Frasch in 1891.
- *Hall-Heroult Process (Hall-Heroult)*: A process used to prepare aluminium by electrolysis in which aluminia (aluminium oxide) is dissolved in cryolite (sodium aluminium fluoride) and electrolyzed. It was developed in 1885 in US by Charles Hall and in France by P. T. Heroult.
- *Parkes Process*: A process used for extraction of silver traces from lead ore galena. Molten zinc is added to molten galena and lead is separated leaving zinc-silver which on heating distills off zinc freeing the silver.

IMPORTANT CHEMICAL TESTS

- *Brown-ring Test*: It is used for chemical analysis of nitrates in which the solution to be tested is mixed with iron sulphate solution in a test tube and concentrated H_2SO_4 (sulphuric acid) is carefully poured along the side of the test tube. In nitrate containing substances a brown ring is formed where the layer of acid touches the solution $(FeNO)SO_4$.
- *Flame Test*: It is used to identify certain elements in which a clean platinum wire is dipped into the mixture to be tested and the wire is heated using a busen flame. The presence of certain elements can be detected by the change in the colour of flame. For example, a brilliant orange-yellow will indicate sodium; crimson, strontium and apple green, barium.

- *Beilstein's Test*: It is used for the detection of halogen in an organic compound in which a clean copper wire is heated in an oxidizing flame till the flame is no longer green. The wire is then dipped in a solution of the substance to be analyzed and heated again. If Cl, Br or I is present the flame turns a bright green.
- *Fehling's Test*: It is used to detect sugars and aldehydes in a solution. Equal amounts of solution of copper sulphate (Fehling A) and sodium tartrate (Fehling B) are mixed in a test tube, On boiling this with a given solution a red precipitate forms if sugar or aldehyde is present.
- *Kjedahl Method*: It is used to measure nitrogen in an organic compound. The compound is boiled with concentrated sulphuric acid and copper sulphate (catalyst) to convert nitrogen to ammonium sulphate. An alkali is added to the mixture and boiled to distill of ammonia which is passed into a standard acid solution and estimated by titrating the solution.
- *Molish's Test*: It is used to detect carbohydrates in a solution. The solution to be tested is mixed with a small quantity of alcoholic alphanaphthol and concentrated sulphuric acid is slowly poured down the side of the test tube. When the two liquids meet the formation of a deep violet rings indicates presence of carbohydrate.
- *Rast's Method*: It is used to determine molecular weight by measuring the depression of freezing point of a camphor by a known weight of the solute.
- *Schiff's Test*: It is used to distinguish between aldehydes and ketones. An aqueous solution of rosaniline and sulphurous acid (Schiff's reagent) is used to test for the presence of aldehydes, which oxidize the reduced form of the dye rosaniline back to its original magenta colour. The aldehydes restore the colour immediately whereas ketones, restore the colour slowly.

Table 10.6 Common Substances and Their Chemical Compositions

Substance	*Chemical*	*Composition*	*Formula*
Alum	Potash	Potassium, Sulphur, Aluminium, Hydrogen and Oxygen	$K_2SO_4Al_2(SO_4)_3$
Bleaching Powder	Calcium hypochlorite	Calcium, Chlorine, Oxygen	$CaCl(OCl)_4H_2O$
Blue Vitriol	Copper sulphate	Copper, Sulphur and Oxygen	$CuSO_45H_2O$
Calomel	Mercurous chloride	Mercury, Chlorine	Hg_2Cl_2
Caustic Lotion	Silver, nitrate	Silver, Nitrogen, Oxygen	$AqNO_3$
Candy Fluid	Potassium permanganate	Potassium Manganese, Oxygen	$KMnO_4$
Caustic Potash	Potassium hydroxide	Potassium, Hydrogen, Oxygen	KOH
Chalk	Calcium carbonate	Calcium, Carbon, Oxygen	$CaCO_3$
Caustic Soda	Sodium hydroxide	Sodium Hydrogen, Oxygen	HaOH
Baking Soda	Sodium bicarbonate	Sodium, Hydrogen, Carbon, Oxygen	$NaHCO_3$
Common Salt	Sodium chloride	Sodium, Chlorine	NaCl

(*Continued*)

Substance	*Chemical*	*Composition*	*Formula*
Epsom Salt	Magnesium sulphate	Magnesium, Sulphur, Oxygen	$MgSO_4 7H_2O$
Galena	Lead sulphide	Lead and Sulphur	PbS
Green Vitriol	Iron sulphate	Iron, Sulphur, Oxygen	$FeSO_4 7H_2O$
Glauber's salt	Sodium sulphate	Sodium, Sulphur, Oxygen	$Na_2SO_4 10H_2O$
	Gypsum	Calcium sulphate, Calcium, Sulphur, Oxygen	$CaSO_4 2H_2O$
Hypo	Sodium thiosulphate	Sodium, Sulphur, Hydrogen, Oxygen	$Na_2S_2O_3 5H_2O$
Laughing gas	Nitrous oxide	Nitrogen, Oxygen	N_2O
Lime water	Calcium hydroxide	Calcium, Hydrogen, Oxygen	$Ca(OH)_2$
Litharge	Lead monoxide	Lead, Oxygen	PbO
Nitre	Potassium nitrate	Potassium, Nitrogen, Oxygen	KNO_3
Plaster of Paris	Calcium sulphate	Calcium, Sulphur, Hydrogen, Oxygen	$2CaSO_4 H_2O$
Quartz	Sodium silicate	Sodium, Silica, Oxygen	Na_2SiO_3
Ouick lime	Calcium oxide	Calcium, Oxygen	CaO
Red lead	Triplumbic tetroxide	Lead, Oxygen	Pb_3O_4
Sal ammoniac	Ammonium chloride	Ammonia, Chlorine	NH_4Cl
Soda ash	Sodium carbonate	Sodium, Carbon, Hydrogen, Oxygen	$Na_2CO_3 10H_2O$
Soda bicarb	Sodium bicarbonate	Sodium Hydrogen, Carbon, Oxygen	$NaHCO_3$
Washing soda	Sodium carbonate	Sodium, Carbon, Hydrogen. Oxygen	$Na_2CO_3 10H_2O$
White vitriol	Zinc sulphate	Zinc, Sulphur, Hydrogen, Oxygen	$ZnSO_4 7H_2O$

CHAPTER

11 LIFE SCIENCE

VARIOUS SCIENCES

The Cell

Cell is the smallest unit of life that is capable of independent existence.

Historical Background

1. In 1665 Robert Hook, an English scientist, first saw a tiny compartment in a section of cork under his selfmade microscope and named it cell.
2. In 1824, R. J. H. Dutrochet concluded that both animals and plants are made up of cells.
3. In 1831, Robert Brown first observed the nucleus of the cell. Van Mohl and Purkings coined the term *protoplasm* for the fluid content of the cell.

Size of the Cell

1. The average cell size is around 3–30 microns (1 micron = 1/1000 mm).
2. The smallest cell size is of bacteria which is around 0.2–0.5 microns.
3. The largest cell is of an ostrich egg (unfertilized) which is about 18 cm (about 7 inches) in diametre.

Structure

Every cell is surrounded by a membrane or a living coverage through which the cell takes in what it needs from the outside atmosphere and discharges what is superfluous. Within the membrane is the protoplasm.

Parts of the Protoplasm: The nucleus controls and directs the activities of all the other parts of the cell. The remainder is known as Cytoplasm, where many of the vital activities of the cell take place.

A cell shows the following structures under a microscope:

Cell Wall: Found only in plant cells. It consists of non-living substances, for example, lignin, pectin, cellulose, etc.

Cell Membrance (Plasmalemma): It is the outer membrane of the cytoplasm found both in animals and plants. It consists of living substances, such as proteins.

Endoplasm Recticulum (ER): A network of tubes or channels of membrane in the cytoplasm which helps in protein synthesis and conduction of material.

Ribosomes: Externally small, dense, granular, spherical bodies found in a free state in the cytoplasm, composed of RNA and proteins. They help in synthesis of proteins from amino acids.

Golgi Bodies: Bag-like structures formed of stacks of membrane. In plants they are called dictysomes. Their functions include secretion of various substances, secretion of pectic material of cell wall in plants and help in the formation of cell plate during cell division.
Vacuoles: A fluid-filled sac within a cell. In plants cells they are very big and surrounded by a membrane called *Tonoplast*, whereas in animals they are tiny. Functions include osmoregulation, maintenance of cell turgidity.
Mitochondria: Rod-like or spherical semi-solid structures containing DNA in their matrix along with some enzymes which are found in all cells. The synthesize A.T.P. (energy storing molecules).
Plastids: Small bodies found in the cells of higher plants. They are two types:

1. Leucoplasts which are colourless and store starch, protein or lipids.
2. Chromoplasts are coloured and are of two types.
   (a) *Non-photosynthetic* chromoplasts which provide colour to flowers, fruits and leaves.
   (b) *Photosynthetic* chromoplasts which in green plants manufacture food from carbon dioxide and water in the presence of sunlight.

Nucleus: May be round, oval, cylindrical or elongated. Each nucleus is bound by the *nuclear membrane* which contains nucleoplasm. Nucleoplasm consists of *chromatin* and *nucleoli.* Chromatin consists of DNA, RNA and proteins. The nucleus controls all cell activities and its responsible for transfer of heredity characteristics and assists in cell division.
Centrosome: A rather dense area of protoplasm, lies close to nucleus. Usually found in animals cells. In the middle of the centrosome are two small dot-like bodies called centroils. They form a spindle in lower plants during cell division.
Cilia and Flagella: These are fine extensions of the cell surface and are similar in structure. Their functions are to help in locomotion or movement and in some animals they also help in feeding.
Cell Inclusions: These are non-living substances present either in the cytoplasm of the cell or in the vacuoles. In animal cells the inclusions are in the form of secretory granules as in zymogen granules, haemoglobin in RBC, food material in the form of glycogen in liver cells, pigments as in the cells of skin, eye and hair. Whereas in plants cells they are in the form of food particles such as starch, oil globules, or excretory products like resin, gum, etc.

Cell Division

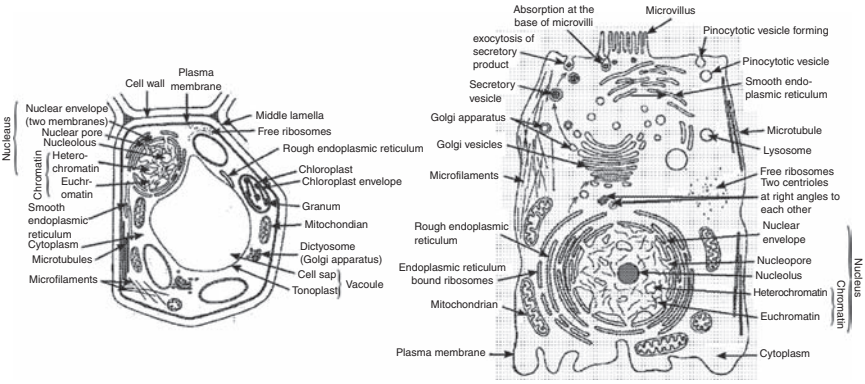
Growth and development of all living things depend upon the growth of cells in size and division whereby increase in number takes place. There are two kinds of cell division.

1. *Mitosis*: Also called somatic cell division. Literally it means division of nucleus but it is generally described as cell as a whole, both nucleus and cytoplasm. It results in formation of two daughter cells with equal number of chromosomes in each, which occur in somatic cells or organs. It is the most common form of cell division which is essential for cell multiplication and growth. Since the number of chromosomes remains the same during mitosis, this division is also referred to as the equational division.
2. *Meiosis*: Occurs in reproductive cells. It causes a reduction in number of chromosomes in the cell besides, formation of gamets which contain half the number of chromosomes. Since the daughter cells have half the number of chromosomes as compared to the mother cell, this division is also called reductional division. It causes hereditary variation in a species due to exchange of genetic material. Before cell division, the cell prepares

itself for division and is called *interphase* in which the cell becomes more active. Each cell division has two steps, such as division of the nucleus and division of the cytoplasm. During cell division chromatin material of the cell gets organized into chromosomes.

Plants and Animal Cells

The basic difference between plants and animal cells is that plant cells are enclosed by a rigid cellulosic cell wall made of cellulose surrounding their plasma membrane whereas animal cells have no such wall. Another difference is that the plant cells have a special organelle, the chloroplast with the help of which they are able to photosynthesize. Also plant cells lack centrioles which are concerned with the organization of the mitotic spindle or the flagella and cilia (discussed above). Plant cells have a large sap-filled vacuole.



CLASSIFICATION OF LIVING THE ORGANISMS

It has been estimated that between 3 million and 20 million different kinds of organisms are alive in the world today. A large number of these organisms have become extinct and some of these are preserved as fossils. Most modern schemes of classification of living beings are based upon the pioneering work of Carl Von Linne.

Scientific Nomenclature

In the 18th century, a Swedish biologist Carl Von Linne (in Latin, Carolus Linnaeus) developed a scheme of scientific classification and devised a system of scientific nomenclature. According to Linne all organisms, having some important characteristics in common and different from a others in one or more ways are placed in a category termed species, for example, cat, monkey, house-fly, frog, etc. Different species having certain common characters are placed in a *genus*. A genus, is therefore, a collection of some related species but they also have some characteristics in common, for example, cat, lion and tiger constitute three different species but they also have some common characteristics and therefore, are placed in the same genus. Similarly, genera are grouped into families and families into orders and orders into classes and classes into phyla. Therefore, the lowest group is species and the highest unit is phylum and various phylum constitute a

kingdom, either plant kingdom or animal kingdom. The naming of organisms is also done on a scientific basis.

1. Each organism is given two names, namely: a *generic name* and a *specific name*.
2. The generic name begins with a capital letter and the specific name begins with a small letter.
3. For example, the zoological name of the common house-fly is *Musca domestica* and that of man is *Homo sapiens*. The botanical name of wheat is *Triticum aestivum*. The order of this nomenclature is illustrated below:

Table 11.1 Order of Nomenclature

Classification	*Frog*	*Dog*	*Man*
Kingdom	Animalae	Animalae	Animalae
Sub-kingdom	Metazoa	Metazoa	Matazoa
Phylum	Chordata	Chordata	Chordata
Sub-phylum	Vertebrae	Vertebrae	Vertebrae
Class	Amphibia	Mammalae	Mammalae
Order	Anura	Carnivora	Primate
Family	Ranidae	Canidae	Hominidae
Genus	Rana	Canis	Homo
Species	Pipiens	Familians	Sapiens

General Classification

Traditionally all living organisms were classified under two main kingdoms:

1. The plant kingdom
2. The animal kingdom

Certain unicellular organisms like bacteria, fungi, etc., were earlier classified under the plant kingdom. However, taxonomists in the last few decades have been opposing this classification of unicellular organisms into the plant kingdom and there have been constant endeavours to revise the system of classification. Accordingly, in 1969, R. H. Whittaker, classified all living organisms into five main kingdoms and this system is now receiving wide acceptance. According to this system the five kingdoms are:

1. Monera (true-bacteria, blue-green algae)
2. Protista (golden algae, yellow-green algae)
3. Fungi (slime molds, bread molds, sac fungi)
4. Plantae
5. Animalae

The kingdom Prokaryotae or Monera is sometimes given to include the viruses. Other systems describe viruses as being outside the normal system of classification.

A brief description of the classification along with sub-classifications is given below:

Monera: They are organisms with prokaryotic cells and diverse nutritional habits, including photosynthesis, chemosynthesis and absorption. Reproduction is a sexual by simple cell division.

For example, true-bacteria, fungus like bacteria, bluegreen algae.

Protista: They are unicellular or colonial eukraryotes with diverse nutritional habits, reproduce both sexual and asexual involving meosis and nuclear fusion. Mobility is by means of more advanced type of flagella.

For example, Euglenophytes, dinoglagellates, golden algae, yellow-green algae.

Fungi: They are multinucleate organisms, with non-photosynthetic nutrition through absorption, lacking tissue differentitation.

For example, slime molds, water molds, white ruts, bread molds, sac fungi, etc.

Plantae: Multicellular organisms with cells being enclosed by a rigid cell wall. Nutrition mostly by photosynthesis with exception of a few species being absorptive. Primarily nonmotile, often anchored to the substratum. Plantae include all botanical organisms.

Animalae: Include all protozoa and metazoa zoological organisms. These are multicellular eukaryotic organisms with cells lacking a rigid cell-wall and photosynthetic apparatus.

IMPORTANT BIOLOGICAL PHENOMENA

Photosynthesis

Process by which green plants are able to utilize energy of sunlight in order to convert water and carbon dioxide into food in the form of simple carbohydrates. The energy from sunlight is trapped in plant cells by choloroplasts which are packed with chlorophyll (gives green colour to the plant and leaves). Incoming sunlight generates tine electric currents in them. These currents convert ADP (adenosine diphosphate) into ATP (adenosine triphosphate) and split water molecules in the cells into oxygen and hydrogen paving the way for the whole complex process of photosynthesis. Thus oxygen is dissipated into the atmosphere and hydrogen combines with carbon dioxide to become glucose, one of the main fuels used by living organisms.

Metabolism

All biochemical reactions of processes taking place in the living organisms have two interwoven aspects, namely,

1. *Anabolism*: Synthesis of complex organic molecules from simple molecules by the living organisms. It is the constructive or synthetic phase of metabolism.
   for example, the formation of proteins from amino acids.
2. *Catabolism*: (also katabolism) Breakdown of complex molecules into simple molecules to release energy, bearing down of hydrocarbons into simpler forms with the release of energy. Metabolism takes place in a controlled manner at body temperature. Enzymes act as bio-catalysts in the process. The energy released in such reactions is stored and used for growth and development. The elimination of waster products generated in the process is called Excretion.

Respiration

A term with two distinct meanings, such as breathing and the transport of oxygen and carbon dioxide to and from the cells known as external respiration. Internal respiration or cell respiration occurs within the cell and constitutes the chemical reactions from which an organism derives energy. Internal respiration using oxygen is termed aerobic while

anaerobic respiration may occur in the absence of oxygen. Both plants and animal respire.

Animals need oxygen to release the energy present in their food and get rid of waste, that is, carbon dioxide.

Skin Breathing: Carried out through the skin by slow-moving animals.

Gill Breathing: Fish possess gills which absorb oxygen from water flowing over them taken in through the mouth.

Tracheal Breathing: System developed by insects which include network of tubes which take oxygen to all parts of the body.

Lung Breathing: Acquired by evolved animals.

Fertilization

Is the union of two gametes or sex cells to produce a zygote or fertilized egg which grows into a new offspring.

External Fertilization: Fertilization in frogs and toads is external as it is in fishes, most water creatures and lower plants (for example, Ferns). By this we mean the male gamete swims across a watery surface to fertilize the female gamete or egg. The fertilized egg cell is then able to develop into an individual creature.

Internal Fertilization: Fertilization in mammals, birds, reptiles and insects is internal. That is to say, the sperms are shed directly into the female's body where they fertilize the egg before these are laid as in birds and reptiles whereas in mammals the cell develops into an embryo within the female body.

Fertilization in Flowering Plants: In higher plants it is a complex process involving pollen grains which are transferred to the egg-bearing organism by wind or insects. The process is called pollination in plants. On falling on a stigma each pollen grain of the right kind germinates and sends a *pollen tube* containing a male reproductive cell down through the style and into an ovule where the male cell fuses with an egg cell which can develop into an embryo plant.

Transpiration

Evaporation of water from the stem and leaves of plants. It serves the purpose of cooling the leaves on hot days and protects delicate leaf tissue from drying up. It draws water up from the roots towards the leaves which give out excess water into the atmosphere.

HUMAN BODY

Anatomy and Physiology

Blood

- Blood contained in blood vessels is a connective tissue in the form of a red viscous fluid.
- On an average, a healthy man has about 5 lr of blood in the body while a woman has about 500 ml less than a man.
- Total volume of blood is said to be 60–80 ml per kg of body weight.

Constituents of Blood

- There are two main constituents of blood solid or cellular part called blood cells (35%) and the fluid part called Plasma (65%).
- The blood cells called corpuscles are of two types the Red Blood Corpuscles (RBCs) and White Blood Corpuscles (WBCs).
- Plasma consist of Water (90%), proteins (7%), nutrients, salts, nitrogen waste, carbon dioxide, hormones.
- Blood also has platelets (thrombocytes):
- Normal count = 1,50,000–3,00,000 per mm^3.

Red Blood Corpuscles (RBC)

- *Red Blood Cells (erythrocytes):* 54% of which is haemoglobin. Normal count = 4–6 million per mm^3.
- These are disc-shaped cells without nucleus and contain a pigment called Haemoglobin which gives the red colour to the blood.
- Haemoglobin is an iron-containing pigment.
- RBCs are produced in the spleen and the bone marrow.
- Haemoglobin picks up oxygen in the lungs by forming a chemical compound.

White Blood Corpuscles (WBC)

- *White Blood Cells (leukocytes):* Normal count = 4500–11,000 per mm^3.
- These are round semi-transparent cells containing a nucleus and are a little larger in size than RBC.
- The WBC are the 'soliders' of the body's defence system and their main function is to combat infection.

Blood Grouping

- K. Landsteiner in 1900–1902, classified human blood into four groups: (i) 'A', (ii) 'B', (iii) 'AB' and (iv) 'O'.
- The 'O group' blood can be given to any of the other groups and therefore, a person possessing the 'O group' is known as a *Universal Donor.*
- 'Group AB' is called *Universal Recipient* and can receive 'A', 'B', 'AB' and 'O' blood groups.

Table 11.2 Types of Blood Groups

Blood group	*Can donate blood to*	*Can receive blood from*
A	A, AB	A and O
B	B, AB	B and O
AB	Only AB	AB, A, B and O
O	AB, A, B and O	Only O

Blood Clotting

- Blood clotting is a body's defence system to combat bleeding.
- Plasma contains fibrinogen, a soluble 'protein' which produces the insoluble protein called *Fibrin* essential for blood coagulation which is produced in the liver.

Rh Factor

- A blood antigen discovered in 1940 by Landsteiner and A. S. Wiener. It is another blood grouping which has important bearing on blood transfusion along with the 'A', 'AB' and 'O' blood grouping.
- The Rh factor is an agglutinogen found in RBC of most people and is called Rh^+. It was initially found in the rhesus monkey and later on found in man.
- People who do not have this antigen in their blood are called Rh^-.
- The Rh^- blood does not carry anti-Rh antibodies naturally but could synthesize them if sensitized through blood transfusion of Rh^+ blood.
- If Rh^+ blood is transfused into an Rh^- patient, the serum will produce anti-Rh agglutinin.
- If another dose of Rh^+ blood is given, the anti-Rh agglutinin will cause clumping of RBC of the donor's blood as soon as it enters the patient receiving it.

Blood Transfusion

- The injection of blood from one person (the donor) into the circulatory system of another is called blood transfusion. It is used to make up a loss in volume of blood or to improve its composition.
- A rapid loss of 3–3.5 lr of blood can be fatal unless it is properly replaced by transfusion.
- Blood transfusion is done after proper matching of blood groups and the Rh factor.
- The technique was first developed by James Blundell, London in 1825.

Blood Pressure

- Is the force exerted by the blood beating against artery walls. As blood is ejected from the left ventricle into the aorta, there is an increase in blood pressure, that is, the pressure of the blood upon the walls of the blood vessels.
- As the ventricle begins to relax, the pressure falls. The highest point in the pressure range is called *Systolic Pressure* (upper reading) and lowest point in the pressure is called *Diastolic Pressure* (lower reading).
- Blood pressure is measured in a large artery of the arm called the brachial artery by sphygmomanometer. The diastolic pressure is always lower than the systolic pressure.
- The average systolic pressure of a healthy young man of 20 years of age is about 120 mm Hg and the diastolic pressure about 80 mm Hg. that is, 120/80 is the normal blood pressure.
- Any systolic pressure over 140 or diastolic pressure over 100 is considered abnormal. High blood pressure may be caused by excitement and low blood pressure may result from malnutrition, etc.
- High blood pressure is called *Hypertension* and low blood pressure *Hypotension*.
- Blood pressure depends on many other factors including the strength of the heart-beat, volume and thickness of blood, elasticity of the arteries and resistance to blood flow offered by capillaries.

The Skeletal System (Bones)

- There are 206 bones in the skeletal system of an adult.
- Bones of hands and feet alone constitute 50% of the total bones in the human body.
- A new born baby has 300 bones out of which 94 bones fuse together as it grows.
- The *largest* bone of human body is the femur in the thigh which constitutes about 27.5% of a person's stature, average length of this bone is about 50 cm.
- The *shortest* bone in the human body is the stirrup bone in the middle ear.

Functions

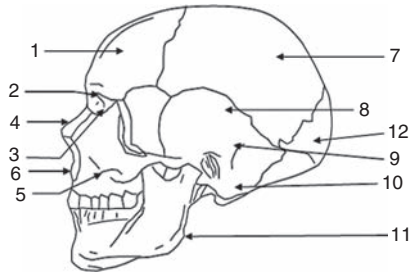
1. They are connective tissues in the body
2. They stiffen the body
3. They provide levers upon which muscles work
4. They give shape to the body
5. They protect internal organs
6. The bone marrow produces blood cells.

Composition of Bones

Organic matter	33.30%
Phosphate of lime	51.04%
Carbonate of lime	1.30%
Flouride of calcium	2.00%
Phosphate of magnesia	1.16%
Soda/Chloride of sodium	1.00%

Important Bones

Skull Bones (Cranium): There are eight hones forming the skull (Figure 11.1). One frontal (forehead), two parietals (side of the head), one occipital, two temporals, one sphenoid and one ethmoid.



1. Frontal bone
2. Sphenoid
3. Ethmoid
4. Nasal bone
5. Zygomatic process
6. Maxilla
7. Parietal bone
8. Squamous part of temporal bone
9. Occipital Bone
10. Mastoid Process
11. Mandible
12. Temporal Bone

Figure 11.1 Skull

Facial Bones: Facial bones comprise 14 individual bones, two lachrymals, two Os-Nazale or Zygomalicum (nasal bones), two check bones, one vomer, two sponge bones, two palate bones, two superior maxillary (Maxilla) and one mandible (lower jaw).

Upper Extremities: There are 32 individual bones forming the shoulder and the arms. Shoulder bones

1. Two scapula (triangular-shaped shoulder blades)
2. Two clavicles (collar bones).

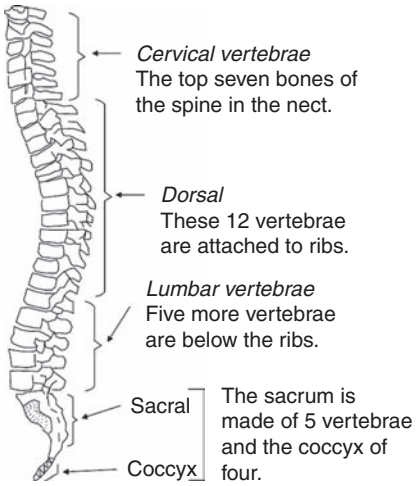
Bones of the Arm: Each arm has 30 individual bones:

1. One humerus (the largest bone of the arm)
2. One radius (outer bone)
3. One ulna (inner bone)
4. Eight carpals
5. Five metacarpals (forming middle hand)
6. Fourteen phalanges (forming the fingers).

Backbone (the Spine): Also called *vertebrae* which encloses the spinal cord (see nervous system). In childhood, the backbone consists of 33 separate bones but in an adult there are only 26 separate vertebrae as several bones become welded (fused) together. The 26 vertebrae are sub-divided in five regions:

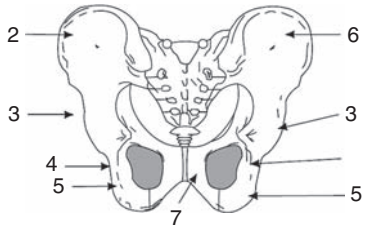
1. Cervical vertebrae (neck bones)—seven
2. Dorsal vertebrae (ribs support)—twelve
3. Lumbar vertebrae (backbones)—five
4. Sacrum (also called 'Sacred Bones') consists of five vertebrae (25th to 29th) fused together in adults and
5. Coccyx (four tail bones fused together in adults).

The Spine: An adults' spine consists of 26 bones called Vertebrae. It is divided into 4 sections.



Chest Bones (The Thorax): The Thorax which is a protective casing for the lungs and heart consists of one sternum (breast bone) and 24 ribs.

Hip Bone (The Pelvis): Each hip bone, originally consists of three bones, the ilium, the ischium (seat bone) and the pubis. These bones become one in a mature adult and called the *oscoxae* or the hip bone. There is a notable difference between male and female pelvis. The female pelvis is proportionately broader (for maternity reasons) and not so deep as that of male which is designed for greater strength (Figure 11.2).



1. Sacrum
2. Iliac crest
3. Acetabulum (Hip joint)
4. Ischium
5. Ishial tuberosity
6. Ilium
7. Pubis

Figure 11.2 Pelvis

Bones of the Leg: Each leg consists of 30 bones. They are

1. Femur (the thigh bone: The longest bone of the human body)—one
2. Tibia (shin bone)—one
3. Fibula (calf bone)
4. Patela (knee cap)
5. Tarsus (ankle bones)—seven
6. Phalanges 14 (toe bones)

Muscular System

Muscles are tissues attached to bones are composed of fibres are capable of contracting and relaxing to effect body movement.

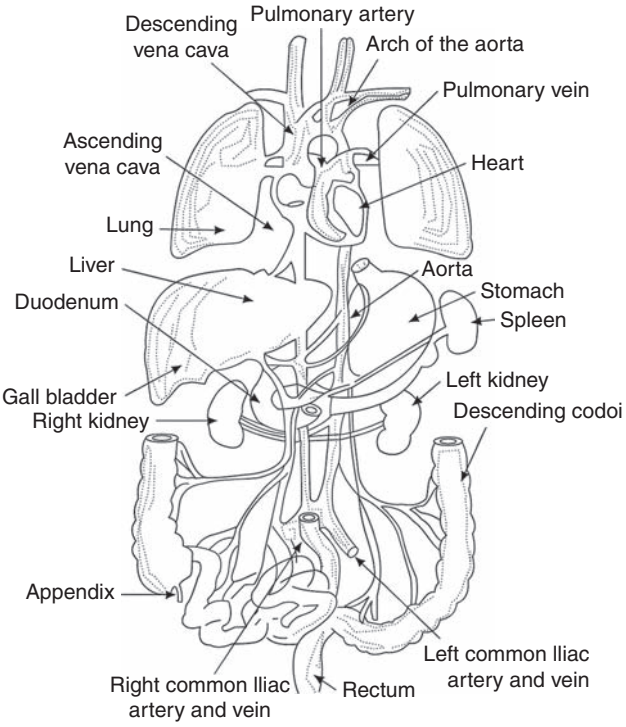
Total Number of Muscles: There are about 630 important muscles in the human body which normally account for 40% of the body weight. There are about 100 joints and about 10,000 km of blood vessels in the human body. Water constitutes about 70% of human body tissues (45 lr).

Largest Muscle: The bulkiest muscle in the body is Gluteus maximum or buttock muscles.

Longest Muscle: Sartorius (Tailor's muscles) is the longest muscle in the body. It has its origin in the upper part of the hip bone, crosses obliquely over the upper portion of the thigh, passes behind the femur and is attached to the tibia bone of the leg.

Smallest Muscle: The smallest muscle in the human body is the Stapedius which controls the stapes, an auditory ossicle in the middle ear. It is less than 1/20 of an inch and 0.127 cm long. The ear also contains one of the few tissues which has no blood supply.

Main Organs



Heart

- The heart is situated in the centre of the thorax, just behind the breast the breast-bone (sternum) and is enclosed in a tough membrane called the *Pericardium*.
- Its average weight is about 340 grams in men and 225 grams in women.
- Contraction and relaxation mechanism of the ventricles results in a heartbeat of about 70–72/min in males and 78–82/min in females.
- Contraction of ventricles is called *Systole* and relaxation is called *Diastole*.
- Circulation of blood in the body is regulated by the heart.

Blood Circulation: The credit of discovering the circulatory system goes to William Harvey (1578–1657). The heart and blood vessels are concerned with blood circulation in the human body (Figure 11.3). Blood vessels consist of

1. *Arteries*: Thick-walled tubes which carry pure blood away from the heart to the tissues at a high pressure.
   —Largest artery The elastic aorta which begins at the heart; approximately 2.5 cm in diameter, is the largest artery in the human body.
   —Smallest artery arteries that are known as arterioles which are approximately 0.1 mm in diameter.

2. *Veins*: Thin-walled tubes which collect impure blood from the tissues and carry the same to the heart for purification in the lungs. Veins have valves to prevent the backward flow of blood which is carried at low pressure.

Human Temperature: Normal human body temperature is about 37°C (98.6°F). Some people have a norm slightly higher or lower-especially young children. Norms change during the day-usually rising a little by mid-afternoon and falling a little during sleep.

- The pulmonary artery (the only artery which carries impure blood) carries blood to the lungs from the heart.
- The pulmonary vein (the only vein which carries pure blood) carries pure blood again to the heart from the lungs to be supplied to the entire body tissues. Both impure and pure blood are forced into two ventricles by contraction of the same.
- The pure blood from the left ventricle goes into the large aorta and impure blood from the right ventricle goes into the pulmonary artery. Thus the aorta takes blood to various parts of the body.
- The pulmonary artery takes impure blood to the lungs. When ventricles relax the auricles are again filled with blood and the same process is repeated.

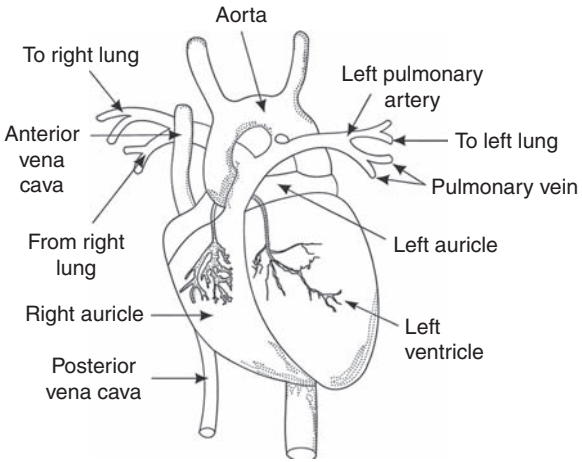


Figure 11.3 The Heart

Lungs

- A pair of spongy organs consisting of elastic tissues situated in the chest cavity (Figure 11.4).
- There are two lungs, the right lung is larger than the left. The right lung weighs approximately 620 g while the left lung weighs about 570 g and together they weigh between 1.18–1.19 kg, in a healthy adult.
- Their main function is to purify blood and supply oxygen to it.
- The entire blood supply (4.5–5 lr) washes through the lungs about once a minute.

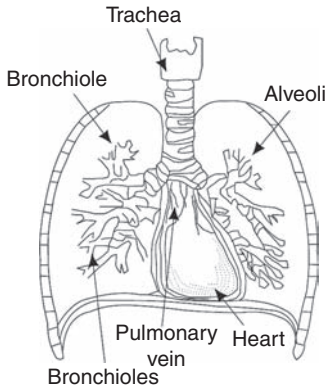


Figure 11.4 The Lungs

Liver

- The liver, situated on the right side of the stomach is the largest gland in the human body.
- It is dark brown in colour and divided into two lobes varying in weight from 1.359–1.812 g.
- The gall bladder is attached to the liver and stores bile produced by it.
- The gall bladder has the storage capacity of 30–60 ml of bile.

Functions: The liver secretes bile, forms and stores glycogen and plays as important part in metabolism of protein and fats. The liver is responsible for

1. The metabolism of the products of digestion.
2. The storage and release of substances (principally glucose) so as to maintain constant level in the blood.
3. The synthesis, conjugation and transformation of substances (for example, formation of proteins, dioxication of poisonous substances, production of carbohydrates from proteins, etc.)

- The bile produced by the liver is an important agent to digestion, especially fats.
- It contains water, bile salts and bile pigments.
- It does not contain digestive enzymes and as such does not take part directly in digestion.
- It contains salts like bicarbonate, glycocholate and taurocholate of sodium.
- The sodium bicarbonate neutralizes the acid and makes the churned food called Chyme Alkaline whereas glycocholate and taurocholate of sodium break down the fats of tissues into small globules.

Kidneys

- The two kidneys are situated in the upper posterior of the abdominal cavity, one on each side of the vertebral column.
- A kidney is approximately 10 cm long, 5 cm wide and 2.5 cm thick. From each kidney emerges a long channel called the Ureter by which the urine passes into the urinary bladder.
- Each kidney has thousands of minute glands in the form of canals known as Uriniferous Tubules.

Functions: They filter nitrogenous waste of the body from the blood and throw them out in the form of urine.

- Kidneys are responsible for the removal of excess water, salts and waste products from the blood and maintaining its pH level (pH value is a number used to express degrees of acidity and alkalinity in a solution).
- To achieve this, blood flows through the wide renal vessels in approximately one quarter of the resting cardiac output, that is, 1.2–1.4 lr/min. The urine expelled by a normal adult is about 1.4 lr per day.
- The human body contains about 45 lr (70%) water.

Spleen

- It is situated near the diaphragm on the left side of the body. It is the *largest lymphatic gland* in the human body. Along with the rest of the lymphoid tissue in the body, the spleen plays a considerable role in the development of immunity. However, this gland is not essential for life and can be removed. Its removal tends to increase the susceptibility of infection.

Functions: The main functions of spleen are

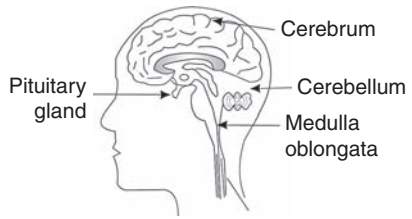
1. Formation of lymphocytes and antibodies
2. Formation of red blood cells (RBC)
3. Storage of RBC
4. Helps to remove worn-out RBC and foreign particles from the blood stream.

Human Brain

- It consists of two parts
  1. The brain located in the skull
  2. The spinal cord located in the vertebral column.
- The weight of the average human brain triples between birth and adulthood.
- The final weight of the brain in an adult male is about 1.4 kg and 1.3 kg in the case of a woman which averages about 3% of the body weight. In both sexes the brain makes up a similar proportion of the total body weight.
- The brain uses about 20% of the oxygen a man breathes, 20% of calories a man takes in and about 15% of body blood.
- The average brain contains about 10,000 million neurons, microscopic nerves cells.

Central Nervous System

- The brain and the spinal chord along with nerves constitute the nervous system.



View of exterior brain showing
Convulsion of the cerebrum and the cerebellum

- The brain consists of
  1. *Cerebrum*: The largest part of the brain consists of two hemispheres separated by corpus callosum, a deep median furrow. It controls voluntary actions and is the seat of intelligence, memory association, imagination and will.
  2. *Cerebellum*: The large mass having ridges and furrows, situated above and behind the mediulla and attached to cerebrum (See diagram). It regulates muscular movement of locomotion.
  3. *Medula Oblongata*: It is the lowermost part of the brain which continues as the spinal chord in the vertebral column. It controls involuntary action.
  4. *Spinal Chord*: It is the elongated, nearly cylindrical continuation of the medulla. It is enclosed in vertebrae and runs down the back. The length of the spinal cord in an average man is about one metre (3.3 ft).
  5. *Nerves*: They are whitish cords consisting of large numbers if exceedingly fine filaments (nerve fibres) of variable diameter, bound together in bundles by fibrous tissues.

Function of Nerves

- Nerve fibres transmit messages (nerve impulses) both to and fro from the central nervous system to the various structures of the body.
- The fibres which carry impulses from the central nervous system are called Efferent. Many of these pass to the muscles to make them contract and are called Motor Nerve Fibres. Those which carry impulses to the central nervous system are called afferent fibres. The information which they transmit from the skin and deeper tissues often evokes subjective sensation within the nervous system hence they are called Sensory nerve fibres.

Classification of Nerves

- Cranial nerves are attached to the brain and emerge from the skull (cranium).
- Spinal nerves are attached to the spinal chord which is enclosed in the vertebral column. There are 31 pairs of these, named after the groups of vertebrae between which they emerge—eight cervical, twelve thoracic, five lumbar, five sacral and one coccygeal.

Sense Organs

Skin: Skin covers the muscles of the body and is said to be the largest organ of the human body.

- In an adult man skin cover is about 1.9 m^2 (20 ft^2) and a woman has about 1.6 m^2 (17 ft^2) of skin (Figure 11.5).
- The human skin is composed of two main layers, namely,
  1. The outer layer called Epidermis which has no nerves of blood vessels and is continuously renewed. There are pigment grains located in the basal layer of the epidermis which give colour to the skin.
  2. Inner layer called Dermis is a thick layer below the epidermis which contains nerves, blood vessels, hair follicles, sebaceous and sweat glands.

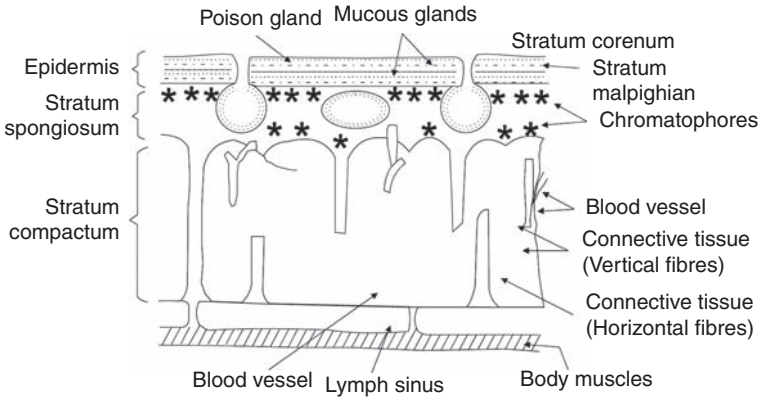


Figure 11.5 Cross Section of Skin

Tongue

- It is the muscular organ in the mouth is the primary organ of taste and important in the formation of speech and in the chewing and swallowing of food.
- The tongue, which is covered by a mucous membrane, extends from the hyoid bone at the back of the mouth upward and forward to the lips. Its upper surface, borders and the forward part of the lower surface are free; elsewhere it is attached to adjacet parts of the mouth.
- Extrinsic muscles attach the tongue to external points and the intrinsic muscle fibres, which run vertically, transversely and longitudinally, allow it a great range of movement.
- The upper surface is convered with small projections called Papillae, which give it a rough texture.
- The colour of the tongue usually pinkish-red, but discoloured by various diseases is an indication of health.
- The tongue serves as an organ of taste, with taste bud scattered over its surface and concentrated towards the back of the tongue (Figure 11.6).

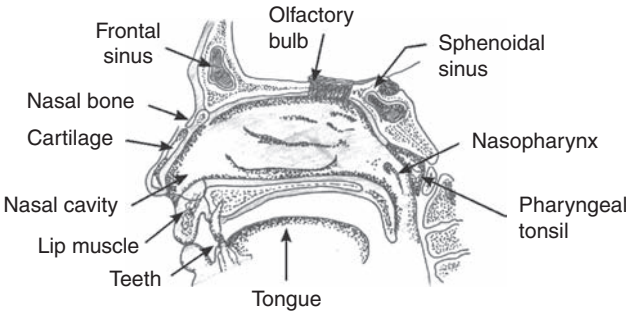


Figure 11.6 Sense of Taste

Nose

- The nose, the main organ of smell is also part of the apparatus responsible for respiration and voice.
- Considered anatomically, it may be divided into an exteranl portion—the visibly projected portion, to which the term nose is popularly restricted—and an internal portion, consisting of two principal cavities or *nasal ffossae* (separated from each other by a vertical septum), subdivided by spongy or turbinated bones that project from the outer wall into three passages (*meatuses*) with which the various siuses in the *ethmoid, sphenoid, frontal* and *superior maxillary bones* communicate through narrow apertures.
- The margins of the nostrils are usually lined with a number of stiff hairs (*vibrissae*) that project across the openings and serve to arrest foreign substances such as dust and small insects, which might otherwise be drawn up with the current of air intented for respiration.
- The skeleton or framework of the nose is partly composed of the bones forming the top and sides of the bridge and partly of cartilage.

Eye

- The eyeball, almost a perfect sphere of 2.5 cm diameter consists of three coatings, namely, sclerotic (upper coating) continuous with the transparent cornea in front (Figure 11.7).
- Within the sclerotic is the middle layer call *choroid* and the inner line called retina. The membrane covering the cornea is conjuctiva.
- The cavity of the eyeball is filled with aqueous humour and vitreous humour and in front there is a convex lens.

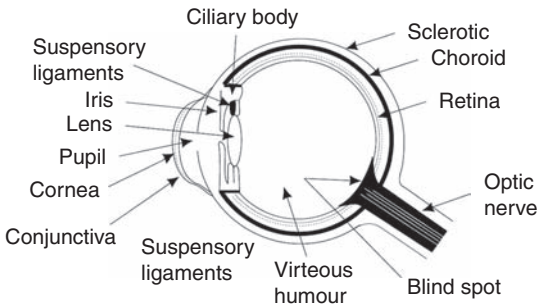


Figure 11.7 Eye

- The lens attached to the ciliary body is situated behind the iris. The iris is the coloured portion of the eyeball situated behind the cornea, which automatically adjusts the size of the pupil (the circular opening or diaphragm in the iris through which light passes) to the intensity of light falling on it.
- In bright light the iris automatically shuts tighter, reducing the amount of light entering the pupil.
- In order to form an image on the retina, light must pass through all the media of the eye (cornea, aqueous humor, lens, vitreous humor) and be brought to a focus on the retina to form an upside down image on it and the process of interpretation takes place in the brain.

Ear

- The ears have two main functions, namely
  1. Defection and analysis of sound
  2. Maintenance of balance of the body.
- Broadly, the ear is divided into three main regions—the outer ear, the middle ear and the inner ear.
- Sound waves or vibrations in the air—are collected by the pinna which acts as a sound collector and travel to the ear-drum which is set into vibration.
- The ossicles transmit the vibration to the inner ear, where they cause waves in the fluid called Perilymph, filling the coiled tube of cochlea, a tube coiled like a small, snail shell of 2 1/2 turns. These waves vibrate the basilar membrane which divides the tube lengthways.
- The membrane it tuned so that each part responds to a different frequency and along it are some 10,000 sensory structures—the rods or corti.
- These structures convert the basilar membrane's vibrations into nerve impulses, which reach the brain along the auditory nerve where they are intercepted into sound (Figure 11.8).

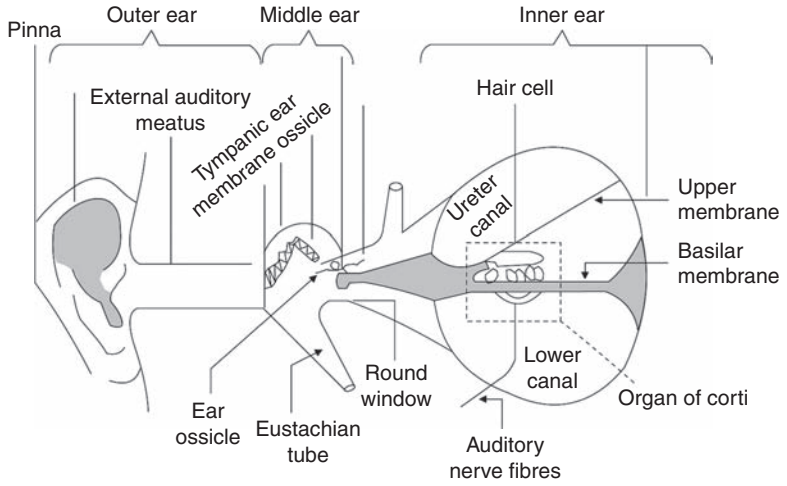


Figure 11.8 Ear

Maintenance of Balance: The second function performed by the ears is the maintenance of balance which is achieved by three semi-circular canals and the utricle and saccule all of which are filled with fluid. The semi-circular canals detect movement in three planes of right angles and so provide a stream of information for the brain on movements of the head. The utricle and saccule detect tilting of the head and combine with the canals to give rapid control of balance in normal circumstances.

Glands of the Human Body

- Organs of the human body which manufacture some liquid products which are secreted from the cells are called Glands. There are two types of glands:

1. *Ducted Glands*: Ducted glands also called Exocrine glands secrete their product through well-defined ducts.

   For example, *Liver* production of bile; *Lachrymal* secretes tears in the eyes; *Salivary* secretes saliva in the mouth; *Sweat glands in the skin* secrete sweat.
2. *Ductless Glands*: Also called Endocrine glands or internally secreting glands. They secrete hormones directly into the blood-stream in response to instructions from the brain.

Table 11.3 Ductless Glands

Name of Gland	*Function*
Thymus	In early childhood it plays some part in building resistance to diseases and physical development
Thyroid	Regulates metabolism
Prostrate	Regulates blood pressure and sexual potency
Gonads	Relates to reproductive system and secretes sex hormones
Adrenal	Causes acceleration of the breath, heightens emotion and a sudden increase in physical strength during fear or anger
Pancreas	Aids in digestion of proteins, carbohydrates and fats; it secretes insulin and deficiency of insulin causes diabetes
Pituitary	Called the master gland as it controls the other ductless glands and influences growth and metabolism.

- *Digestive System*: The process of converting food into energy-giving substances is carried out by the digestive system. The digestive system comprises the alimentary canal and the associated digestive glands like liver and pancreas.
- *Alimentary Canal*: The entire tube-like structure starting from mouth to the anus, is called alimentary canal. It includes various digestive organs.

  For example, mouth, gullet, oesophagus, stomach, small and large intestine, rectum and anus.

Digestive Organs

- *Teeth*: The teeth cut and grind the food with the help of saliva secreted by the mouth.
- *Milk Teeth*: Appear by the age of 7 months and are 20 in number.
- *Adult Teeth*: Milk teeth drop and 32 permanent teeth begin to replace them from the 6th year onwards There are four chisel-shaped incisors, two conical premolars and six molars for crushing and grinding the food. The two wisdom teeth, the rearmost, develop at a later stage and are largely non-functional. In the mouth salivary glands secrete saliva which moistens the food and ptyalin ferment contained in it acts on carbohydrates.
- *Gullet*: Also called oesophagus, is a 25 cm long duct system covering mouth and the food pipe pharynx. The food is carried to the stomach thereon by peristalsis movement (contraction of the wall of the pipe).
- *Stomach*: A warehouse where food can be stored to await the main process of digestion. Gastric juices produced in the stomach help in digestion of food.
- *Small Intestine*: Measuring 6–7 m long and 2 cm in diameter is arranged in coils. Here the food from the stomach is mixed with bile and pancreatic juice and moves

forward through peristalsis movement. Part of the intestine near the stomach is called Duodenum where bile and pancreatic juices digest the food.

- *Large Intestine*: A 1.4 m long tube called colon. It receives undigested material from the small intestine and absorbs water. The remaining waste material is sent to the rectum and discharged from the anus.

Process of Digestion

Chewed food is converted into food pulp called Chyme. After being processed by bile and other secretions it becomes an emulsion called chyle. The end product is absorbed through the walls of the small intestines and taken into the blood. The undigested waste part is excreted as faeces.

Digestive Secretions

- *Saliva*: Produced by salivary glands in the mouth (situated under the tongue) saliva helps to lubricate the chewed food making it fit for swallowing. It also contains a ferment called *ptyalin* which acts on starches (carbohydrates) and hydrolyzes the same into maltose.
- *Gastric Juice*: Produced in the stomach, contains hydrochloric acid and enzymes. Hydrochloric acid kills bacteria present in food and the enzymes help to digest the food. It contains 90% water, 5% enzymes (pepsin, renin and gastric lipase) and 5% hydrochloric acid. Pepsin and hydrochloric acid turn protein into peptones and proteoses. Renin curdles milk to form casein and gastric lipase acts on fat to convert it into glycerol and fatty acids.
- *Pancreatic Juice*: Produced in the pancreas, meets the food pulp in the duodenum along with bile juice (alkaline) from the liver plus intestinal juice from the small intestine. Bile produced in the liver is stored in the *gall bladder*. Pancreatic juice contains several enzymes which act on proteins, carbohydrates and fats. Amylase catalyzes hydrolysis of starch, lipase acts on fat which is converted into glycerol and fatty acids.

Table 11.4 Important Hormones

Hormone	*Produced by*	*Action*
Adrenalin	Adrenalin	Blood pressure control
Insulin	Pancreas	Sugar metabolism
Oestrogen	Ovary	Affects female organs
Testoterone	Testes	Affects male reproductory function
Thyroxin	Thyroid	Growth and metabolic rate

Table 11.5 Important Digestive Enzymes

Enzyme	*Produced by*	*Converts*
Amylase, Ptylain	Salivary glands in mouth	Starch to sugars (Maltose)
Peptin	Gastric glands in stomach	Proteins to amino acids (Peptones)
Trypsin	Pancreas in abdomen	Proteins to Peptones
Amylase	Pancreas	Carbohydrates to Maltose
Lipase	Pancreas	Fats to fatty acids and glycerol

(*Continued*)

Enzyme	*Produced by*	*Converts*
Erepsin	Intestinal glands in small intestines	Peptides to amino acids
Maltase	Intestinal glands	Maltose to glucose
Lactase	Intestinal glands	Lactose to glucose
Sucrase	Intestinal glands	Sucrose to glucose

The Reproductive Organs

- A human reproductive organs or sex organ or primary sexual characteristic narrowly defined is any of those parts of the body (which are not always bodily organs organs according to the strict definition) which are involved in sexual reproduction and constitute the reproductive system in an complex organism namely:
  1. *Female*: Vulva (notably the clitoris), vagina (notably the cervix), labia, uterus, fallopian tubes, ovaries, skene's glands, bartholin's glands.
  2. *Male*: Penis (notably the glans penis and foreskin), testicles, scrotum, prostate, seminal vesicles, epididymis, cowper's glands.
- The latin term genitalia is used to describe the sex organs and in the English language this term and genital area are most often used to describe the externally visible sex organs or external genitalia: in males the penis and scrotum in females the vulva.
- The other parts of the sex organs are called the Internal genitalia.
- A gonad is a sex organ that produces gametes, specifically the testes or ovaries in humans.
- Organs of sexual anatomy originate from a common anlage and differentiate into male or female sex organs. Each organ in one sex has a homologous counterpart in the other one

Human Cell, Genes and Heredity

Human cell

- The smallest unit of life that is capable of independent existence. It occurs in all living organisms (both plants and animals). The average diameter of a cell is between l/50 and 1/100 millimetre.
- The largest human cell is the ovum. Every square inch of skin of the human body contains about a million cells. The brain is made of 30 million cells. Our blood contains about 20 trillion cells.
- The whole cell is surrounded by a strong membrane called the membrane which is approximately 5,00,000th of an inch in thickness. Each cell has a dense kernel called Nucleus which controls the activities of the rest of the cell.
- Outside the nucleus is cytoplasm, a gelatinous substance The nucleus is enclosed in a thin but strong membrane called Nuclear envelope and contains chromosomes.

Chromosomes

- Chromosomes are carriers of genes (hereditary traits). They are threadlike bodies found in the nucleus of the cell. They are always found in pairs and vary in number in each species of living organisms.
- Human cells have 23 pairs (46 in all) of chromosomes. In every chromosome there are protein molecules and two kinds of nucleic acid molecules called RNA (Ribose Nucleic Acid) and DNA (Deoxyribose Nucleic Acid).

- The DNA is concentrated in the chromosomes while RNA is concentrated in the nucleoli both of which are present in the nucleus.

Genes

- The gene is a hereditary unit located in chromosomes. Transmission of physical and mental traits from parents to offspring is through the base unit of genes.
- The gene consists of DNA molecules in different patterns and hereditary traits are determined by these patterns and they also mastermind the process of life.
- In 1896 Gregor Mendel proved that certain hereditary factors operate in all biological species and it was Wilhelm Johannsen (a Danish biologist) who gave them the name *genes*.
  1. *Isolation of Pure Gene*: In 1969 scientists at Harvard University isolated and photographed the pure gene.
  2. *Artificial Gene*: Dr Hargobind Khorana, an Indian-born American scientist (who received the Nobel Prize in 1968) successfully created an artificial gene in a test tube in 1970 by protein synthesis.
  3. *Genetic Code*: is the code of life by which inherited characteristics pass from generation to generation. It is expressed by the molecular configration of chromosomes of cells in which the code bearing material is DNA.

Genetic Engineering

- Also called Bio-engineering is the artificial manipulation of parental genes to form combinations to give birth to a new organism with predetermined, mental and physical characteristics.
- The beginning of bio-engineering can be traced back to the discover of DNA in 1953 (responsible for carrying hereditary traits) followed by the development of the technique of manipulating DNA in a living cell by recombinant DNA in 1973. The technique is known as Recombinant DNA or gene splicing.
- The genes cut from the donor DNA using chemicals called Enzymes that act as molecular knives.
- The isolated gene is then inserted into the DNA of a bacterium commonly the intestinal bacterium called *E. Coli,* again using an enzymatic reaction.
- The hybrid DNA thus produced is put back into *E. Colli* growing in the culture medium has the hybrid DNA in it, nucleus and is capable of exhibiting the traits and characteristics coded by the foreign gene.
- The four DNA bases A, G, T and C, like the letters of the alphabet can be used to store information. This genetic information is passed on via RNA or ribonucleic acid consisting of the four bases adenine, guanine cytosine and uracil (u) which prov-ides a template for the assembly of amino acids in a particular sequence, thereby building a protein.
- A group of three DNA or RNA bases is known as a triplet of codon and codes for a particular amino acid. Information is passed from DNA to RNA by complementary pairing: A pairs only with U and G only with C.

Sex Determination

- Out of 46 chromosomes (23 pairs) only 44 (22 pairs) are true homologous (similar). The other two, the X and Y are sex chromosomes.

- Two X chromosomes produce a female and an X and a Y chromosome produce a male. Hence the sex of a child depends entirely on whether the female egg is fertilized by an X-carrying sperm or Y-carrying sperm.

Twins

1. *Fraternal Twins*: If two eggs are released by the ovaries at the same time due to some irregularity and both get fertilized, they develop into two separate babies. Such twins may be of the same sex or of different sex.
2. *Identical Twins*: Develop from a single fertilized egg during the first division of the zygote (egg) into two similar cells that develop into two separate embryos. Since they develop from a single zygote, these twin have the same genetic characters and are always of the same sex. Identical twins who are born joined together, generally at the head, chest or hip are called *Siamese* twins. Siamese twins occur very rarely and can usually be separated surgically unless a vital organ such as heart is shared by both. The first such twins who received wide publicity came from Siam (now Thailand) in the 19th century.

Human Genetics

- Human Genetics is that branch of medical science, which deals with the study of hereditary material passing from one generation to another.
- The study leads to a better understanding of the way by which this hereditary material develops into physical characters under the influence of intrinsic and extrinsic environmental factors.
- In other words, the science deals with transmission of physical, mental and biochemical characteristics from parents to off-springs.
- The science also reasons out why an offspring will not be the exact replica of the parents. The tendency on the part of the offsprings to produce parental features is known as Heredity.
- This science is the youngest branch of medical sciences. During the last six or seven decades, a phenomenal growth of this science has occurred and thus opened up biological thinking towards a better understanding of some of the problems of life as far as health of the future generation is concerned.
- Thus, in the present era Genetics is one of the new and most significant developing branches of medical sciences. There are two main components of this science.
  1. *Heredity*: Study of similar traits passed from parents to their offsprings.
  2. *Variation*: Study of traits influenced by the internal or external forces so that no two individuals are exact replicas of each other.
- For human beings, the knowledge of Genetics can be helpful in many ways:
  1. To understand the underlying cause of the disease and the means of transmission
  2. To understand the reasons of normal variations
  3. To apply the knowledge to the possible means of preventing genetic disorders through counselling and antenatal diagnosis
  4. This knowledge can be applied to solve legal problems like disputed parentage or traits of murderer, etc.

- The study of Genetics can be subdivided into following branches:

1. *Cytogenetics*: This field gives the knowledge of structure of nucleus of cell and its part. that is, chromosomes which normally lies in the condensed form in the nucleus.
2. *Molecular and Developmental Genetics*: The field dealing with molecular structure of the Genetic materials, its significance during embryogenesis and functional state of individuals during normal as well as abnormal conditions.
3. *Eugenics*: The field dealing with clinical applications of principles of heredity for betterment of mankind.
4. *Physiological Genetics*: The field elucidates the normal functions of various organelles of a cell governed by the genetic material.
5. *Population Genetics*: The field deals with the distribution and behaviour of genetic material in a particular population so that the genes and the genotype frequencies are maintained or changed.
6. *Clinical Genetics*: The field deals with the application of knowledge of genetic material responsible for certain diseases and their transmission from one generation to another. The field also includes, the investigative and preventive methods adopted for diagnosis and preventing their disorders.
7. *Environmental Genetics*: This field deals with the manipulation of genetic material in living form by recent advanced technologies of genetic engineering and recombinant DNA.
8. *Radiation Genetics*: This field deals with the effects of various types of radiation on genetic material producing various diseases.
9. *Biochemical Genetics*: The field deals with the biochemistry of genetic material for normal metabolic processes. This also includes immunogenetics and blood groups, that is, genetic material concerned with the mechanisms of producing antigenes and antibodies.
10. *Genetic Counselling*: The branch deals with the immediate and practical preventive and social health promotional measure, in problems of genetic disorders. The counsellor named as Medical Geneticist can deal with matters pertaining to the causation, incidence, risk and recurrence of inherited defects, radiation hazards, mutant viral strains in biological warfare. Some newer drugs including the anticancer drugs which can cause genetic problems duo to mutation also come under the purview of the counsellor.

Human Diet

- Balanced Diet is one which contains all the necessary nutrients required for growth and maintenance of the human body in the right proportion.
- Normally, a balanced diet:

  —should be able to provide about 3000 calories per day for a normal adult.
  —should contain all essential elements in appropriate proportion.
- An average person requires approximately 400–500 g of carbohydrates, 70 g of proteins and 75 g of fat, that is, the ratio of fat, protein and carbohydrates should be around 1 : 1 : 6.
- Food should be in a form that can be easily digested and properly cooked so as to remove any harmful bacteria.
- The requirement of carbohydrates, proteins and fat is greater for growing children, nursing mothers and patients suffering from certain diseases.
- A sportsman needs two-and-a-half times more carbohydrates than an ordinary person.

Table 11.6 Vitamins

Vitamin	*Source*	*Deficiency results in*
Vitamin A	Animal fat, eggs, carrots, mangoes, papayas, tomatoes, spinach, whole milk	Poor growth, rough and dry skin and less resistance to infection; also causes night blindness
Vitamin B Complex	Brewer's yeast, cereals, eggs, fruits, liver, meat, pulses	Poor growth and also causes beri-beri, pellagra, diarrhoea
Vitamin C	Fresh fruit, oranges, lemons, milk, fresh vegetables	Sore mouth and gums, capillary bleeding, delayed healing of wounds, scurvy
Vitamin D	Oily fish, dairy products, eggs, milk, sun's rays, butter	Ricketts in children, osteomalacia and osteoporosis in adults
Vitamin E	Wheat germ, milk, cereals, egg yolk, beef, liver, mutton, spinach, soyabeans	Thought to interfere with reproduction and also causes certain degenerative diseases of the nervous system, liver damage, haemorrhage; also abortion, menstruation irregularities
Vitamin K	Green leafy vegetables, oats, fish, rye, peas	Delayed clotting of blood, liver damage, increased tendency to haemorrhage
Vitamin P	In almost all sources of vitamin C like oranges, lemons and other citrus fruits.	Unhealthy blood capillaries

DISEASES OF HUMAN BODY

Acquired Immuno-Deficiency Syndrome

AIDS is a killer disease. Its full form is 'Acquired Immuno-Deficiency Syndrome'. The disease was first reported in early 1981 from the United States and created a worldwide scare. The World Health Organization's great concern during the decade is to combat the spread of this fatal incurable disease.

- *Causes*: AIDS is transmitted by a virus known as HLV-III, which disrupts the entire immunity system of the human body. When AIDS was first detected, it was thought to be a sexually transmitted disease found in homosexuals only. However, later investigations revealed that the principal mode of its transmission was through blood by way of:
  1. Shared needles for injecting drugs
  2. Transfusion of contaminated blood
  3. Anal sex which often damages blood vessels making entry of the virus easy
  4. Sexual relations with an infected person also spreads the virus
- *Symptoms*: The most common symptoms are a form of severe lung infection known as *Pneumocystis* carnii pneumonia and cancerous skill tumour known as *Caposi's Sarcoma*. Death mainly occurs as a result of skin tumours and other complications including brain damage and severe diarrhoea.
- *Treatment*: There is no specific treatment yet available for AIDS. However, encouraging results have been achieved by administration of AZT (Short for 3-azido-3-deoxythymidine) taken orally four times a day. However, its long term effects are not yet known.

It in fact does not cure AIDS but only keeps the multiplication of new virus in check. Efforts are afoot to develop a vaccine against this virus. According to medical circles in the US a vaccine against AIDS, even if successfully developed would not be available for general use at least till 1999.

COMMON DISEASES

Malaria

An insect borne tropical disease.

- *Cause*: Malaria parasite (Plasmodium) which enters the blood through a mosquito bite (female anopheles).
- *Symptoms*: Shivering, fever. Repeated attacks lead to enlargement of spleen. Also leads to anaemia, pigmentation of the face and general weakness.
- *Cure/prevention*: Administration of quinine or plaurdine. Prevented by keeping the atmosphere free from mosquitoes.

Tuberculosis

An infectious and endemic disease, both airborne and caused by food, unhealthy living and working conditions.

- *Cause*: *Mycobacterium tuberculosis* (detected by Robert Koch in the mid-19th century), a type of bacteria. It attacks a person suffering from malnutrition, weak chest, unhealthy living and working conditions.
- *Symptoms*: General weakness, regular temperature (generally in the evening and not very high), coughing, bloodstained sputum.
- *Cure/Prevention*: Streptomycin and surgery. Prevented by BCG inoculation and healthy living and working atmosphere. *BCG,* the vaccine was developed in 1906 by Calmette Guerin in Paris and called BCG.

Cholera

An acute epidemic, water and food-borne disease.

- *Cause*: *Cholera vibrio* or *Vibriocholerae* which attacks during exposure to chill when stomach is empty for long duration, eating of unripe or overripe fruits and stale food.
- *Symptoms*: Vomitting, stomach ache, loose stools with high frequency followed by temperature and unconsciousness.
- *Cure/Prevention*: Avoiding consumption of cut fruits exposed to flies and contaminated water. Anti-cholera drugs are administered.

Tetanus

- *Cause*: *Bacillus tetanus* and *Clostridum tetani* which live in soil, dust, cow and horse dung. It attacks an open wound exposed to dust and soil.
- *Symptoms*: Painful contraction of muscles, usually of neck and jaws, followed by paralysis of thoracic muscle.
- *Cure/Prevention*: Preventing exposure of wounds to dust and administering of Anti-Tetanus (ATS) injection.

Diphtheria

An acute infectious disease of the throat.

- *Cause*: Acute infection by diphtheria *bacillus/corynebacterium* diphtheria causing infection of throat.
- *Symptoms*: Inflammation of throat where a grey membrane (a false membrane on mucous surface) is formed. Pain and swelling of throat with fever.
- *Cure/Prevention*: Immunization vaccine/injection of diphtheria antitoxin within 12–24 hours of appearance of symptoms.

Typhoid

A food and water-borne infectious disease.

- *Cause*: *Salmonella typhi* bacillus transmitted through contaminated food and water, either directly by sewage or indirectly by hands and faulty hygiene.
- *Symptoms*: Temperature, slow pulse, abdominal tenderness, rose-coloured rash.
- *Cure/Prevention*: Rest and administration of Chloromycetin, proper sanitation, protection of eatables.

Plague

A contagious disease which takes the form of an epidemic.

- *Cause*: *Pasteurella pestis* spread by infected rats. Transfer of infection from rat to man through flea bite or accidental contact with infected rats.
- *Symptoms*: Acute body ache, reddish eyes, sudden rise of temperature, inflammation of neck glands and glands in armpit and thighs.
- *Cure/Prevention*: Antiplague inoculation, isolation of patient, disinfection of patient's clothes and utensils, burning of killed rats. Sulpha drugs and streptomycine administration.

Typhus

A viral infection.

- *Cause*: *Rickettsia prowazekii*, usually caused by poor hygiene and malnutrition. *Symptoms*: High fever, skin eruptions and severe headache.
- *Cure/Prevention*: Sulphonamides and antibiotics.

Pneumonia

- *Cause*: Diplococus pneumonia
- *Symptoms*: Chills, pain in chest, rusty sputum, rapid breathing, abdominal pain.
- *Cure/Prevention*: Antibiotics.

Gonorrhoea

A venereal disease.

- *Cause*: *Neisseria gonorrhea*, through sexual intercourse with infected person.
- *Symptoms*: Redness, swelling, pus discharge through urethra, painful urination.
- *Cure/Prevention*: Penicillin G. Tetracycline.

Syphillis

- *Cause*: *Treponema pallidum* transmitted through sexual contact.
- *Symptoms*: A hard painless sore on the genitalia, skin eruption.
- *Cure/Prevention*: Penicillin, protected sexual intercourse.

Whooping Cough

Chiefly occurs among infants and children.

- *Cause*: *Nemophilus pertusis* transmitted through air.
- *Symptoms*: Severe cough, usually at night.
- *Cure/Prevention*: Immunization of infants with immunity serum.

Some Blood Diseases

- *Anaemia*: A condition where the RBC are seriously reduced in number or else are deficient in haemoglobin. This results in reduced supply of oxygen to tissues which retards normal functioning of the body systems.
- *Leukemia*: Also called Blood Cancer is caused by over production of WBC. The WBC overrun the bone marrow and crowd out the RBC causing anaemia. The disease is caused due to malfunctioning of bone marrow and is normally incurable. However, bone marrow transfusion is believed to yield good results.
- *Agranulocytosis*: A condition where there are two few WBC. This lowers body resistance to disease and causes secondary infections whereby the patient may die from infections he cannot resist.
- *Thrombocytopenia*: A condition where there are too few platelets in the blood, as a result blood seeps out of the circulatory system making black and blue bruise spots. If not properly treated, it may result in fatal bleeding.
- *Haemophilia*: A hereditary bleeding tendency due to inadequate clotting of blood. It is a rare disease almost always seen only in males.
- *Haemorrhage*: Loss of blood from the blood vessels which may be from external wounds and occur in the tissues or escape into the body cavity.

Diseases of the Eyes

- *Hypermetropia (Far-Sightedness)*: A vision defect when a person cannot see objects near at hand because the light focuses behind the retina. This can be corrected with convex lenses.
- *Myopia (Near-Sightedness)*: A vision defect when a person cannot see distant objects because the light entering the eyes focuses in front of the retina. The lens refracts the parallel rays entering the eye. This can be corrected by using concave lenses.
- *Astigmatism (Distorted vision)*: A condition in which light focuses on a line instead of at a point (when cornea is not spherical). This line may focus behind the retina in which case it is called *Hyperopia astigmatism* or *Myopic astigmatism* when in front of the retina. This defect can be corrected by using cylindrical lenses.
- *Presbyopia*: Lack of normal focusing power of the eye on objects near at hand and common in most persons after 40–42 years of age. Presbyopia causes difficulty in reading and working with objects close at hand. This defect can be corrected by the use of *convex* lenses.

- *Conjunctivitis*: Inflammation of the eyes resulting in itchiness and reddening of eyes making them sensitive to light. For cure, the affected eye is daubed with a simple solution of weak, salt water or boric acid and use of antibiotic eyedrops.
- *Trachoma*: Caused by a germ called *chalmydiae* and spreads by direct contact. It always affects both eyes and causes mild itching and irritation. For cure tetracyline group orally is administered.
- *Cataract*: A condition of opacity of lens which occurs with ageing, causing progressive blurring of vision. Distant view is mostly affected whereas near vision is often improved in early stages. Cataract can be cured by operation called *Lens extraction.*

Common Body Disorders

- *Allergy*: A special reaction to a certain substance such as pollen (causes sneezing) or certain foods (causes skin rash). Allergy can be from any material even by colour of clothes and furnishings, etc.
- *Arthritis*: Inflammation of joints.
- *Asthma*: A respiratory disorder caused by narrowing of bronchial tubes. It is caused both by infection and due to allergy to dust-ridden atmosphere.
- *Bronchitis*: Inflammation of bronchial tubes caused by bacteria or virus. A fatal disease among infants and secondary infection among adults.
- *Cancer*: An abnormal growth of body cells, often resulting in a malignant tumour. There are several causes for this dreaded disease and certain cancers are yet incurable.
- *Diabetes*: Excess sugar in the body when the body is not able to control level of blood sugar due to malfunctioning of the pancreas (digestive gland) that is, when it produces inadequate *insulin.* A controlled diet (less carbohydrates) and intake of insulin is the treatment for diabetes.
- *Epilepsy*: Unwarned and periodic loss of consciousness along with convulsions due to nervous disorders.
- *Glandular Fever (Mumps)*: An acute infection probably caused by a virus occurs particularly in children and young adults following swelling of the glands of the neck and high fever.
- *Hepatitis*: Any infectious or inflammatory disease of the liver commonly identified by its primary symptoms of jaundice.
- *Hernia*: A weakness of the muscle surrounding an organ allowing it to bulge through, often found in the groin. It is cured by operation.
- *Jaundice*: Excessive bilirubbin (present in bile juice secreted by liver) in the blood, causes yellowing of the skin, eyes and yellowish urine.
- *Leukemia*: Also called blood cancer.
- *Measles*: A contagious disease caused by virus, a red rash appears on the body along with fever. Disappears gradually after about ten days.
- *Migraine*: A type of a headache followed by disturbed vision and speech accompanied by nausea.
- *Pellagra*: A disease caused by deficiency of nicotinic acid (Vitamin B Complex). The symptoms are diarrhoea, mental laziness and symmetrical dermatitis. Skin becomes red and itchy.
- *Osteomalacia*: A disease caused by shortage of Vitamin D which results in softening of bones, pain causing frequent fractures and bending of the backbone.

- *Pleurisy*: Inflammation of the membrane that covers the lungs and lines the chest cavity
- *Rabies*: A virus disease transmitted by the saliva of infected animals, symptoms include convulsions and revulsion to water (Hydrophobia).
- *Ringworm*: A skin disease causing circular swelling on the skin. Transmitted through air-borne spores and contact with infected patient.
- *Scarlet Fever*: Caused by haemolytic streptococcal infection, symptoms are fever, sore throat and a red rash.
- *Slipped Disc*: A painful condition in which a cartilage disc in the spine is displaced putting pressure on the nearest nerve.
- *Small Pox*: A contagious virus disease, common among children, characterized by a rash of pustules that leave permanent scars on skin. The WHO started a sustained campaign in the 1960s and 1970s to eradicate small pox by mass vaccination. In 1980 WHO declared that small pox was eradicated. It was the *first disease to be eradicated* from the face of the earth.
- *Thrombosis*: Formation of a blood clot in a blood vessel or in the heart which results in death of the patient.
- *Ulcer*: An inflamed open sore on the skin or the membrane of a body cavity. Peptic ulcer is a state when there are ulcers in the food pipe associated with indigestion and mental tension a common disease among people working in an industrial society.

Common Drugs

- *Anaesthetics*: Drugs that block sensory nerves and make a patient fully unconscious to prevent him from feeling pain. In case of local anaesthesia a particular area is made senseless temporarily. Used for surgical operations and includes drugs like chloroform, ether, sodium pentothal, etc.
- *Analgesics*: Drugs used to prevent or relieve pain like aspirin (acetylsalicyclic acid) or analgesic tablets.
- *Antibiotics*: Drugs used to prevent growth of body germs and to destroy them as soon as possible. Most common drugs under this category are penicillin, terramycetin, etc.
- *Antihistamines*: These drugs are used to relieve symptoms of asthma, hay fever and other allergies.
- *Antipyretics*: Drugs used to lower body temperature.
- *Hormones*: Drugs used to combat hormone deficiency that causes diseases. Drugs like insulin (for diabetics) or adrenalin come under this category.
- *Narcotics*: Drugs that deaden the nervous system and prevent a person from feeling pain, e.g., opium and its derivatives such as codeine, heroin, morphine, etc.
- *Sedatives*: Drugs used to induce sleep like barbiturates and bromides.
- Tranquillizers Drugs that calm nervous system and prevent worry, tension, etc.
- *Vaccines*: Drugs that are injected to help the body to develop resistance to disease or immunization of the body.

Chapter

12 COMPUTERS AND INFORMATION TECHNOLOGY

- A computer is a programmable machine. It is an electronic, data processing device which can read and write, compute and compare, store and process large volumes of data with high speed, accuracy and reliability.
- The two principal characteristics of a computer are:
  1. It responds to a specific set of instructions in a well-defined manner.
  2. It can execute a prerecorded list of instructions (a program).
- Modern computers are electronic and digital. The actual machinery—wires, transistors and circuits is called Hardware; the instructions and data are called Software.
- It works on the instructions given to it, that is, on the stored programme concept.
- Once the data and the instructions set are fed into its memory, it obeys the instructions, performs instructions on the data and produces results.
  1. *Input*: Data is collected and entered into the computer. This is called input process.
  2. *Storage*: What is entered into the computer is stored in the memory called Physical memory of the computer. Physical memory is supported by another memory called Auxiliary memory.
  3. *Processing*: Actions are taken on the data stored in physical memory to get required results which is termed as processing. Results are stored back in the Physical memory.
  4. *Output*: Stored results are taken out of physical memory. This process is known as Output.
- Its working is automatic. It uses electronic components: Transistors, resistors, diodes and circuits.
- All general purpose computers require the following hardware components:
  1. M*emory*: Enables a computer to store, at least temporarily, data and programs.
  2. *Mass Storage Device*: Allows a computer to permanently retain large amounts of data. Common mass storage devices include disk drives and tape drives.
  3. *Input Device*: Usually a keyboard and mouse, the input device is the conduit through which data and instructions enter a computer.
  4. *Output Device*: A display screen, printer, or other device that lets you see what the computer has accomplished.
  5. *Central Processing Unit (CPU)*: The heart of the computer, this is the component that actually executes instructions.
- In addition to these components, many others make it possible for the basic components to work together efficiently. For example, every computer requires a bus that transmits data from one part of the computer to another.

- Computers can be generally classified by size and power as follows, though there is considerable overlap:
  1. *Personal Computer*: A small, single-user computer based on a microprocessor. In addition to the microprocessor, a personal computer has a keyboard for entering data, a monitor for displaying information and a storage device for saving data.
  2. *Workstation*: A powerful, single-user computer. A workstation is like a personal computer, but it has a more powerful microprocessor and a higher-quality monitor.
  3. *Minicomputer*: A multi-user computer capable of supporting from 10 to hundreds of users simultaneously.
  4. *Mainframe*: A powerful multi-user computer capable of supporting many hundreds or thousands of users simultaneously.
  5. *Supercomputer*: An extremely fast computer that can perform hundreds of millions of instructions per second.
- An integrated circuit (IC) is a small electronic device made out of a semiconductor material. The first integrated circuit was developed in the 1950s by Jack Kilby of Texas Instruments and Robert Noyce of Fairchild Semiconductor.

THE FIVE GENERATIONS OF COMPUTERS

- The history of computer development is often referred to in reference to the different generations of computing devices.
- Each of the five generations of computers is characterized by a major technological development that fundamentally changed the way computers operate, resulting in increasingly smaller, cheaper, more powerful and more efficient and reliable computing devices.
- Our journey starts in 1940 with vacuum tube circuitry and goes to the present day and beyond with artificial intelligence.

First Generation (1940–1956): Vacuum Tubes

- The first computers used vacuum tubes for circuitry and magnetic drums for memory and were often enormous, taking up entire rooms.
- They were very expensive to operate and in addition to using a great deal of electricity, generated a lot of heat which was often the cause of malfunctions.
- First generation computers relied on machine language, the lowest-level programming language understood by computers, to perform operations and they could only solve one problem at a time.
- Input was based on punched cards and paper tape and output was displayed on printouts.
- The UNIVAC and ENIAC computers are examples of first-generation computing devices.
- The UNIVAC was the first commercial computer delivered to a business client, the US Census Bureau in 1951.

Second Generation (1956–1963): Transistors

- Transistors replaced vacuum tubes and ushered in the second generation of computers. The transistor was invented in 1947 but did not see widespread use in computers until the late 1950s.

- The transistor was far superior to the vacuum tube, allowing computers to become smaller, faster, cheaper, more energy-efficient and more reliable than their first-generation predecessors.
- Though the transistor still generated a great deal of heat that subjected the computer to damage, it was a vast improvement over the vacuum tube.
- Second-generation computers still relied on punched cards for input and printouts for output.
- Second-generation computers moved from cryptic binary machine language to symbolic, or assembly, languages which allowed programmers to specify instructions in words.
- High-level programming languages were also being developed at this time, such as early versions of COBOL and FORTRAN. These were also the first computers that stored their instructions in their memory which moved from a magnetic drum to magnetic core technology.
- The first computers of this generation were developed for the atomic energy industry.

Third Generation (1964–1971): Integrated Circuits

- The development of the integrated circuit was the hallmark of the third generation of computers.
- Transistors were miniaturized and placed on silicon chips, called semiconductors which drastically increased the speed and efficiency of computers.
- Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with an operating system which allowed the device to run many different applications at one time with a central program that monitored the memory.
- Computers for the first time became accessible to a mass audience because they were smaller and cheaper than their predecessors.

Fourth Generation (1971–Present): Microprocessors

- The microprocessor brought the fourth generation of computers, as thousands of integrated circuits were built onto a single silicon chip. What in the first generation filled an entire room could now fit in the palm of the hand.
- The Intel 4004 chip developed in 1971, located all the components of the computer—from the central processing unit and memory to input/output controls—on a single chip.
- In 1981, IBM introduced its first computer for the home user and in 1984, Apple introduced the Macintosh.
- Microprocessors also moved out of the realm of desktop computers and into many areas of life as more and more everyday products began to use microprocessors.
- As these small computers became more powerful, they could be linked together to form networks which eventually led to the development of the Internet.
- Fourth generation computers also saw the development of GUIs, the mouse and handheld devices.

Fifth Generation (Present and Beyond): Artificial Intelligence

- Fifth generation computing devices, based on artificial intelligence, are still in development, though there are some applications, such as voice recognition, that are being used today.

- The use of parallel processing and superconductors is helping to make artificial intelligence a reality.
- Quantum computation and molecular and nanotechnology will radically change the face of computers in years to come.
- The goal of fifth-generation computing is to develop devices that respond to natural language input and are capable of learning and self-organization.

COMPUTER HARDWARE AND SOFTWARE

Computer Hardware

- Refers to objects that you can actually touch, like disks, disk drives, display screens, keyboards, printers, boards and chips.
- In contrast, software is untouchable. Software exists as ideas, concepts and symbols, but it has no substance.
- Books provide a useful analogy. The pages and the ink are the hardware, while the words, sentences, paragraphs and the overall meaning are the software.
- A computer without software is like a book full of blank pages, you need software to make the computer useful just as you need words to make a book meaningful.

Computer Software

- Software means computer instructions or data. Anything that can be stored electronically is software, in contrast to storage devices and display devices which are called hardware.
- The terms software and hardware are used as both nouns and adjectives. For example, you can say: 'The problem lies in the software,' meaning that there is a problem with the program or data, not with the computer itself. You can also say: 'It's a software problem.'
- The distinction between software and hardware is sometimes confusing because they are so integrally linked.
- Clearly, when you purchase a program, you are buying software. But to buy the software, you need to buy the disk (hardware) on which the software is recorded.

Categories of Software

- Software is often divided into two categories:
  1. Systems software includes the operating system and all the utilities that enable the computer to function.
  2. Applications software includes programs that do real work for users. For example, word processors, spreadsheets and database management systems fall under the category of applications software.

Application Software

- An application is a program or group of programs, that is, designed for the end user.
- Application software can be divided into two general classes:
  1. Systems software
  2. Applications software.

Applications software (also called end-user programs) include such things as database programs, word processors, Web browsers and spreadsheets.

- Figuratively speaking, applications software sits on top of systems software because it is unable to run without the operating system and system utilities.

System Software

- Refers to the operating system and all utility programs that manage computer resources at a low level.
  Software is generally divided into systems software and applications software.
- Applications software comprises programs designed for an end user, such as word processors, database systems and spreadsheet programs. Systems software includes compilers, loaders, linkers and debuggers.

Software Package

- A special method of distributing and installing software (or software upgrades) to a computer. For example, on a Macintosh computer, a package usually means 'software.' It's specifically a directory, presented as a single file, that contains all the information the Mac OS X Installer application needs to install your software. That includes the software itself, as well as files that are used only during the installation process. In a Windows environment it is sometimes called an installation package or update package.
- Multiple software programs that work together (or performs similar functions) and is bundled and sold together as a software package.

CHARACTERISTICS OF COMPUTERS

- *Speed*: Electronic pulses travel at incredible speed and because the computer is electronic, its internal speed is virtually instantaneous. The units of speed are the microsecond, the nanosecond and even picosecond.
- *Storage*: As a human being acquires new knowledge, the brain subconsciously selects what it feels to be important and worth retaining in its memory and relegates unimportant details to the back of the mind or forgets them. However, in computers, the internal memory of the central processing unit CPU is only large enough to retain a certain amount of information. It is therefore impossible to store inside the computer each and every bit of information. All of this data is stored outside the memory of the CPU, in auxiliary or secondary storage devices.
- *Accuracy*: The accuracy of computers is consistently high. Most of the errors in computing are human rather than those of the machines.
- *Versatility*: Computers are seen as capable of performing almost any task, provided that the task can be reduced to a series of logical steps.
- *Automation*: Once a programme is in the computer's memory, the individual instructions are then transferred, one after the other, to control unit for execution. The CPU follows these instructions until it meets a last instruction which says 'Stop Programme Execution', hence leading to automation.
- *Diligence*: Being a machine, a computer does not suffer from the human traits of tiredness and lack of concentration. It will perform the millionth calculation with exactly the same accuracy and speed as the first.

COMPUTER ARCHITECTURE

A typical computer system essentially consists of:

1. Input devices
2. Output devices
3. CPU (Brain of computer)

- *Input Device*: This device is used for Man to Machine communication. Data which is to be processed in the computer is entered through this device, for example, keyboard, optical character reader, mark reader, magnetic ink character reader.
- *Output Device*: This device is used for Machine to Man communication. Processed results are retrieved from the system through these devices, for example, Video Display Unit, printers, plotters, etc.
- *CPU:* The Central Processing Unit controls the whole system by coordinating and organizing all the operations of the computer. It obeys the instructions issued to it by various input devices such as the keyboard and organizes the output to the various peripheral units such as the printer. It is responsible for fetching instructions that are stored in the primary storage, interpreting them and then issuing commands to all the hardware units that are necessary to carry out the instructions.
- *ALU:* It is responsible for performing all the arithmetic and logical operations of the computer. The arithmetic operations are used to compare numbers and include 'less than', 'equal to' and 'greater than'. The ALU can handle text as well as numbers. Some computers are equipped with an arithmetic co-processor which is a second microprocessor dedicated to perform arithmetic functions only. The advantage of coprocessor is the increased speed of performing calculations.
- *Memory Unit*: It is used to store the data and the programme. The whole memory is partitioned into two parts. One part consists of a large number of labelled boxes—one box per data item. Other stores the algorithm. A datum in a box in the memory may be retrieved by referring to the label or name of the box. When a datum is used from a box, a copy of the datum is used; the original datum is not destroyed. When a datum is written in the memory, this datum is stored in the specified box in the memory and old contents of the box are destroyed.
- *Primary Storage Unit*: It is the computer's memory where information is stored permanently. There are two distinct types of memories:
  1. *ROM*: It contains all the information and instructions necessary to make the computer operate when it is switched on. This information is ROM resident and is put in during the manufacturing and remains stored on the chip permanently. This memory is capable of being read from only but not of being written to and hence known as ROM. It is non-volatile memory.

  Various types of ROM are:
  (a) *PRO*M: It is Programmable ROM chip which can be programmed by a user to perform specific functions.
  (b) *EPROM*: Erasable Programmable ROM Chips. These chips can be programmed.
  (c) *EEROM*: Electrically Erasable ROM. Already existing information on these chips can be erased using electrical signals.

2. *RAM*: It is volatile memory. It is used to store temporary information in the form of data and instructions in the RAM. RAM can be written into as well as read from.

- *Secondary Storage Devices*: There are a number of secondary storage devices which are used to store the data permanently. These devices are also called Auxiliary memories, for example, hard disk magnetic tapes, floppy, CD-ROM.

INPUT/OUTPUT DEVICES

- Essential part of the computer system. Without these 'man to machine' and 'machine to man' communication is impossible. Information link between the outside world and CPU. Act as an interface between man and machine.

Input Devices

Keyboard

- It is used to input data to the computer. This device allows data to be entered directly into the computers.
- The electrical contacts and circuits just below the keys translate the information directly into binary.
- Main drawback of this device is slow speed (It is because speed of work is dependent on the typing speed).

Optical Mark Reader

- It involves recognition of marks or characters. OMR is able to scan forms completed in pen as well as in pencil.
- The forms or cards are passed under a light source and pressure of a mark is detected by measuring very accurately the infrared light levels.
- An advantage of OMR is that it requires no specialist skills to collect and input data.
- Data collection can be practised at the point at which the information first becomes available, for example, on the factory floor, on the building site, etc.

Magnetic Ink Character Recognition (MICR)

- The magnetized ink induces a current reading the circuit. The current induced will be directly proportional to the area of the ink being scanned.
- The patterns of the varying currents can then be compared with and specified as bit patterns of the selected character.
- MICR system employs character styles designed specifically for magnetic ink character recognition. Thus, characters have to be accurately formed.
- They also require magnetic ink. This factor makes printing expensive.
- The advantage of this device is that characters printed with ink containing magnetisable particles can still be read even when overstamped as may be the case with bank cheques.
- MICR reader can only identify a cheque, someone still has to verify information like amount, to whom the cheque has to be paid, signature, etc.

Optical Character Reader (OCR)

- It examines each character as if it were made up of a collection of minute spots.
- Once the whole character has been scanned, the pattern detected is matched against a set of patterns stored in the computer whichever pattern it matches or nearly matches is considered to be the character read.

Output Units

Printers: Used for hard copy printing.

Plotters: Line drawing devices which move a pen under computer control in such a way that continuous lines and curves can be drawn. Used to produce outputs demanding continuous high-precision line drawing, for example, maps, graphs, mathematical curves, engineering drawings, etc.

Graphic VDU: These are video display units on which, by selecting a suitable combination of axis, scales and colours, output can be displayed in the pictorial form, for example, CRT monitors and LCD monitors.

Some Commonly Used Terms

- *Programme*: It is a set of instructions given to the computer in a particular sequence for solving a given problem. In other words, it contains a set of actions to be performed by the computer on the data to produce necessary results. Programming is done in one of the computer languages.
- *Liveware*: The users working on the system are termed as 'liveware'.
- *Firmware*: It is defined as software embedded into the hardware, for example, ROM which has the basic input-output system (BIOS).
- *Compiler*: A programme which translates a high-level language programme into machine language.
- *Interpreter*: A programme that translates each instruction of high level language and executes it before passing on to the next instruction.
- *Assembler*: A programme which converts assembly language programme into machine language programme. It is a system software.
- *Multiprocessing*: In this type of processing, the CPU has a number of processors which operate in parallel, thereby allowing simultaneous execution of several programmes.
- *Multiprogramming*: This type of processing enables more than one programme to reside in the central memory at the same time and share the available processor time and peripheral units.
- *Distributed Data Processing*: It is also called Decentralized processing. This approach involves using a network of computers interconnected by datacommunication lines where each remote location has a small computer or minicomputer for input-output communication with a central computer and some local processing.
- *Bit*: It is the basic unit of digital information. It can have only two values—one and zero.
- *Nibble*: Combination of four bits.
- *Byte*: Combination of eight bits.
  1. 1 Kilobyte = 1024 bytes
  2. 1 Megabyte = (1024) × (1024) bytes
  3. 1 Gigabyte = (1024) × (1024) × (1024) bytes

- *Word*: Combination of two or more than two bytes.
- *Database*: It is a general collection of data shared by a variety of users. In particular, it has the following features:
  1. Redundancy of data is eliminated.
  2. Data is independent of any programme.
  3. Data is usable by many users, simultaneously.
- *Time Sharing*: It is the concurrent use of a single computer system by many independent users. In time sharing, many terminals can be attached to a central computer. The terminal users can thus share time on the computer, that is, time sharing. The operating system can allocate the CPU time of the various users by giving each a time slice, each operating independently without awareness of use by others.
- *Microprocessor*: It is a single chip based device which is a complete processor in itself and is capable of performing arithmetic and logical operations.
- *Modem*: An electronic device used to convert computer (digital) electronic signals to communication channel (analog) electronic signals and vice versa. It is used in distributed data processing where terminals are joined by a telecommunication link to the host computer.

DIFFERENT TYPES OF LANGUAGES

Low Level Languages

- *Machine Language*
  —These instructions may be coded in the language the machine is capable of understanding.
  —This language is in the form of binary codes, the combination of binary zeros and ones.
- *Assembly Language*
  —A machine language programme is the only kind of programme that can be executed by a computer. But it is too hard for the user to remember instructions in the form of zeros and ones.
  —It is also time consuming to write programmes in the machine language. Therefore, another language called assembly language was developed which greatly simplified programming.
  —In this language, instructions are written in mnemonic codes such as ADD, SUB, MPY, DIV, etc.
  —Writing programmes in the assembly language is more convenient for the programmer but it creates a gap as the computer recognises only a programme in binary code.
  —One method of bridging this gap is an assembly programme which translates the programme written by the programmer in assembly language into a programme in machine language.

High Level Languages

- These languages resemble the normal languages of the intended application area (for example, business or mathematical) rather than that of a computer.
- Since problem or procedure oriented languages are not directly understood by computers, special computer programmes called compilers and interpreters are needed

so that the computer itself can translate the problem or procedure oriented language programmes into a machine language programme which can be run on the computer.
- These languages have found great acceptance in the business accounting and science engineering worlds because they greatly facilitate the use of computer by non professional programmers, for example, COBOL, FORTRAN, C, C++, ALGOL, LISP, etc.

OPERATING SYSTEM

- It is an organized collection of routines and procedures for operating a computer.
- It acts as an intermediary between a computer user and the computer hardware.
- The basic purpose of the OS is to provide an environment in which a user can execute programmes.
- It is used to make the computer convenient to operate.
- Another goal is to use the computer hardware in an efficient manner, for example, DOS, UNIX, XENIX, WINDOWS etc.
- *Uses of Operating System*: The components of a computer are hardware, software and data. The operating system provides the means for the proper use of these resources in the operation of the computer system. Like a government, the OS performs no useful function by itself. It simply provides an environment within which other programmes can do useful work.
- *Resource Allocator*: A computer system has many resources (Hardware, Software) that may be required to solve a problem. CPU time, memory space, file storage space, Input/Outputs devices and so on. The OS acts as the manager of these resources and allocates them to specific programmes and users, as necessary. The operating system must decide which requests are essential resources to operate the computer system efficiently and fairly.
- *Control Programme*: It controls the execution of user programmes to prevent errors and improper use of the computer. Its functions include controlling operation in multi-programming, multi-processing and time sharing module.

NETWORKING

- It means interconnecting of the terminals wherein these are linked to the server and each terminal has its own processors.

Advantages of Networking

1. Sharing of Data
2. Transfer of files is possible without floppies
3. Distinct advantage in medicine, engineering, etc.
4. Data security
5. Less memory usage
6. Common hardware, software resources, for example, printers, memory
7. Less expensive

There are three types of Networks:
1. LAN–Local Area Network
2. MAN–Metropolitan Area Network

3. WAN–Wide Area Network
   ——LAN—A local area network which is basically a digital communication network, interconnects different computing devices located in a well defined locality which can be a building, office or a campus.
   ——A LAN is characterized by high speed transmission rates and low error rate due to transmission. It mainly consists of the following three components:
      (i) *Medium*: Over which data transfer takes place. It can be a telephone line; a coaxial cable or a fiber optical cable.
      (ii) *Network Interface Unit (NIU)*: It provides an interface between the LAN medium and the computer hardware, generally a NIU directly interfaces with the main system.
      (iii) *Network Software*: Runs in each of the computer systems connected to LAN and provides network-wide communication capabilities to the user software. A part of this software resides in the network interface unit.

Most Popularly used LAN Configuration:

- *Star Configuration*: Here all the nodes in the network are connected to a central mode to form a star-like picture.
- *Bus Configuration*: Here all the nodes on a LAN share the same cable and there is no centralized node.
- *Ring Configuration*: In this scheme, nodes are connected in series and form a complete ring. The data flows from one node to other which is picked by the appropriate target node.

THE INTERNET

What Is the Internet?

- The internet, sometimes called the 'information superhighway', is a vast network of computer networks.
- It is estimated that there are some 100 million internet users in the world and that, by the year 2015, half of the world will be online. Some other facts about the Internet:
- The internet is accessible in more than 150 countries and there are more than 1 million Web servers worldwide.
- An average World Wide Web page contains about 500 words and experts put the number.
- Web pages somewhere between 50 million and 80 million.
- The average Web user is 35.2 years old and accesses the Web primarily from home.
- The Internet is neither owned nor funded by any one institution, organization or government.
- It does not have a CEO and is not a commercial service.
- The Internet is, however, directed by the Internet Society (ISOC) composed of volunteers.
- The ISOC appoints a sub-council, the Internet Architecture Board (IAB) which works out issues of standards, network resources, network addresses and so on.
- Another volunteer group, the Internet Engineering Task Force (IETF) handles day-to-day issues of Internet operation.
- Practically speaking, the internet is composed of people, hardware and software.
- With proper equipment on both ends, you can sit at your computer and communicate with someone sitting at any place in the world.

- You can also use the internet to access vast amounts of information, including text, graphics, sound and video.
- From your computer, you can send e-mail, chat with others, work with others on an electronic whiteboard and with appropriate equipments, video-conferencing is also possible.

How Did it Originate?

The Internet grew out of a series of developments in the academic, governmental and information technology communities. Listed below are some of the major milestones:

- In 1969, ARPAnet an experimental 4-computer network was established by the Advanced Research Projects Agency (ARPA) of the US Department of Defence so that research scientists could communicate.
- By 1971, ARPAnet linked almost 2 dozen sites including MIT and Harvard.
- By 1974, there were over 200 sites.
- During the 1980s, more and more computers using different operating systems were connected.
- In 1983, the military portion of ARPAnet was moved onto the MILnet and ARPAnet was officially disbanded in 1990.
- In the late 1980s, the National Science Foundation's NSFnet began its own network and allowed everyone to access it.
- It was, however, primarily the domain of 'techies,' computer-science graduates and university professors.
- In 1991, Al Gore then a US senator proposed widening the NSFnet to include more schools and colleges.
- Resulting legislation expanded NSFnet renamed it NREN (National Research and Educational Network) and allowed businesses to purchase part of the network for commercial uses.
- The mass commercialization of today's Internet is a result of this legislation.
- In 1992, the World Wide Web system and software were released and in 1993, the National Center for Supercomputing Applications released versions of Mosaic (first graphical Web browser) for Microsoft Windows for Unix systems running the X Window System and for the Apple Macintosh.
- In 1994, Netscape Communications released the Netscape Navigator browser and in 1995, Microsoft released Internet Explorer.
- By mid-1997, these browsers were in head-to-head competition for a place on each Internet user's computer.

How Can You Get There?

- First, you need the equipment. You can get basic Internet access with any computer that has a modem connected to a phone line. However, to take full advantage of all that Internet has to offer, you need either a Macintosh that has a 68040 or higher CPU or a PC that has an 80486 or higher CPU.
- With either system, you also need the following:
  1. At least 4 megabytes of RAM (8 is recommended)
  2. A 250-megabyte hard drive
  3. A 14.4-bps modem (28.8 or faster is even better)

- An Internet service provider (ISP) is a company that provides access to the Internet. Some ISPs also provide content and e-mail.
- National companies and local and regional companies also provide Internet access. ISPs generally charge a monthly subscription rate.

Internet Resources

What you can do on the Internet depends on which resource you access.

- *E-mail*: Electronic mail is probably the most popular and widely used resource on the Internet. To use it you must know and accurately input the recipient's address.
- An e-mail address consists of a username, a service and a domain. for example, in Pearsonindia@gmail.co.in (The Pearson Education's address), Pearsonindia is the username, 'gmail' the service (in this case, Google) and '.co' the domain (in this case, a commercial organisation) and '.in' indicates India.
- Domains are identified in the Domain Name Service also known as the Domain Name System.
- A consortium between AT&T and Network Solutions, called InterNIC (Internet Network Information Center) manages the task of registering addresses or domain names.

Here are the most familiar domains:

Domain: What It Is?

.com	a commercial organization, business or a company
.edu	an educational institution
.gov	a nonmilitary government entity
.int	an international organization
.mil	a military organization
.net	a network administration
.org	some other organization
.res	research institute

- In general, the final part of a domain name represents the name of the country where the site is located—for example, *.in* for India *.jp* for Japan *.uk* for United Kingdom, etc.

The World Wide Web

The Web may be the most complete realization of the Internet to date.

- It was developed in the early 1990s at the European Center for Nuclear Research as an environment in which scientists in Geneva and Switzerland could share information. It has evolved into a medium that consists of text, graphics, audio, animation and video.
- The address of a Website usually begins with 'www'.
- The World Wide Web is a graphical environment that can be navigated through hyperlinks. From one site you can click on hyperlinks to go to any number of related sites.

How the World Wide Web Works?

- The Internet involves 3 fundamental elements: server, client and network. A server is a computer program that makes data available to other programs on the same or other computers—it 'serves' them. A client is a computer that requests data from a server.

- A network is an interconnected system in which multiple computers can communicate.
- The communication may be via copper wire, coaxial cable, fiber-optic cable, satellite transmission, etc.
- The software by which one can access Internet resources is called the Browser. When you go to a site on the World Wide Web, you access the site's files.
- Following are the steps used to open and access a file:
  1. In the browser, specify the address or URL of the Web site.
  2. The browser sends your request to the Internet service provider's server.
  3. That server sends the request to the server at the specified URL.
  4. The file is sent to the Internet service provider's server which sends the file back to the browser which displays the file.

Types of Internet Connections

- As technology grows, so does our need for bigger, better and faster Internet connections. Over the years the way content is presented via the Web has also changed drastically.
- Ten years ago being able to center, bold and produce text in different colors on a webpage was something to admire.
- Today, Flash, animations, online gaming, streaming HD video, database-driven websites, ecommerce and mobile applications to name but a few are standards.
- The need for speed has changed the options available to consumers and businesses alike in terms of how and how fast we can connect to the Internet.
- The connection speeds listed below represent a snapshot of general average to maximum speeds at the time of publication.
- This is no doubt will change over time and Internet connection speeds also vary between Internet Service Providers (ISP).

Analog

- *Dial-up Internet Access*: Also called dial-up access, an analog Internet connection is both economical and slow.
- Using a modem connected to your PC, users connect to the Internet when the computer dials a phone number (which is provided by your ISP) and connects to the network. Dial-up is an analog connection because data is sent over an analog, public-switched telephone network.
- The modem converts received analog data to digital and vice versa. Because dial-up access uses normal telephone lines the quality of the connection is not always good and data rates are limited.
- Typical Dial-up connection speeds range from 2400 bps to 56 kbps. Today, analog has been widely replaced by broadband (Cable and DSL).

Integrated Services Digital Network (ISDN)

- Integrated services digital network (ISDN) is an international communications standard for sending voice, video and data over digital telephone lines or normal telephone wires.
- Typical ISDN speeds range from 64 kbps to 128 kbps.

Broadband ISDN (B-ISDN)

- Broadband ISDN is similar in function to ISDN but it transfers data over fiber optic telephone lines, not normal telephone wires.
- SONET is the physical transport backbone of B-ISDN. Broadband ISDN has not been widely implemented.

Digital Subscriber Line (DSL)

- DSL is frequently referred to as an 'always on' connection because it uses existing 2-wire copper telephone line connected to the premise so service is delivered simultaneously with wired telephone service—it will not tie up your phone line as an analog dial-up connection does.
- The two main categories of DSL for home subscribers are called ADSL and SDSL. All types of DSL technologies are collectively referred to as xDSL. xDSL connection speeds range from 128 kbps to 9 mbps.

Asymmetric Digital Subscriber Line (ADSL)

- ADSL is the most commonly deployed types of DSL in North America.
- Short for asymmetric digital subscriber line ADSL supports data rates of from 1.5 to 9 mbps when receiving data known as the Downstream rate and from 16 to 640 kbps when sending data known as the Upstream rate.
- ADSL requires a special ADSL modem.

Symmetric Digital Subscriber Line (SDSL)

- Short for symmetric digital subscriber line (SDSL) is a technology that allows more data to be sent over existing copper telephone lines (POTS). SDSL supports data rates up to 3 mbps.
- SDSL works by sending digital pulses in the high-frequency area of telephone wires and cannot operate simultaneously with voice connections over the same wires.
- SDSL requires a special SDSL modem. SDSL is called Symmetric because it supports the same data rates for upstream and downstream traffic.

Very High DSL (VDSL)

- Very High DSL (VDSL) is a DSL technology that offers fast data rates over relatively short distances—the shorter the distance, the faster the connection rate.

Cable-Broadband Internet Connection

- Through the use of a cable modem you can have a broadband Internet connection that is, designed to operate over cable TV lines.
- Cable Internet works by using TV channel space for data transmission with certain channels used for downstream transmission and other channels for upstream transmission.
- Because the coaxial cable used by cable TV provides much greater bandwidth than telephone lines, a cable modem can be used to achieve extremely fast access.
- Cable providers typically implement a cap to limit capacity and accommodate more customers. Cable speeds range from 512 kbps to 20 mbps.

Wireless Internet Connections

- Wireless Internet or wireless broadband is one of the newest Internet connection types. Instead of using telephone or cable networks for your
- Internet connection, you use radio frequency bands. Wireless Internet provides an always-on connection which can be accessed from anywhere—as long as you geographically within a network coverage area.
- Wireless access is still considered to be relatively new and it may be difficult to find a wireless service provider in some areas.
- It is typically more expensive and mainly available in metropolitan areas.

T-1 Lines—Leased Line

- T-1 lines are a popular leased line option for businesses connecting to the Internet and for Internet Service Providers (ISPs) connecting to the Internet backbone.
- It is a dedicated phone connection supporting data rates of 1.544mbps.
- A T-1 line actually consists of 24 individual channels, each of which supports 64Kbits per second. Each 64Kbit/second channel can be configured to carry voice or data traffic.
- Most telephone companies allow you to buy just one or some of these individual channels.
- This is known as fractional T-1access. T-1 Lines support speeds of 1.544 mbps.
- Fractional T-1 speeds are 64 kbps per channel (up to 1.544 mbps) depending on number of leased channels.

Bonded T-1

- A bonded T-1 is two or more T-1 lines that have been joined (bonded) together to increase bandwidth.
- Where a single T-1 provides approximately 1.5mbps, two bonded T1s provide 3mbps or 46 channels for voice or data.
- Two bonded T-1s allow you to use the full bandwidth of 3mbps where two individual T-1s can still only use a maximum of 1.5mbps at one time.
- To be bonded the T-1 must run into the same router at the end, meaning they must run to the same ISP.
- Typical Bonded T-1 (two bonded T-1 lines) speed is around 3 mbps.

T-3 Lines—Dedicated Leased Line

- T-3 lines are dedicated phone connections supporting data rates of about 43 to 45 mbps. It too is a popular leased line option.
- A T-3 line actually consists of 672 individual channels, each of which supports 64 kbps.
- T-3 lines are used mainly by Internet Service Providers (ISPs) connecting to the Internet backbone and for the backbone itself.
- Typical T-3 supports speeds ranging from 43 to 45 mbps.

OC3—Optical Carrier

- Short for Optical Carrier, level 3 it is used to specify the speed of fiber optic networks conforming to the SONET standard.

- OC3 is typically used as a fiber optic backbone for large networks with large voice, data, video and traffic needs. Speeds are 155.52 mbps, or roughly the speed of 100 T1 lines.

IoS—Internet over Satellite

- Internet over Satellite (IoS) allows a user to access the Internet via a satellite that orbits the earth.
- A satellite is placed at a static point above the earth's surface, in a fixed position.
- Because of the enormous distances signals must travel from the earth up to the satellite and back again, IoS is slightly slower than high-speed terrestrial connections over copper or fiber optic cables.
- Typical Internet over satellite connection speeds (standard IP services) average around 492 up to 512 kbps.

Recent Developments

Pen Drive

- USB Pen Drive is a small keyring-sized device that can be used to easily transfer files between USB-compatible systems.
- Available in a range of capacities and in some cases, with an MP3 player built-in this handy little gizmo can save all those data-transfer hassles.

Thumb Drive

- A thumb drive is portable memory storage.
- It is re-writeable and holds its memory without a power supply, unlike RAM.
- Thumb drives will fit into any USB port on a computer.
- They will also 'hot swap,' which means a user can plug the drive into a computer and will not have to restart it to access the thumb drive.
- The drives are small about the size of a human thumb hence, their name and are very stable memory storage devices.

Flash Drive

- A small, portable flash memory card that plugs into a computer's USB port and functions as a portable hard drive.
- USB flash drives are easy-to-use as they are small enough to be carried in a pocket and can plug into any computer with a USB drive.
- USB flash drives have less storage capacity than an external hard drive but they are smaller and more durable because they do not contain any internal moving parts.

Blog

- Short for Web log, a blog is a Web page that serves as a publicly accessible personal journal for an individual.
- Typically updated daily, blogs often reflect the personality of the author.
- To author a Web log. Other forms: Blogger (a person who blogs).

Viruses

- A malacious program that is, loaded onto your computer without your knowledge and runs against your wishes.
- Viruses can also replicate themselves.

- All computer viruses are manmade.
- A simple virus that can make a copy of itself over and over again is relatively easy to produce.
- Even such a simple virus is dangerous because it will quickly use all available memory and bring the system to a halt.
- An even more dangerous type of virus is one capable of transmitting itself across networks and by passing security systems.

Wireless Access

- The word wireless is dictionary defined as 'having no wires'.
- In networking terminology, wireless is the term used to describe any computer network where there is no physical wired connection between sender and receiver, but rather the network is connected by radio waves and/or microwaves to maintain communications.
- Wireless networking utilizes specific equipment such as NICs, APs and routers in place of wires (copper or optical fiber) for connectivity.

Bluetooth

- Bluetooth is a technology that describes how mobile phone, computers and personal digital assistants (PDAs) can easily interconnect with each other and with home and business phones and computers using a short-range wireless connection.
- The technology requires that a low-cost transceiver chip be included in each device.
- Each device is equipped with a microchip transceiver that transmits and received in a previously unused frequency band of 2.45 GHz that is, available globally.
- In addition to the data, upto three voice channels are available.
- Each device has a unique 48 bit address from the IEEE 802 standard.
- The maximum range is 10 metres.
- Data can be exchanged at a rate of 1 megabit per second (up to 2 mbps in the second generation of the technology).

Laptops/Note Books

- A laptop computer now referred to as notebook computer by manufacturers is a battery or AC-powered personal computer generally smaller than a briefcase that can easily be transported and conveniently used in temporary spaces such as on airplanes, in libraries, temporary offices and at meetings.
- A laptop typically weighs less than 5 pounds and is 3 inches or less in thickness.
- Among the best-known makers of laptop computers are IBM, Apple, Compaq, Dell and Toshiba.

Servers

- A computer program that provides services to other computer programs in the same or other computers.
- The computer that runs a server program is also referred to as a server.
- In client/server model, a server is a program that awaits and fulfills requests from client programs in the same or other computers.

Mail System

- Mailing has become a key part of the communications network of most modern offices.
- Data and messages can be transmitted from one computer to another using telephone lines, microwave links, communication satellites, or other telecommunication equipment.
- The same message can be sent to a number of different addresses.
- A specialized type of mail system, voice mail is a relatively simple, computer-linked technology for recording, storing, retrieving and forwarding phone messages.
- It is called voice mail or voice-messaging because the messages are spoken and left in a 'voice mailbox.'

Multimedia

- The use of computers to present text, graphics, video, animation and sound in an integrated way.
- Long touted as the future revolution in computing, multimedia applications were, until the mid-90s, uncommon due to the expensive hardware required.
- With increase in performance and decrease in price however, multimedia is now commonplace.
- Nearly all PCs are capable of displaying video, though the resolution available depends on the power of the computer's video adapter and CPU.

New Technologies

- *RFID (Radio-Frequency Identification)*: Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. An RFID tag is an object that can be attached to or incorporated into a product, animal, or person for the purpose of identification using radio waves. Chip-based RFID tags contain silicon chips and antennas. Passive tags require no internal power source whereas active tags require a power source.
- *Retina Scan*: A retinal scan is a biometric technique that uses the unique patterns on a person's retina to identify them. The human retina is stable from birth to death, making it the most accurate biometric to measure. It has been possible to take a retina scan since the 1930s, when research suggested that each individual had unique retina patterns. The research was validated and we know that the blood vessels at the back of the eye have a unique pattern, from eye to eye and person to person. A retinal scan involves the use of low-intensity light source and coupler that are used to read the blood vessel patterns, producing very accurate biometric data.
- *WiMAX*: It is defined as Worldwide Interoperability for Microwave Access by the WiMAX Forum, formed in June 2001 to promote conformance and interoperability of hte IEEE 802.16 standard, officially known as Wireless MAN. WiMAX aims to provide wireless data over long distances, in a variety of different ways, from point to point links to full mobile cellular type access. The Forum describes WiMAX as 'a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL (Digital Subscribers Link).

Websites

- A website (or web site) is a collection of web pages, images, videos and other digital assets and hosted on a particular domain or sub domain on the World Wide Web.
- A web page is a document, typically written in HTML (Hyper Text Markup Language) that is, almost always accessible via HTTP (Hyper Text Transfer Protocol), a protocol that transfers information from the website's server to display in the user's web browser.
- All publicly accessible websites are seen collectively as constituting the 'World Wide Web'.
- The pages of websites can usually be accessed from a common root URL (Universal Resource Location) called the Homepages and usually reside on the same physical server.
- The URLs of the pages organize them into a hierarchy, although the hyperlinks between them control how the reader perceives the overall structure and how the traffic flows between the different parts of the sites.

PART D

Chapter

13 BOOKS AND AUTHORS

A

- *Adventures of Sherlock Holmes* by Arthur Conan Doyle
- *Adventures of Tom Sawyer* by Mark Twain (Samuel Longhorn Clemens)
- *Affluent Society* by J. K. Galbraith
- *After the Dark Night* by S. M. Ali
- *Agony and the Ecstasy, The* by Irving Stone
- *Airport* by Arthur Hailey
- *Ain-i-Akbari* by Abul Fazal
- *Alchemist, The* by Ben Jonson (Note-there is another book by Paulo Coelho by the same name but ben Jonson's work is a classic)
- *Alice in Wonderland* by Lewis Carroll
- *All's Well that Ends Well* by William Shakespeare
- *All the President's Men* by Carl Bernstein and Bob Woodward
- *All the Prime Minister's Men* by Janardhan Thakur
- *All Things Bright and Beautiful* by James Herriot
- *Ambassador's Journal* by J. K. Galbraith
- *Ambassador's Report* by Chester Bowles
- *An American Tragedy* by Theodore Dreiser
- *An Eye to China* by David Selbourne
- *An Idealist View of Life* by Dr S. Radhakrishnan
- *Anand Math* by Bankimchandra Chatterjee
- *Androcles and the Lion* by George Bernard Shaw
- *Animal Farm* by George Orwell
- *Antony and Cleopatra* by William Shakespeare
- *Ape and Essence* by A. Huxley
- *Apple Cart* by George Bernard Shaw
- *Arabian Nights* by Sir Richard Burton
- *Area of Darkness* by V. S. Naipaul
- *Arthashastra* by Kautilya
- *Arms and the Man* by George Bernard Shaw
- *Around the World in Eighty Days* by Jules Verne
- *Arrival and Departure* by Arthur Koestler
- *As You Like it* by William Shakespeare
- *Ascent to Everest* by Sir John Hunt
- *Asian Drama* by Gunnar Myrdal
- *Atoms of Hope* by Mohan Sundar Rajan
- *Autobiography of an Unknown Indian* by Nirad C. Choudhary
- *Across Borders, Fifty-years of India's Foreign Policy* by J. N. Dixit
- *Adhe Adhure* by Mohan Rakesh
- *Agni Veena* by Kazi Nazrul Islam
- *Ajatshatru* by Jai Shankar Prasad
- *Akbarnama* by Abul Fazal
- *Amar Kosh* by Amar Singh
- *An Autobiography* by Jawaharlal Nehru
- *An idealist View of Life* by Dr S. Radhakrishnan

- *Anatomy of a Flawed inheritance* by J. N. Dixit
- *Anguish of Deprived* by Lakshmidhar Mishra
- *Answer to History* by Mohammad Reza Pahlavi
- *Arion and the Dolphin* by Vikram Seth
- *Ashtadhyayi* by Panini
- *Asia and Western Dominance* by K. M. Panikkar
- *Assassination of a Prime Minister* by S. Anandram
- *Assignment Colombo* by J. N. Dixit
- *Atoms of Hope* by Mohan Sundara Rajan

B

- *Baburnama* by Babur (Translated into English by John Falkland)
- *Back to Methuselah* by George Bernard Shaw
- *Bang-e-Dara* by Mohd Iqbal
- *Bend in the Ganges, A* by Manohar Malgaonkar
- *Bend in the river, A* by V. S. Naipaul
- *Ben Hur* by Lewis Wallace
- *Best and the Brightest, The* by David Halberstam
- *Between the Lines* by Kuldip Nayar
- *Bharat Bharati* by Maithili Sharan Gupt
- *Bisarjan* by Rabindranath Tagore
- *Birth and Death of the Sun* by George Bernard Shaw
- *Bitter Sweet* by Noel Coward
- *Blind Beauty, The* by Boris Pasternak
- *Born Free* by Joy Adamson
- *Brave New World* by Aldous Huxley
- *Bread, Beauty and Revolution* by Khwaja Ahmad Abbas
- *Bride for the Sahib and Other Stories, The* by Khushwant Singh
- *Bride's Book of Beauty, The* by Mulk Raj Anand
- *Broken Wing* by Sarojini Naidu
- *Brush with Life, A* by Satish Gujral
- *Bunch of Old Letters, A* by Jawaharlal Nehru
- *Backward Place* by Ruth Prawer Jhabwala
- *Bandicoot Run* by Manohar Malgonkar
- *Beginning of the Beginning* by Acharya Rajneesh
- *Bewildered India-Identity, Pluralism, Discord* by Rasheedud-din Khan
- *Beyond Boundaries: A Memoire* by Swaraj Paul
- *Beyond Modernisation, Beyond Self* by Sisir Kumar Ghose
- *Bhagwat Gita* by Veda Vyas
- *Bharal Aur Europe* by Nirmal Verma
- *Bharat Bharati* by Maithili Sharan Gupta
- *Bharaitya Parampara Ke Mool Swar* by Govind Chandra Pande
- *Blind Men of Hindoostan-indo-Pak Nuclear War* by Gen Krishnaswamy Sundarji
- *Bliss was it in that Dawn* by Minoo Masani
- *Borders and Boundaries: Women in India's Partition* by Ritu Menon and Kamla Bhasin
- *Bostaan* by Sheikh Saadi
- *Bread, Beauty and Revolution* by Khwaja Ahmed Abbas
- *Breaking the Silence* by Anees Jung
- *Breakthrough* by Gen Moshe Dayan
- *Brishbikkha* by Bankim Chandra Chatterji
- *Britain's True History* by Prem Bhatia
- *Bubble* by Mulk Raj Anand
- *Buddha Charitam* by Ashvaghosha
- *By God's Decree* by Kapil Dev.

C

- *Caesar and Cleopatra* by George Bernard Shaw

- *Candida* by George Bernard Shaw
- *Canterbury Tales* by Geoffrey Chaucer
- *Chitra* by Rabindranath Tagore
- *Comedy of Errors* by William Shakespeare
- *Coolie* by Mulk Raj Anand
- *Conceptual Encyclopaedia of Guru Granth Sahib, A* by S. S. Kohli
- *Crime and Punishment* by Fyodor Dostoevsky
- *Crisis in India* by Ronald Segal
- *Culture in the Vanity Bag, The* by Nirad C. Choudhary
- *Canvass of Life* by Sheila Gujral
- *Chandalika* by Rabindranath Tagore
- *Chemmeen* by Thakazhi Sivasankara Pillai
- *Chidambara* by Sumitranandan Pant
- *Chikaveera Rajendra* by Masti Venkatesh lyengar
- *Chinese Betrayal* by B. N. Mullick
- *Choma's Drum* by K Shivaram Karanath
- *Chithirappaavai* by P. V. Akilandam
- *Confessions of a Lover* by Mulk Raj Anand
- *Confrontation with Pakistan* by Gen B. M Kaul
- *Conquest of Self* by Mahatma Gandhi
- *Continent of Circle* by Nirad C Chaudhuri
- *Court Dancer* by Rabindranath Tagore
- *Crescent Moon* by Rabindranath Tagore
- *Crescent Over Kashmir* by Anil Maheshwari
- *Crisis into Chaos* by E. M. S. Namboodiripad
- *Crossing the Sacred Line-Women's* by Abhilasha Kumari, Sabina
- *Search for Political Power* by Abhilasha and Sabina Kidwai
- *Crown and the Loincloth* by Chaman Nahal
- *Cuckold* by Kiran Nagar Kar
- *Curtain Raisers* by K. Natwar Singh

D

- *Darkness at Noon* by Arthur Koestler
- *Dark Room, The* by R. K. Narayan
- *Das Kapital* by Karl Marx
- *David Copperfield* by Charles Dickens
- *Days of His Grace* by Eyvind Johnson
- *Death of a City* by Amrita Pritam
- *Death of a President* by William Manchester
- *Decline and Fall of the Roman Empire* by Edward Gibbon
- *Defence without Drift* by P. V. R. Rao
- *Decline of the West* by O. Spengler
- *Descent of Man* by Charles Darwin
- *Devdas* by Sharatchandra Chatterjee
- *Dilemma of Our Time* by Harold Laski
- *Discovery of India* by Jawaharlal Nehru
- *Distant Neighbours* by Kuldip Nayar
- *Divine Comedy* by Dante Alighieri
- *Divine Life* by Swami Sivananda
- *Doctor's Dilemma* by George Bernard Shaw
- *Doctor Zhivago* by Boris Pasternak
- *Don Juan* by Lord Byron
- *Dashkumar Charitam* by Dandi
- *Daughter of the East* by Benazir Bhutto
- *Day in Shadow* by Nayantara Sehgal
- *Days of My Years* by H. P. Nanda
- *Death-The Supreme Friend* by Kakasaheb Kalelkar
- *Decline and Fall of Indira Gandhi* by D. R. Mankekar and Kamala Mankekar
- *Democracy Redeemed* by V. K. Narsimhan
- *Dharmashastra* by Manu
- *Distant Drums* by Manohar Malgonkar
- *Don't Laugh-We are Police* by Bishan Lal Vohra
- *Dream in Hawaii* by Bhabani Bhattacharya
- *Durgesh Nandini* by Bankim Chandra Chatterjee
- *Dynamics of Social Change* by Chandra Shekhar.

E

- *End of an Era* by C. S. Pandit
- *Ends and Means* by Aldous Huxley
- *Essays for Poor to the Rich* by John Kenneth Galbraith
- *Essays of Elia* by Charles Lamb
- *Expanding Universe* by Arthur Stanley Eddington
- *Experiments with Untruth* by Michael Anderson
- *Eye of the Storm* by Patrick White
- *Eternal Himalayas* by
- Maj. H. P. S. Ahluwalia
- *Earth in the Balance: Forging a New* by Albert Gore
- *East of Eden* by B. N. Mullick
- *East West* by Salman Rushdie
- *Economic Planning of India* by Ashok Mehta
- *Economics of the Third World* by S. K. Ray
- *Eight Lives* by Rajmohan Gandhi
- *End of an Era* by C. S. Pandit
- *English August* by Upamanyu Chatterjee
- *Essays On Gita* by Aurobindo Ghosh
- *Eternal India* by Indira Gandhi
- *Eternity* by Anwar Shaikh

F

- *Faces of Everest* by Maj. H. P. S. Ahluwalia
- *Face to Face* by Lasse and Lisa Berg
- *Family Reunion* by T. S. Eliot
- *Far from the Madding Crowd* by Thomas Hardy
- *Farewell to Arms, A* by Ernest Hemingway
- *Farewell to Trumpets* by James Morris
- *Fathers and Sons* by Ivan Turgenev
- *First Among Equals* by Jeffrey Archer
- *For Whom the Bell Tolls* by Ernest Hemingway
- *Freedom at Midnight* by Larry Collins and Dominique Lapierre
- *Friends, Not Masters* by Ayub Khan
- *From Here to an Eternity* by James Jones
- *Future Shock* by Alvin Toffler
- *Facts are Facts* by Khan Abdul Wali Khan
- *Faith and Fire: A Way Within* by Madhu Tandon
- *Fall of a Sparrow* by Salim Ali
- *Farewell to a Ghost* by Manoj Das
- *Fasana-i-Azad* by Ratan Nath Sarkar
- *Flames from the Ashes* by P. D. Tandon
- *Food, Nutrition and Poverty in India* by V. K. R. V. Rao
- *Forbidden Sea* by Tara Ali Baig
- *Fortynine Days* by Amrita Pritam
- *Freedom Behind Bars* by Sheikh Mohd Abdullah
- *Friends and Foes* by Sheikh Mujibur Rehman
- *Friends, Not Masters* by Ayub Khan
- *From India to America* by S Chandrashekhar
- *From Rajpath to Lokpath* by Vijaya Raja Scindia
- *Future of NPT* by Savita Pande
- *Foreign Policy for India, A* by I. K. Gujral

G

- *Gardener, The* by Rabindranath Tagore
- *Geet Govinda* by Jaya Dev
- *Gitanjali* by Rabindranath Tagore
- *Gita Rahasya* by Bal Gangadhar Tilak
- *Glimpses of World History* by Jawaharlal Nehru
- *Godan* by Munshi Prem Chand
- *Golden Threshold* by Sarojini Naidu
- *Going After Cacciato* by Tim O'Brien
- *Golden Gate, The* by Vikram Seth
- *Gone with the Wind* by Margaret Mitchell
- *Good Earth* by Pearl S. Buck
- *Gora* by Rabindranath Tagore
- *Grammar of Politics* by Harold Laski

- *Great Expectations* by Charles Dickens
- *Great Illusion* by Norman Angell
- *Guide, The* by R. K. Narayan
- *Gul-e-Naghma* by Raghupati Sahai Firaq
- *Gulistan Bostan* by Sheikh Saadi
- *Gulliver's Travels* by Jonathan Swift
- *Ganadevata* by Tara Shankar Bandopadhyaya
- *Ghasiram Kotwal* by Vijay Tendulkar
- *Gitanjali* by Rabindra Nath Tagore
- *Glimpses of Indian Ocean* by Z. A. Quasim
- *Glimpses of World History* by Jawaharlal Nehru
- *Goa* by Asif Currimbhoy
- *Godrej—A Hundred Years* by B. K. Karanjia
- *Golden Threshold* by Sarojini Naidu
- *Great Depression of 1990* by Ravi Batra
- *Gulistan Boston* by Sheikh Saadi
- *Gulzari Lal Nanda: A Peep in the Service of the People* by Promilla Kalhan
- *Gurusagaram* by O. V. Vijayan

H

- *Hamlet* by William Shakespeare
- *Harsha Charita* by Bana Bhatt
- *Heat and Dust* by Ruth P. Jhabwala
- *Henry Esmond* by W. M. Thackeray
- *Hero of Our Time* by Richard Hough
- *Heroes and Hero Worship* by Thomas Carlyle
- *Himalayan Blunder* by Brig. J. P. Dalvi
- *Hindu Civilisation* by J. M. Barrier
- *History of the Congress Party* by Dr Shankar Ghose
- *Hindu View of Life* by Dr Radhakrishnan
- *House Divided* by Pearl S. Buck
- *Human Factor* by Graham Greene
- *Hungry Stones* by Rabindranath Tagore
- *Harvest* by Majula Padmanabhan
- *Heavy Weather* by P. G. Wodehouse
- *Heir Apparent* by Dr Karan Singh
- *Higher than Hope* by Fatima Meer
- *History of Hindu Chemistry* by Sir P. C. Ray
- *Hitopadesh* by R. K. Narayan
- *Hindi Sahitya Aur Samvedna Ka Vikas* by R. S. Chaturvedi
- *Hind Swaraj* by M. K. Gandhi
- *Hindu Civilisation* by J. M. Barrie
- *Hinduism* by Nirad C Chaudhary
- *Himalayan Love Story, A* by Namita Gokhale

I

- *I Am Not An Island* by K. A. Abbas
- *I Follow the Mahatma* by K. M. Munshi
- *Idiot, The* by Fyodor Dostoevsky
- *If I am Assassinated* by Z. A. Bhutto
- *Illiad* by Homer
- *Importance of Being Earnest* by Oscar Wilde
- *India Divided* by Rajendra Prasad
- *India from Curzon to Nehru and After* by Durga Dass
- *India We Left, The* by Humphrey Trevelyan
- *India Wins Freedom* by Maulana Abul Kalam Azad
- *Indian Home Rule* by M. K. Gandhi
- *Indian Philosophy* by Dr S. Radhakrishnan
- *Indian Muslims* by Prof. Mohammed Mujeeb
- *Indo-Pakistan Conflict, The* by Russel Brines
- *India-China War* by Neville Maxwell
- *Inside Asia* by John Gunther
- *Inside Europe* by John Gunther
- *Invisible Man* by H. G. Wells
- *Iron in the Soul* by Jean Paul Sartre
- *Ivanhoe* by Walter Scott
- *I Dare* by Parmesh Dangwal
- *I follow the Mahatma* by K. M. Munshi
- *I Muse; Therefore I am* by V. N. Narayanan

- *Idols* by Sunil Gavaskar
- *In the Light of the Black Sun* by Rohit Manchanda
- *In the Shadow of Pines* by Mandeep Rai
- *India 2020: A Vision for the New Millennium* by Dr A. P. J. Abdul Kalam and Dr Y. S. Rajan
- *India-A Wounded Civilisation* by V. S. Naipaul
- *India-From Midnight to the Millennium* by Shashi Tharoor
- *India-Independence Festival* (1947–1997) by Raghu Rai
- *India in Transition* by Prof Jagdish Bhagwati
- *India is for Sale* by Chitra Subramaniam
- *India of Our Dreams* by M. V. Kamath
- I*ndia Today* by Rajni Palme Dutt
- *India's Culture the State the Arts and Beyond* by B. P. Singh
- *India's Economic Crisis* by Bimal Jalan
- *Essay's for Manmohan Singh* by I. J. Ahluwalia and M. D. Little
- *Indian Arms Bazaar* by Maj-Gen, Pratap Narain
- *India, the Critial Years* by Kuldip Nayar
- *Indira Gandhi's Emergence and Style* by Nayantara Sehgal
- *Indira's India* by S. Nihal Singh
- *Inside the CBI* by Joginder Singh
- I*nsider* by P. V. Narsimha Rao
- *Intelligence Services* by Dr Bhashyam Kasturi
- *It is Always Possible* by Kiran Bedi

J

- *Jai Som Nath* by K. M. Munshi
- *Jane Eyre* by Charlotte Bronte
- *Jean Christopher* by Romain Rolland
- *Judgement, The* by Kuldip Nayar
- *Judge's Miscellany, A* by A. M. Hidayatullah
- *Julius Caesar* by William Shakespeare
- *Jaguar Smile* by Salman Rushdie
- *Jajar, Churashir Maa* by Mahashweta Devi
- *Jankijeevanam* by Prof Rajendra Mishra
- *Jawaharlal Nehru-A Communicator and Democratic Leader* by A. K. Damodran
- *Jawaharlal Nehru, Rebel and Statesman* by B. R. Nanda
- *Junglee Girl* by Ginu Kamani
- *Jungle Book* by Rudyard Kipling

K

- *Kadambari* by Bana Bhatt
- *Kagaz Te Kanwas* by Amrita Pritam
- *Kamsutra* by Vatsyayan
- *Kamayani* by Jai Shanker Prasad
- *Kapal Kundala* by Bankim Chandra Chatterjee
- *Kaya Kalp* by Munshi Prem Chand
- *Khak-i-Dil* by Jan Nissar Akhtar
- *Kidnapped* by Robert Louis Stevenson
- *Killer Angles* by Michael Shaara
- *King of Dark Chamber* by Rabindranath Tagore
- *King Lear* by William Shakespeare
- *Kora Kagaz* by Amrita Pritam
- *Kumar Sambhava* by Kalidas
- *Kamadhenu* by Kubernath Ray
- *Kali Aandhi* by Kamleshwar
- *Kanthapura* by Raja Rao
- *Kanyadaan* by Vijay Tendulkar
- *Kapal Kundala* by Bankim Chandra Chatterjee
- *Kashmir-A Tale of Shame* by Hari Jaisingh
- *Kashmir-Behind the Vale by* M. J. Akbar
- *Kashmir Diary: Psychology of Militancy* by Gen Arjun Ray
- *Kashmir-The Wounded Valley* by Ajit Bhattacharjee
- K*ashmir in the Crossfire* by Victoria Shaffield

- *Kashmir A Tragedy of Errors* by Tavleen Singh
- *Katghare Main* by Ram Sharan Joshi
- *Kayakalp* by Munshi Prem Chand
- *Kayar* by Thakazhi Sivasankara Pillai
- *Keepers of the Keys* by Milan Kundera
- *Kiratarjuniya* by Bharavi
- *Kitni Navon Main Kitni Bar* by S. H. Vatsyayan
- *Koraner Nari* by Taslima Nasreen
- *Kulliyat* by Ghalib

L

- *Lady Chatterley's Lover* by D. H. Lawrence
- *Life Divine* by Aurobindo Ghosh
- *Living Room* by Graham Greene
- *Letters from a Father to his Daughter* by Jawaharlal Nehru
- *Light That Failed* by Rudyard Kipling
- *Lipika* by Rabindranath Tagore
- *Lolita* by Vladimir Nabokov
- *Lost Child* by Mulk Raj Anand
- *Love Story* by Eric Segal
- *Lajja* by Taslima Nasreen
- *Lal Bahadur Shastri* by C. P. Srivastava
- *Last Phase* by Pyare Lal
- *Law, Lawyers and Judges* by H. R. Bhardwaj
- *Laws Versus Justice* by V. R. Krishna Iyer
- *Legacy of a Divided Nation* by Prof Mushirul Hasan
- *Life Divine* by Aurobindo Ghosh
- *Life is Elsewhere* by Milan Kundera
- *Lost Child* by Mulk Raj Anand
- *Love and Longing in Bombay* by Vikram Chandra
- *Love in A Blue Time* by Hanif Khureshi
- *Love, Truth and A Little Malice* by Khushwant Singh

M

- *Macbeth* by William Shakespeare
- *Magic Mountain* by Thomas Mann
- *Mahabharata* by Maharishi Ved Vyas
- *Major Barbara* by George Bernard Shaw
- *Man and Superman* by George Bernard Shaw
- *Man of Destiny* by George Bernard Shaw
- *Man the Unknown* by Lewis Carroll
- *Man for All Seasons, A* by Robert Bolt
- *Marriage and Morals* by Bertrand Russell
- *Mayor of Casterbridge* by Thomas Hardy
- *Moti Mahal* by Gopinath Mohanty
- *Meghdoot* by Kalidas
- *Memories of World War II* by Winston Churchill
- *Men Who Kept the Secret* by Thomas Powers
- *Men Who Killed Gandhi, The* by Manohar Malgonkar
- *Merchant of Venice* by William Shakespeare
- *Middle March* by George Eliot
- *Midnight's Children* by Salman Rushdie
- *Midsummer Night's Dream, A* by William Shakespeare
- *Mill on the Floss* by George Eliot
- *Modern Painters* by John Ruskin
- *Mother* by Maxim Gorky
- *Mother India* by Katherine Mayo
- *Mountbatten and Independent India* by Larry Collins and Dominique Lapierre
- *Mountbatten and Partition of India* by Larry Collins and Dominique Lapierre
- *Mrs Warren's Profession* by George Bernard Shaw
- *Much Ado About Nothing* by William Shakespeare
- *Mudra Rakshas* by Vishakadutta
- *Murder in the Cathedral* by T. S. Eliot
- *Muslim Dilemma in India* by M. R. A. Baig
- *My Early Life* by Mahatma Gandhi

- *My Experiments with Truth* by Mahatma Gandhi
- *My India* by S. Nihal Singh
- *My Life, Law and Other Things* by M. C. Setalvad
- *My Music, My Life* by Ravi Shankar
- *My Truth* by Indira Gandhi
- *Malati Madhav* by Bhavabhuti
- *Magnificent Maharaja* by K. Natwar Singh
- *Mahatma Gandhi* by Girija Kumar Mathur
- *Malavikagnimitra* by Kalidas
- *Manviya Sanskriti Ke Rachnatmak Aayam* by Prof Raghuvansh
- *Many Worlds* by K. P. S. Menon
- *Memoris of a Bystander—Life in Diplomacy* by Iqbal Akhund
- *Meri Rehen Meri Manzil* by Krishna Puri
- *Million Mutinies Now* by V. S. Naipaul
- *Missed Opportunities—Indo-Pak War 1965* by
- Maj-Gen, Lakshman Singh
- *Mistaken identity* by Nayantara Sehgal
- *Modern South Asia: History, Culture, Political Economy* by Sugata Bose and Ayesha Jalal
- *Modernity Morality And The Mahatma* by Madhuri Santhanam Sondhi
- *Mondays on Dark Night of Moon* by Kirin Narayan
- *Mookhajjiva Kanasugalu* by K. Shivram Karanth
- *Moor's Last Sigh* by Salman Rushdie
- *Mrinalini* by Bankim Chandra Charrerjee
- *Mritunjaya* by Shivaji Sawant
- *Mrs Gandhi's Second Reign* by Arun Shourie
- *Mughal Maharajas And The Mahatma* by K. R. N. Swami
- *Muslim Law and the Constitution* by A. M. Bhattacharjea
- *My Days* by R. K. Narayan
- *My Life and Times* by V. V. Giri
- *My Own Boswell* by M. Hidayatullah
- *My India* by S. Nihal Singh
- *My Presidential Years* by Ramaswamy Venkataraman
- *My South Block Years* by J. N. Dixit
- *My Struggles* by E. K. Nayanar
- *My Prison Diary* by J. P. Narayan

N

- *Naganandan* by HarshaVardhan
- *Naked Face, The* by Sydney Sheldon
- *Naked Came the Stranger* by Penelope Ashe
- *Naked Triangle* by Balwant Gargi
- *Natya Shastra* by Bharat Muni
- *Nehru by The Making of India* by M. J. Akbar
- *Nehru Family and Sikhs* by Harbans Singh
- *Netaji Dead or Alive* by Samar Guha
- *Nine Days Wonder* by John Masefield
- *Nineteen Eighty Four* by George Orwell
- *Non-Violence in Peace and War* by Mahatma Gandhi
- *Naari* by Humayun Azad
- *Naku Thanthi* by D. R. Bendre
- *Nai Duniya Ko Salam and Pathor Ki Dewar* by Ali Sardar Jafri
- *Naivedyam (The Offering)* by N. Balamani Amma
- *New Dimensions of India's Foreign Policy* by Atal Behari Vajpayee
- *Nice Guys Finish Second* by B. K. Nehru
- *Nisheeth* by Uma Shankar Joshi
- *Niti-Sataka* by Bhartrihari
- *Nirbashita Narir Kabita* by Taslima Nasreen
- *Nuclear India* by G. G. Mirchandani and P. K. S.
- *Nurturing Development* by Ismail Serageldin
- *Nation Flawed-Lesson from Indian History, A* by P. N. Chopra

O

- *Odakkuzhal* by G. Shankara Kurup
- *Odyssey* by Homer
- *Of Human Bondage* by W. Somerset Maugham
- *Oh, Calcutta* by Kenneth Tynan
- *Oliver Twist* by Charles Dickens
- *Old Man and the Sea, The* by Ernest Hemingway
- *One World* by Wendell Wilkie
- *One Hundred Years of Solitude* by Gabriel Garcia Marquez • *Origin of Species* by Charles Darwin
- *One Life* by Christian Barnard
- *Othello* by William Shakespeare
- *Other Side of Midnight, The* by Sydney Sheldon
- *Our India* by Minoo Masani
- *One-eyed Uncle* by Laxmikant Mahapatra
- *One World to Share* by Sridath Ramphal
- *Operation Bluestar-the True Story* by Lt-Gen K. S. Brar
- *Our Films, Their Films* by Satyajit Ray
- *Our India* by Minoo Masani
- *Out of Dust* by F. D. Karaka

P

- *Painter of Signs* by R. K. Narayan
- *Pair of Blue Eyes, A* by Thomas Hardy
- *Pakistan Crisis* by David Loshak
- *Pakistan Cut to Size* by D. R. Mankeikar
- *Panchagram* by Tarashankar Bandyopadhyay
- *Panchali Sapatham* by Subramania Bharati
- *Panchatantra* by Vishnu Sharma
- *Passage to England, A* by Nirad C. Choudhary
- *Paradise Lost* by John Milton
- *Paradise Regained* by John Milton
- *Passage to India, A* by E. M. Forster
- *Past and Present* by Thomas Carlyle
- *Patriot, The* by Pearl S. Buck
- *Pickwick Papers* by Charles Dickens
- *Pinjar* by Amrita Pritam
- *Post Office* by Rabindranath Tagore
- *Prem Pachisi* by Munshi Prem Chand
- *Premonitions* by P. N. Haksar
- *Pride and Prejudice* by Jane Austen
- *Principia* by Isaac Newton
- *Prison Diary* by Jayaprakash Narayan
- *Promises to Keep* by Chester Bowles
- *Padmavati* by Malik Mohammed Jayasi
- *Pakistan in the 20th Century* by Lawrence Ziring
- *Pakistan Papers* by Mani Shankar Aiyer
- *Panchagram* by Tarashankar Bandopadhyaya
- *Panchtantra* by Vishnu Sharma
- *Past Forward* by G. R. Narayanan
- *Pather Panchali* by Bibhuti Bhushan Bandyopadhyaya
- *Plans for Departure* by Nayantara Sehgal
- *Portrait of India* by Ved Mehta
- *Prathama Pratishruti* by Ashapurna Devi
- *Premonitions* by P. N. Haksar
- *Price of Partition* by Rafiq Zakaria
- *Prison and Chocolate Cake* by Nayantara Sehgal
- *Prisoner's Scrapbook* by L. K. Advani
- P*rithviraj Raso* by Chand Bardai
- *Profiles and Letters* by K. Natwar Singh
- *Punjab, The Knights of Falsehood* by K. P. S. Gill
- *Peep into the Past, A* by Vasant Navrekar
- *Possible India, A* by Partha Chatterjee
- *Psychoanalysis of the Prophets, A* by Abdulla Kamal

Q

- *Quest for Conscience* by Madhu Dandavate

R

- *Raghuvamsa* by Kalidas
- *Rainbow, The* by Pearl S. Buck
- *Ram Charita Manas* by Tulsidas
- *Ramayana* by Maharishi Valmiki
- *Rangbhoomi* by Munshi Prem Chand
- *Rape of Bangladesh* by Anthony Mascarenhas
- *Ratnavali* by Harsha Vardhan
- *Red Star Over China* by Edgar Snow
- *Reminiscences of the Nehru Age* by M. O. Mathai
- *Republic, The* by Plato
- *Resurrection* by Leo Tolstoy
- *Return of the Native, The* by Thomas Hardy
- *Revenue Stamp, The* by Amrita Pritam
- *Ritu Samhara* by Kalidas
- *Road to Folly* by Leslie Ford
- *Robe, The* by L. C. Douglas
- *Romeo and Juliet* by William Shakespeare
- *Rubaiyat* by Omar Khayyam
- *Radharani* by Bankim Chandra Chatterjee
- *Raghuvamsa* by Kalidas
- *Rajtarangini* by Kalhana
- *Ram Charit Manas* by Tulsidas
- *Ramayana* by Maharishi Valmiki (in Sanskrit)
- *Ramayana Dharshanam* by K. V. Puttappa
- *Rang-e-Shairi* by Raghupati Sahai 'Firaq' Gorakhpuri
- *Ravi Paar (Across the Ravi)* by Gulzar
- *Rediscovering Gandhi* by Yogesh Chadha
- *Return of the Aryans* by Bhagwan S. Gidwani
- *Returning to the Source* by Acharya Rajneesh
- *Rich Like Us* by Nayantara Sehgal
- *Ritu Ka Pehla Phool* by Vijendra
- *River Sutra* by Gita Mehta
- *Road to Freedom* by K. K. Khullar
- *Rukh Te Rishi* by Harbhajan Singh.
- *Reveolutionary Life, A* by Laxmi Sehgal

S

- *Sadar-i-Riyasat* by Karan Singh
- *Saket* by Maithili Sharan Gupt
- *Satyartha Prakash* by Swami Dayanand
- *Savitri* by Sri Aurobindo Ghosh
- *Scholar Extraordinary* by Nirad C. Choudhary
- *Search for Home, A* by Sashti Brata
- *Sense and Sensibility* by Jane Austen
- *Seven Lamps of Architecture* by John Ruskin
- *Satanic Verses, The* by Salman Rushdie
- *Seven Summers* by Mulk Raj Anand
- *Shahnama* by Firdausi
- *Shakuntala* by Kalidas • *Shall We Tell the President* by JeffreyArcher
- *Shape of Things to Come* by H. G. Wells
- *Shame* by Salman Rushdie
- *She Stoops to Conquer* by Oliver Goldsmith
- *Shivaji, The Great Patriot* by Lala Lajpat Rai
- *Sohrab and Rustum* by Mathew Arnold
- *Song of India, The* by Sarojini Naidu
- *Sons and Lovers* by D. H. Lawrence
- *Saz-i-Watan* by Munshi Prem Chand
- *St. Joan George* by Bernard Shaw
- *Story of My Life* by Moshe Dayan
- *Sunny Days* by Sunil Gavaskar
- *Sardar Patel and Indian Muslims* by Rafiq Zakaria
- *Sakharam Binder* by Vijay Tendulkar
- *Savitri* by Aurobindo Ghosh
- *Sceptred Flute* by Sarojini Naidu
- *Scholar Extraordinary* by Nirad C. Chaudhuri
- *Scope of Happiness* by Vijayalakshmi Pandit
- *Search for Home* by Sasthi Brata
- *Sense of Time* by S. H. Vatsyayan
- *Secular Agenda, A* by Arun Shourie
- *Suitable Boy, A* by Vikram Seth

T

- *Tale of Two Cities, A* by Charles Dickens
- *Tales from Shakespeare* by Charles Lamb
- *Tempest, The* by William Shakespeare
- *Tess of the D'Urbervilles* by Thomas Hardy
- *Three Musketeers* by Alexander Dumas
- *Through the Looking Glass* by Lewis Carroll
- *Time Machine* by H. G. Wells
- *To Each His Stranger* by S. H. Vatsyayan
- *To Live or Not to Live* by Nirad C. Choudhary
- *Treasure Island* by Robert Louis Stevenson
- *Triumph* by John Kenneth Galbraith
- *Twelfth Night* by William Shakespeare
- *Twenty Years After* by Alexander Dumas
- *Two Leaves and a Bud* by Mulk Raj Anand
- *Tamas* by Bhisham Sahni
- *Tarkash* by Javed Akhtar
- *Tehriq-e-Mujahideen* by Dr Sadiq Hussain
- *The Assassination* by K. Mohandas
- *The Betrayal of East Pakistan* by A. A. K. Lt Gen
- *The Calcutta Chromosome* by Amitav Ghosh
- *The Career and Legend of Vasco de Gama* by Sanjay Subramanyam
- *The Chinese Betrayal* by B. N. Mullick
- *The Congress Splits* by R. P. Rao
- *The Defeat or Distant Drumbeats* by Bhaskar Roy

U

- *Ulysses* by James Joyce
- *Uncle Tom's Cabin* by H. B. Stowe
- *Unhappy India* by Lala Lajpat Rai
- *Universe Around Us* by James Jeans
- *Unto This Last* by John Ruskin
- *Utopia* by Thomas Moore *Uttar Ramcharita* by Bhavbhuti
- *Until Darkness* by Parvin Ghaffari
- *Utouchable* by Mulk Raj Anand
- *Urvashi* by Ramdhari Singh 'Dinkar'
- *Untold Story* by Gen B. M. Kaul

V

- *Valley of Dolls* by Jacqueline Susann
- *Vanity Fair* by William Thackeray
- *Vendor of Sweets, The* by R. K. Narayan
- *View from the UN* by U. Thant
- *Village, The* by Mulk Raj Anand
- *Vinay Patrika* by Tulsidas
- *View from Delhi, A* by Chester Bowles
- *Virginians, The* by William Thackeray
- *Vish Vriksha* by Bankimchandra Chatterjee
- *Voice of Conscience* by V. V. Giri
- *Venisamhara* by Narayana Bhatt
- *Village by the Sea* by Anita Desai
- *Vinay Patrika* by Tulsidas
- *Virangana* by Maithili Sharan Gupta
- *Voice of Freedom* by Nayantara Sehgal

W

- *Wake up India* by Annie Besant
- *Walls of Glass, The* by K. A. Abbas
- *War and Peace* by Leo Tolstoy
- *War of Indian Independence* by Vir Savarkar
- *War of the Worlds, The* by H. G. Wells
- *Waste Land, The* by T. S. Eliot
- *Way of All Flesh* by Samuel Butler
- *Wealth of Nations* by Adam Smith
- *We Indians* by Khuswant Singh
- *Wonder That Was India, The* by A. L. Basham
- *Wreck, The* by Rabindranath Tagore
- *Waiting for the Mahatma* by R. K. Narayan
- *War and No Peace Over Kashmir* by Maroof Raza
- *We, the People* by N. A. Palkhivala
- *Widening Divide* by Rafiq Zakaria

- *Wings of fire, an Autobiography* by Dr A. P. J. Abdul Kalam and A. Tiwari
- W*itness to History* by Prem Bhatia
- *Without Fear or Favour* by Neelam Sanjiva Reddy
- *Women and Men in My Life* by Khushwant Singh
- *Worshipping False Gods* by Arun Shourie.

Y

- *Yama* by Mahadevi Verma
- *Yashodhara* by Maithili Sharan Gupt
- *Year of the Vulture, The* by Amita Malik
- *Yajnaseni* by Pratibha Roy
- *Yayati* by V. S. Khandekar
- *Years of Pilgrimage* by Dr Raja Ramanna
- *Yesterday and Today* by K. P. S. Menon

Z

- *Zulfikar Ali Bhutto and Pakistan* by Rafi Raza

CHAPTER

14 AWARDS AND HONOURS

INTERNATIONAL AWARDS

Nobel Prize

- *Year of Institution*: 1901
- *Founder*: Alfred Bernhard Nobel
- *Date on which awarded*: 10 December (death anniversary of the founder)
- *Number of Disciplines Awarded*: Total Six

1. Physics
2. Chemistry
3. Physiology or Medicine
4. Literature
5. Peace
6. Economics (established in 1967)

The most prestigious award in the world, supported by The Nobel Foundation (USD 58,960,000) was set up in 1900 under the will of Alfred Bernhard Nobel (1833–96). Alfred Nobel was a Swedish scientist and chemical engineer who discovered Nitroglycerin ($C_3H_5N_3O_9$) and its use in the manufacture of dynamite in 1866. These awards are presented annually on 10 December, the death anniversary of the founder and is presented by the Sewdish King.

Originally, awards were for work in five disciplines. The prize for Economics was instituted in 1967 by Sveriges Riksbank, (Swedish Bank) in celebration of its 300th anniversary and was awarded for the first time in 1969. It is called the Nobel Memorial Prize in Economics.

Table 14.1 Other Important International Awards

Name of Award	*Year Instituted*	*Awarded for*
Pulitzer Prize	1917	Named after the US publisher, Joseph Pulitzer. It is annually conferred in the US for accomplishment in journalism, literature and music

(*Continued*)

Name of Award	*Year Instituted*	*Awarded for*
Magsaysay Award	1957	Named after Ramon Magsaysay, President of Philippines; it is annually conferred for outstanding contribution to Public Service, Community Leadership, Journalism, Literature, Creative Arts and International Understanding
Templeton Award	1972	Conferred by the Templeton Foundation for progress in religion—inaugurated by John M. Templeton, a presbyterian of Nassau, Bahamas
Booker Prize	1968	Highest literary award, set up by the Booker Company and the British Publishers Association
Right Livelihood	1980	Instituted by Jakob Von Vexkull, a Swedish-German writer and philatelic expert, after selling his stamp collection; also known as the Alternative Nobel Prize and conferred annually for practical and exemplary solutions to real problems of today
Jawaharlal Nehru	1965	Instituted by Government of India, it is conferred annually to persons for outstanding contribution in promotion of international understanding, goodwill and friendship among the people of the world.
Oscar Awards	1929	Conferred annually by the Academy of Motion Pictures, Arts and Sciences in the US in recognition of contribution and performance in the field of cinema.
Jesse Owens	1992	Instituted by the International Amateur Athletic Federation Global Award to honour individuals with sports background who have made significant and lasting contribution to society.

Note: No Civilian Awards in 1993 and 1994.

NATIONAL AWARDS

Republic Day Awards (Civilian Awards)

Bharat Ratna

This is the highest national award in the country for exceptional work in the advancement of art, literature and science, or in recognition of public service of the highest order. It has been awarded by the President of India on January 26 every year since 1954. The foremost recipients of Bharat Ratna were:

1. C. Rajagopalachari
2. S. Radhakrishnan
3. C. V. Raman

These awards were discontinued in 1977 by the Janata Government but were revived by the Congress Government in 1980. After revival of these awards, Mother Teresa was the first recipient.

Mr Satya Pal Anand challenged before the MP High Court, the process of 'Conferment of the Bharat Ratna to Rajiv Gandhi posthumously'. Mr Anand succeeded in gaining an *ex-parte* stay against the government in August 1992. The government announced that no Bharat Ratna or Padma awards would be given till the constitutionality of these awards was decided by the courts. Therefore, these awards were not conferred in 1993 and 1994.

Padma Awards

Padma Awards fall next in line after the Bharat Ratna. They were also discontinued in 1977 along with the Bharat Ratna and revived again in 1980. There are three Padma awards:

1. *Padma Vibhushan*: It is the second highest national award given for exceptional and distinguished service in any field including services rendered by government employees.
2. *Padma Bhushan*: It is the third highest national award given for distinguished service in any field.
3. *Padma Shri*: It is the fourth highest award given for distinguished service in any field.

Gallantry Awards

Param Vir Chakra: It is the highest decoration of valour awarded for most conspicuous bravery or some act of valour or self-sacrifice in the presence of the enemy whether on land, at sea or in the air. The medal is made of bronze.

Mahavir Chakra: It is the second highest gallantry award for acts of conspicuous gallantry in the presence of the enemy whether on land, at sea or in the air. The medal is made of standard silver.

Vir Chakra: It is awarded for acts of gallantry in the presence of enemy whether on land at sea or in the air. The medal is made of standard silver.

Winners of Param Vir Chakra

- Major Somnath Sharma, 4 Kumaon Regiment: Posthumous—November 1947 (Kashmir Operations 1947–48)
- 2nd Lt R. R. Rane, Corps of Engineers: April 1948 (Kashmir Operations 1947–48)
- Company Havildar Major Piru Singh, 6 Rajputana Rifles: Posthumous—July 1948 (Kashmir Operations 1947–48)
- L/N. K. Karam Singh, 1 Sikh Regiment: Oct 1948 (Kashmir Operations 1947–48)
- Naik Jadunath Singh, 1 Rajput Regiment: Posthumous—December 1948 (Kashmir Operations 1947–48)
- Captain Gurbachan Singh Salaria, 3/1 Gorkha Rifles: Posthumous—December 1961 (Congo)
- Major Dhan Singh Thappa, 1/8 Gorkha Rifles: October 1962 (Ladakh)
- Subedar Joginder Singh, 1 Sikh Regiment, Posthumous—October 1962 (NEFA)
- Major Shaitan Singh, 13 Kumaon Regiment: Posthumous—November 1962 (Ladakh)
- Abdul Hamid, 4 Grenadiers: Posthumous—September 1965 (Operations against Pakistan)
- Lt Col A. B. Tarapore, 17 Poona Horse: Posthumous—September 1965 (Operation against Pakistan)
- FIg Officer Nirmal Jit Singh Sekhon No. 8 Squadron: Posthumous—December 1971 (Indo-Pak Conflict)

- Major Hoshiar Singh, 3 Grenadiers: Dec 1971 (Indo-Pak conflict)
- 2nd Lt Arun Khetarpal, 17 Poona Horse: Posthumous—December 1971 (Indo-Pak Conflict)
- L/N. K. Albert Ekka, 14 Brigade of Guards: Posthumous—December 1971 (Indo-Pak Conflict)
- Naib Subedar Bana Singh, 8 JAK Light Infantry: June 1987 (Operations in Siachen Glacier)
- Major Ramaswamy Parameswaran, 8 Mahar Regiment: Posthumous—November 1997 (IPKF Operations in Sri Lanka)
- Captian Vikram Batra, 13 JAK Rifles: Posthumous—June 1999 (OP Vijay in Kargil)
- Lt Manoj Kumar Pandey, 1/11 GR: Posthumous—June 1999 (OP Vijay in Kargil)
- Rifleman Sanjay Kumar, 13 JAK Rifles—June 1999 (OP Vijay in Kargil)
- Gdr Yogender Singh Yadav, 18 GDRS—June 1999 (OP Vijay in Kargil)

Other Gallantry Awards (Civilian Gallantry Awards)

1. *Ashok Chakra*: It is awarded for most conspicuous bravery or some act of courage or pre-eminent valour or self-sacrifice other than in the face of enemy.
2. *Kirti Chakra*: It is awarded for conspicous gallantry, other than in the face of the enemy.
3. *Shaurya Chakra*: It is awarded for bravery other than in the presence of enemy.

Table 14.2 Other National Awards

Name of Award	*Date Instituted*	*Awarded for*
Dada Saheb Phalke	1969	Awarded for outstanding contribution to the cause of film/cinema—first recipient was Devika Rani in 1969
Bharatiya Jnanpith	1962	The most prestigious literary award, given to outstanding authors of creative literature in any of the Indian languages recognised by the Constitution of India
Arjuna Award	1961	Awarded to outstanding sports persons in various disciplines
Dronacharya Award	1985	Named after Dronacharya, the legendary guru of the epic age of the 'Mahabharata' who taught archery to Kauravas and Pandavas—it is awarded to sports coaches for outstanding work on constant basis in the last three consecutive years
Rajiv Gandhi Khel Ratna Award	1991–92	The highest honour given to a sports person across sporting disciplines

CHAPTER

15 SPORTS AND GAMES

OLYMPICS

This is an international sports festival which originated in the city of Olympia, an ancient city of Greece.

Ancient Olympics

These games were held at Mount Olympia in Greece in honour of Zeus from 776 BC to AD 394. From AD 394 these games started degenerating and by AD 580 they altogether vanished and were banned by the Roman emperor Theodosius.

Modern Olympics

It was the French nobleman, Baron Pierre de Coubertin, who revived Olympic games (almost 1500 years after the last ancient Olympics) in 1894. The modern series of the Olympic games started in 1896 in Athens and since then are held every four years.

Separate winter Olympic games began in 1924. Women have been competing in the Olympics since 1912. India officially participated in the Olympics for the first time in 1920 when four athletes and two wrestlers were sent to participate in the sixth Olympic games at Antwerp, Belgium.

The Olympic Flag is made up of white silk and contains fine intertwined rings as the Olympics Emblem. From right to left the rings are Blue (Europe), Yellow (Asia), Black (Africa), Red (America) and Green (Australia).

In 1897, Father Didon composed the games motto 'Citius, Altius, Fortius' in Latin, which means 'Swifter, Higher and Stronger'. However, it was introduced as Olympic motto only in 1920 games.

Table 15.1 Olympics—Where and When

Olympiad	*Year*	*Venue*	*Country*
I	1896	Athens	Greece
II	1900	Paris	France
III	1904	St Louis	US
IV	1908	London	Great Britain
V	1912	Stockholm	Sweden

(*Continued*)

Olympiad	*Year*	*Venue*	*Country*
VI*	1916	Berlin	Germany
VII	1920	Antwerp	Belgium
VIII	1924	Paris	France
IX	1928	Amsterdam	Netherlands
X	1932	Los Angeles	US
XI	1936	Berlin	Germany
XII**	1940	Tokyo (Helsinki)	Japan (Finland)
XIII**	1944	London	Great Britain
XIV	1948	London	Great Britain
XV	1952	Helsinki	Finland
XVI	1956	Melbourne	Australia
XVII	1960	Rome	Italy
XVIII	1964	Tokyo	Japan
XIX	1968	Mexico City	Mexico
XX	1972	Munich	W. Germany
XXI	1976	Montreal	Canada
XXII	1980	Moscow	USSR
XXIII	1984	Los Angeles	US
XXIV	1988	Seoul	S. Korea
XXV	1992	Barcelona	Spain
XXVI	1996	Atlanta	US
XXVII	2000	Sydney	Australia
XXVIII	2004	Athens	Greece
XXIX	2008	Beijing	China
XXX	2012	London	UK
XXXI	2016	Rio de Janerio	Brazil

*Games were not held due to World War I

**Games were not celebrated due to World War II. In 1940 the Games were retracted from Tokyo and were awarded to Helsinki by the IOC.

ASIAN GAMES

These games were organized at the initiative of the late Prime Minister, Pt Jawaharlal Nehru, in 1951 and are held once in four years mid-way between the Olympics.

The first Asian Games were held in 1951 at the National Stadium, New Delhi and were inaugurated by Dr Rajendra Prasad (first President of India). About 489 participants from 11 nations participated in the Games.

Asian Games Federation adopted the motto 'Ever Onward', given by Pt Jawahar Lal Nehru and the emblem of Asian games is 'a bright full rising sun with interlocking rings'. The 'Torch and Flag' was presented by Maharaja of Patiala at the First Asian Games held at New Delhi, India.

Table 15.2 Asiads—Where and When

Year	*Venue City*	*Participation Country*	*No. of Athletes*	*No. of Nations*	*No. of Sports*	*Ranking (First Three)*
1951	New Delhi	India	489	11	6	1. Japan 2. India 3. Iran
1954	Manila	Philippines	967	18	8	1. Japan 2. Philippines 3. S. Korea
1958	Tokyo	Japan	1422	20	13	1. Japan 2. Philippines 3. S. Korea
1962	Jakarta	Indonesia	1545	17	13	1. Japan 2. Indonesia 3. India
1966	Bangkok	Thailand	1945	18	14	1. Japan 2. S. Korea 3. Thailand
1970	Bangkok	Thailand	1752	18	13	1. Japan 2. S. Korea 3. Thailand
1974	Tehran	Iran	2357	25	16	1. Japan 2. Iran 3. China
1978	Bangkok	Thailand	2879	25	19	1. Japan 2. China 3. S. Korea
1982	New Delhi	India	3411	33	21	1. China 2. Japan 3. S. Korea
1986	Seoul	S. Korea	3345	27	25	1. China 2. S. Korea 3. Japan
1990	Beijing	China	4684	37	27	1. China 2. S. Korea 3. Japan
1994	Hiroshima	Japan	5300	42	34	1. China 2. S. Korea 3. Japan
1998	Bangkok	Thailand	8100	41	36	1. China 2. S.Korea 3. Japan

(*Continued*)

Year	*Venue City*	*Participation Country*	*No. of Athletes*	*No. of Nations*	*No. of Sports*	*Ranking (First Three)*
2002	Busan	South Korea	9919	42	38	1. China 2. S. Korea 3. Japan
2006	Doha	Qatar	10500	45	39	1. China 2. S. Korea 3. Japan
2010	Guangzhou	China	14000	45	42	1. China 2. S. Korea 3. Japan
2014	Icheon	S. Korea (Scheduled)				

COMMONWEALTH GAMES

The first Commonwealth Games were held in 1930 at Hamilton, Canada. They are conducted, like Olympics, once in four years. All commonwealth countries (erstwhile British Colonies) participate in the sports events which is next to Olympics in terms of participating countries. India is to host the next edition of games at New Delhi in 2010.

Table 15.3 Commonwealth Games—Where and When

Year	*Venue*	*Countries Participated*	*No. of Participants*	*No. of Disciplines*
1930	Hamilton, Canada	11	400	6
1934	London, Great Britain	16	500	6
1938	Sydney, Australia	15	467	7
1950	Auckland, New Zealand	12	590	9
1954	Vancouver, Canada	24	662	9
1958	Cardiff, UK	35	1130	9
1962	Perth, Australia	35	863	9
1966	Kingston, Jamaica	34	1050	9
1970	Edinburgh, UK	42	1383	9
1974	Christchurch, New Zealand	39	1276	9
1978	Edmonton, Canada	46	1473	10
1982	Brisbane, Australia	46	1583	10
1986	Edinburgh, UK	26	1662	10
1990	Auckland, New Zealand	29	2826	10
1994	Victoria, Canada	34	2557	13
1998	Kuala Lumpur, Malaysia	70	3679	16
2002	Manchester, UK	70	5766	16
2006	Melbourne, Australia	71	5766	16
2010	Delhi, India	71	6800	17
2014	Glasgow, Scotland (Scheduled)			

WORLD CUP CRICKET

1.	1975 (Lord's, England)	:	West Indies beat Australia
2.	1979 (Lord's, England)	:	West Indies beat England
3.	1983 (Lord's, England)	:	India beat West Indies
4.	1987 (Calcutta, India)	:	Australia beat England
5.	1992 (Melbourne, Australia)	:	Pakistan beat England
6.	1996 (Lahore, Pakistan)	:	Sri Lanka beat Australia
7.	1999 (Lord's, England)	:	Australia beat Pakistan
8.	2003 (Johannesburg, South Africa)	:	Australia beat India
9.	2007 (Bridgetown, West Indies)	:	Australia beat Sri Lanka
10.	2011 (Mumbai, India)	:	India beat Sri Lanka
11.	2015 (Melbourne, Australia)	:	Scheduled
12.	2019 (Lord's, England)	:	Scheduled

T-20 CRICKET WORLD CUP

1.	2008 (Johannesburg, South Africa)	:	India beat Pakistan
2.	2009 (England)	:	Pakistan beat Sri Lanka
3.	2010 (West Indies)	:	England beat Australia
4.	2012 (Sri Lanka)	:	West Indies beat Sri Lanka
5.	2014 (Bangladesh)	:	Sri Lanka beat India
6.	2016 (India)	:	Scheduled

INDIAN PERMIER LEAGUE

1.	2008 (Mumbai)	:	Rajasthan Royals beat Chennai Super Kings
2.	2009 (Johannesberg, South Africa)	:	Deccan Chargers beat Royal Challengers
3.	2010 (Mumbai)	:	Chennai Super Kings beat Mumbai Indians
4.	2011 (Chennai)	:	Chennai Super Kings beat Royal Challengers, Bangalore
5.	2012 (Chennai)	:	Kolkata Knight Riders beat Chennai Super Kings
6.	2013 (Kolkata)	:	Mumbai Indian beat Chennai Super Kings
7.	2014 (UAE and India; Finals in Bangalore)	:	Kolkata Knight Riders (KKR) beat Kings XI Punjab (KXI)

WORLD CUP HOCKEY

1. 1971—Pakistan beat Spain in Barcelona
2. 1973—Holland beat India in Amsterdam
3. 1975—India beat Pakistan in Kuala Lampur
4. 1978—Pakistan beat Holland in Buenos Aires
5. 1982—Pakistan beat Germany in Mumbai

6. 1986—Australia beat England in London
7. 1990—Holland beat Pakistan in Lahore
8. 1994—Pakistan beat Holland in Sydney
9. 1998—Holland beat Spain in Utrecht
10. 2002—Germany beat Australia in Kuala Lampur (Malaysia)
11. 2006—Germany beat Australia in Monchengladbach, Germany
12. 2010—Australia beat Germany in India
13. 2014—Scheduled, in The Hague, Netherlands

WORLD CUP SOCCER (FOOTBALL) TOURNAMENT

1. 1930—Uruguay beat Argentina, in Uruguay
2. 1934—Italy beat Czechoslovakia, in Italy
3. 1938—Italy beat Hungary, in Brazil
4. 1950—Uruguay beat Brazil, in Brazil
5. 1954—West Germany beat Hungary, in Switzerland
6. 1958—Brazil beat Sweden, in Sweden
7. 1962—Brazil beat Czechoslovakia, in Chile
8. 1966—England beat West Germany, in England
9. 1970—Brazil beat Italy, in Mexico
10. 1974—West Germany beat Holland, in West Germany
11. 1978—Argentina beat Holland, in Argentina
12. 1982—Italy beat West Germany, in Spain
13. 1986—Argentina beat West Germany, in Mexico
14. 1990—West Germany beat Argentina, in Italy
15. 1994—Brazil beat Italy, in USA
16. 1998—France beat Brazil, in France
17. 2002—Brazil beat Germany, in Japan
18. 2006—Italy beat France, in Germany
19. 2010—Spain beat Netherlands, in South Africa
20. 2014—Scheduled, in Brazil

- The Football World Cup is organized by FIFA (Federation of International Football Association)
- The World Cup is called 'Jules Rimet Cup' named after the name of FIFA president from 1921–1953
- In 1942 and 1946, the World Cup Soccer was not played.

SAF (SOUTH ASIAN FEDERATION) GAMES

The SAF games, as a part of SAARC programme, was first held in 1984 at Kathmandu, Nepal. The seven participating countries are India, Pakistan, Sri Lanka, Bangladesh, Nepal, Bhutan and Maldives. The motto of SAF games is 'Peace, Prosperity and Progress'. The games in year 1986 edition was not staged as it was a year of Commonwealth and Asian Games.

Table 15.4 SAF Games—Where and When

Year	*Games*	*Venue*	*Ranking (1st/2nd/3rd)*
1984	I	Kathmandu, Nepal	India/Sri Lanka/Pakistan
1985	II	Dhaka, Bangladesh	India/Pakistan/Bangladesh
1987	III	Calcutta, India	India/Pakistan/Sri Lanka
1989	IV	Islamabad, Pakistan	India/Pakistan/Sri Lanka
1991	V	Colombo, Sri Lanka	India/Sri Lanka/Pakistan
1993	VI	Dhaka, Bangladesh	India/Pakistan/Sri Lanka
1995	VII	Chennai, India	India/Sri Lanka/Pakistan
1999	VIII	Kathmandu, Nepal	India/Nepal/Sri Lanka
2004	IX	Islamabad, Pakistan	India/Pakistan/Sri Lanka
2006	X	Colombo, Sri Lanka	India/Pakistan/Sri Lanka
2010	XI	Dhaka, Bangladesh	Event scheduled to take place in November 2009 took place in January 2010 (India/ Pakistan/Bangladesh)
2013	XII	New Delhi (India)	Postponed from Bhutan but dates yet to be confirmed
2014	XIII	Kathmandu (Nepal)	Scheduled
2016	XIV	Hambantota (Sri Lanka)	Scheduled

IMPORTANT TROPHIES AND CUPS

Table 15.5 International

Name	*Associated Sport*
American Cup	Yacht Racing
Ashes	Cricket (Australia-England)
Canada Cup	Golf (World Championship)
Colombo Cup	Football (India, Pakistan, Sri Lanka and Myanmar)
Corbillion Cup	World Table Tennis (Women)
Davis Cup	Tennis
Derby	Horse Racing
Holker	Bridge
Jules Rimet Trophy	World Football (Soccer)
Merdeka	Football (Asian Cup)
Ryder Cup	Golf
Reliance Cup	Cricket
Swaythling Cup	World Table Tennis (Men)
Todd Memorial Trophy	Basketball
Thomas Cup	World Badminton (Men)
Tunku Abdul Rahman Cup	Asian Badminton
U. Thant Cup	Lawn Tennis
Uber Cup	World Badminton (Women)
Yonex Cup	Badminton

(*Continued*)

Name	*Associated Sport*
Walker Cup	Golf
William Cup	Basketball
Wimbledon Trophy	Tennis
World Cup	Cricket (Prudential/Reliance Cup)

Table 15.6 National

Name	*Associated Sport*
Aga Khan Cup	Hockey
Barna-Bellack Cup	Table Tennis (Men)
Beighton Cup	Hockey
Ezar Cup	Polo
Dhyan Chand Tropny	Hockey
Dr B. C. Roy Trophy	Football (National junior)
Duleep Trophy	Cricket
Durand Cup	Football
Guru Nanak Championship	Hockey (All India women)
Irani Cup	Cricket
Lady Ratan Tata Trophy	Hockey (Women)
Maharaja Ranjit Singh Gold Cup	Hockey
Murugappa Gold Cup	Hockey
Nehru Trophy	Hockey
Nizam Gold Cup	Football
Rangaswami Cup	Hockey (National championship)
Ranji Trophy	Cricket (National championship)
Rovers Cup	Football
Sanjay Gold Cup	Football
Santosh Trophy	Football
Sheesh Mahal Trophy	Cricket
Subroto Mukherjee Cup	Football
Todd Memorial Trophy	Football
Vittal Trophy	Football
Vizzy Trophy	Cricket
Yadavindra Cup	Hockey

Table 15.7 Special Names of Playgrounds

Sport	*Name of Playing Area*	*Sport*	*Name of Playing Area*
Badminton	Court	Golf	Link, Green**
Baseball	Diamond	Lawn Tennis	Court
Boxing	Ring	Skating	Rink
Cricket	Pitch*	Wrestling	Ring, Arena

*Pitch in fact is the space between the wickets and not the entire cricket field.
**It is the area around the hole only.

Table 15.8 Important National Sports

Country	*National Sport*
Australia	Tennis and Cricket
Canada	Lacrosse
China	Table Tennis (Ping Pong)
England	Cricket, Football
India	Hockey, Kabaddi
Japan	Judo, Sumo
Malaysia	Badminton
Scotland	Rugby, Football
Spain	Bull Fighting
US	Baseball

Table 15.9 Sports Stadiums of India

Name	*Location*
Netaji Indoor Stadium	Kolkata
Wankhede Stadium	Mumbai
Nehru (Chepauk) Stadium	Chennai
National Stadium	New Delhi
Vallabhbhai Patel Stadium	Ahmedabad
Keenan Stadium	Jamshedpur
Brabourne Stadium	Mumbai
Yadvindra Stadium	Patiala
Ranjit Stadium	Kolkata
Barabati Stadium	Cuttack
Eden Gardens	Kolkata
Green Park Stadium	Kanpur
Sawai Mansingh Stadium	Jaipur
Shivaji Stadium	New Delhi
Jawaharlal Nehru Stadium	New Delhi
Yuva Bharati Stadium* (Salt Lake Stadium)	Kolkata
Indira Gandhi Indoor Stadium	New Delhi

*It is India's largest stadium and can accommodate 1,20,000 people; it is spread over an area of 30.75 hectares. It is also the largest stadium in the world.

Table 15.10 Terms Associated with Sports

Sport	*Associated terms*
Badminton	drop, deuce, smash, double touch, clash service, love, service line
Base Ball	bunting, home, pitcher, put out, strike
Basketball	block, dribble, held ball, pivot, basket
Billiards	cue, cannon, baulk, pot scratch, long jenny, short jenny, frame, spider, short and long rest, in-off

(*Continued*)

Sport	*Associated terms*
Boxing	rounds, knock-outs, countdown, flyweight, featherweight, middleweight, light heavy-weight, welterweight, lightweight, super heavy-weight, jab, uppercut, hook, punch
Bridge	contract bridge, duplicate bridge, tricks, suite, rubber, trump, grand slam, little slam
Chess	gambit, stalemate, move, resign, checkmate, king, queen, rook, bishop, knight, pawn, double check, Sicilian Defence, Caro Kann Defence
Cricket	innings, runs, wickets, overs, hat-trick, maiden, follow-on, declare, bowled, caught, run-out, leg- before wicket (LBW), stumped, boundary, six, four, single, batsman, bowler, wicket-keeper, non-striker, slips, gully, forward short-leg, silly mid-on, mid-on, point, cover, mid-off, long off, mid-wicket, short-leg, long leg, fine-leg, yorker, bouncer, beamer, googly, full toss, drive, cut, pull, hook, flick
Football	kick off, goal, corner-kick, free-kick, throw-in, penalty, offside, red card, yellow card, foul, hat trick, dribble, pass, forward, defender, half, goalkeeper, tie-breaker, trapping, heading
Golf	course, links, tee, hole, caddie, threesome, four- some, niblic, club, putt, iron, birdie, eagle
Hockey	centre, defender, forward, half, penalty-stroke, penalty corner, push-in, free-hit, striking circle goal, goal-line, touch-line, goal keeper, off-side, foul, stick, carry, dribble, tiebreaker, trapping
Horse Racing	race course, steeplechase, bets, bookies, jockey, punter
Polo	mallet, bunker, chukker, handicap, goal, sixty yarder
Shooting	bag, bullseye, marksmanship, plug, skeet
Table Tennis	smash, drop, deuce, spin, let, service
Tennis	smash, cross-court, passing shot, backhand, forehand, slice, top-spin, serve, dropshot, lob, down-the-line, deuce, tie-breaker, set, game, grand slam, ace, volley
Volleyball	blocking, doubling, heave, smash, point, serve, volley

CHAPTER

16 MISCELLANEOUS TOPICS

Table 16.1 Firsts' in the World

S. No	*Field*	*Name*	*Year*
1.	Man to reach South Pole	Roald Amundsen (Norway)	1911
2.	Man to reach North Pole	Robert E. Peary (USA)	1909
3.	Woman to reach North Pole	Karoline Mikkelsen (Norway)	1935
4.	Woman to reach South Pole	Fran Phipps (Canada)	1971
5.	Man to go to Space	Yuri Gagarin (former USSR)	1961
6.	Man to set foot on the Moon	Neil Alden Armstrong (US)	1969
7.	Man to walk in Space	Alexei Leonov (former USSR)	1965
8.	Woman Cosmonaut in Space	Valentina Tereshkova (former USSR)	1963
9.	Man to climb Mt Everest	Tenzing Norgay (Nepal)	1953
10.	Woman to climb Mt Everest	Junko Tabei (Japan)	1975
11.	President of USA	George Washington	1789
12.	Foreign invader of India	Alexander the Great (Greece)	326 BC
13.	Woman to cross the Strait of Gibraltar	Arti Pradhan (India)	1988
14.	Handicapped man to cross Strait of Gibraltar (deaf and dumb)	Taranath Shenoy (India)	1988
15.	President of Chinese Republic	Dr Sun Yat-Sen	1921–1925
16.	Chairman of People's Republic of China	Mao Tse Tung	1949–1976
17.	Man to sail around the world	Ferdinand Magellan (Portugal)	1519–1521
18.	First Prime Minister of a country	Sir Robert Walpole (Britain)	1721–1742
19.	Lady Prime Minister of a country	Srimavo Bhandarnaike (Sri Lanka)	1970–1977
20.	Lady Prime Minister of England	Margaret Thatcher	1979–1990
21.	Polar circumnavigation Charles	Sir Ranulph Fiennes and Burton (Britain)	1979–1982
22.	Chinese traveller to India	Fahien	405–411
23.	Woman Bishop	Rev. Barbara C. Harris (USA)	1988
24.	Lady President of a Country	Maria Estela Peron (Argentina)	
25.	First to have skied to both North and South Poles and climbed Mount Everest	Erling Kagge (Norway)	1994

Table 16.2 Indian Nobel Laureates

Years	*Discipline*	*Details*
1915	Literature	**Rabindranath Tagore** (1861–1941) Gurudev Rabindranath Tagore is one of India's most distinguished and respected men of letters. He was the first Indian to have won the Nobel Prize for *Gitanjali*. He was a great author and educationist who founded the 'Shantiniketan' (1901) at Bolepur, West Bengal, which later became the Vishvabharti University. *Works* Poems: *Sonar Tari, Puravi, The Cycle of the Spring, The Evening Songs, The Morning Songs*, etc. Novels: *Gora, Raja our Rani, Muktdahara, Raj Rishi, Ghare Baire, Nauka Dubi, Kabuliwallah, Kshudit Pashan*, etc. The British Government knighted him but he returned the title in 1919 in protest against the Jallianwala Bagh tragedy.
1930	Physics	**C. V. Raman** (1888–1970) The first Indian scientist to have won the Nobel Prize for his study of the scattering of light known as the 'Raman Effect'. The theory describes change in the frequency of light passing through a transparent medium. He was the first Indian and Asian to receive the Nobel Prize in Physics.
1968	Medicine	**Hargobind Khorana** (b. 1922) An Indian-born American citizen. He was awarded the Nobel Prize for the laboratory synthesis of a yeast gene for the first time.
1979	Peace	**Mother Teresa** (1910–1998) Born in Albania (Yugoslavia), she came to India in 1929 at the age of 19 years and became an Indian citizen. She established 'Missionaries of Charity' and won the Nobel Prize for her missionary services. She was also awarded: Bharat Ratna (1980), Jawaharlal Nehru Award for International Understanding (1969), Ramon Magsaysay Award (1962) and Templeton Foundation Award (1973), to name a few. For her, life was a mission to serve the suffering humanity.
1983	Physics	Subramanyan Chandrasekhar (1910–1995) Born in Lahore (now in Pakistan), he later became an American citizen. He was awarded the Nobel Prize for his work known as '*Chandrasekhar's Limit*' which determines the minimum mass of a dying star which enables it to survive.
1998	Economics	**Amartya Sen** (b. 1933) Recipient of the Nobel Prize for Economics in 1998, becoming the first Asian to have been honoured with the award. He is credited with finding a mathematical solution of 'Impossibility Theorem' suggested by Kenneth Arrow which states that it is not possible to aggregate individual choices into a satisfactory choice for society as a whole. Prof. Sen showed that societies could find ways to such a poor outcome.
2009	Chemistry	**Venkatraman Ramakrishnan** (b. 1952) He is credited with his study on structures and functioning of ribosomes.

RELIGIONS OF THE WORLD

1. Buddhism

Founder	:	Gautam Siddhartha Buddha (563–483 BC) born in Nepal (Lumbini)
Founded in	:	525 BC
Followed in	:	India, China, Tibet, Korea, Mongolia, Nepal, Bhutan, Thailand, Japan, Laos, Myanmar (Burma), Sri Lanka, Cambodia, Taiwan, Indonesia, Bhutan and Vietnam
Sacred Text	:	The 'Tripitaka' (Collection of Buddha's teachings) also called 'Sutras'
Sacred Places	:	Lumbini (Nepal) where Buddha was born, Bodh Gaya (Bihar), where he received enlightenment and Kusinagar (UP) where he attained 'Nirvana'
Place of Worship	:	Vihar (temple) and Monastery (where monks reside)
Sects	:	Mahayana and Hinayana

2. Confucianism

Founder	:	King Fu Tsu, better known as Confucius (551–479 BC) born in the state of Lu in China.
Founded in	:	500 BC
Followed in	:	China, Taiwan, South Korea, Nauru and Vietnam
Sacred Text	:	'The Analects'
Sacred Place	:	Peking (Beijing) in China.
Place of worship	:	No church or temple

3. Christianity

Founder	:	Jesus Christ (5 BC to AD 30) born in Judea, also called Jesus of Nazareth
Founded in	:	2000 years ago
Followed in	:	Spread all over the world
Sacred Text	:	Holy Bible consisting of 'Old Testament' (before Christ) and the 'New Testament' (during and after Christ)
Sacred Places	:	Jerusalem, where Christ lived and preached
Place of Worship	:	Church
Important Sects	:	Catholics and Protestants

4. Hinduism

Founder	:	Ancient Sages.
Founded in	:	Around 1500 BC
Followed in	:	Concentrated in India and Nepal and also found in Bhutan, Fiji, Guyana, Indonesia, Mauritius, Sri Lanka, South Africa, Surinam, Trinidad and Tobago
Sacred Texts	:	'The Vedas', 'the Upanishads', 'the Bhagavad Gita' and the epics of the 'Mahabharata' and the 'Ramayana'
Place of Worship	:	Temple

5. Islam

Founder	:	Prophet Mohammed (AD 570–632) born in Mecca (Saudi Arabia)
Founded in	:	AD 622
Followed in	:	From west coast of Africa to the Phillippines which includes Tanzania, Southern part of Russia and China, India, Pakistan, Bangladesh, Malaysia and Indonesia. Also parts of North Africa.
Sacred Texts	:	'Quran' (words of God), 'Hadis' (Collection of Prophet's sayings)
Sacred Places	:	Makkah (Mecca) in Saudi Arabia
Place of Worship	:	Masjid (mosque)
Important Sects	:	Sunnis and Shias

6. Judaism (Religion of the Hebrews)

Founder	:	Moses, born in Egypt
Founded in	:	1300 BC
Followed in	:	Worldwide with concentration in Israel and United States
Sacred Texts	:	Talmads, found particularly in the five books of the Bible; commentary on 'Torah' known as 'Talmud and Midrash'
Sacred Places	:	Jerusalem
Place of Worship	:	Synagogue

7. Shintoism

Founder	:	Began with Japanese culture and developed out of tradition and ancestor worship
Followed in	:	Japan
Sacred Texts	:	No specific text
Sacred Place	:	Central Shrine of Ise (central Japan) and the Yasukuni Shrine in Tokyo

8. Sikhism

Founder	:	Guru Nanak (1469–1539)
Founded in	:	AD 1500
Followed in	:	India
Sacred Texts	:	'Guru Granth Saheb'
Sacred Place	:	The Golden Temple of Amritsar
Place of Worship	:	Gurudwara

9. Taoism

Founder	:	Lao-tse, a Chinese philosopher
Founded in	:	6th century BC
Followed in	:	China, Taiwan, Nauru, Brunei, Singapore and Vietnam
Sacred Text	:	'Tao-te-Ching'

10. Zoroastrianism (Parsi Religion)

Founder	:	Zoroaster, born in Medea (modern lran) in about 660 BC
Founded in	:	Around 500 BC
Followed in	:	Iran and north-west India. The Zoroastrians who fled to India during the eighth century are the ancestors of the present Parsi Community in India
Sacred Text	:	'Zend Avesta'
Place of Worship	:	Fire temple

ABBREVIATIONS

A

AAFI	Amateur Athletics Federation of India
AAGSP	All Assam Gana Sangram Parishad
AARRO	Afro-Asian Rural Reconstruction Organization
AASU	All Assam Students Union
ABC	Audit Bureau of Circulation; American (or Australian) Broadcasting Co.
ABM	Anti-Ballistic Missiles
ABU	Asian Broadcasting Union
AC	Ante Christum (Before Christ)
ACC	Auxiliary Cadet Corps
AD	Anno Domini (After Christ)
ADB	Asian Development Bank
ADC	Aide-de-Camp
ADF	African Development Fund
ADMK	Anna Dravida Munnetra Kazhagam
ADR	American Depository Receipt
AEC	Atomic Energy Commission
AF	Audio Frequency
AFC	Asian Football Confederation
AFP	Agence France-Presse
AFPRO	Action for Food Programme
AGM	Annual General Meeting
AH	Anno Hegirae
AGP	Asom Gana Parishad
AGSOC	Asian Games Special Organizing Committee
AI	Air India
AIADMK	All India Anna Dravida Munnetra Kazhagam
AICC	All India Congress Committee
AICS	All India Council of Sports

AICTE	All India Council of Technical Education
AID	Agency for International Development
AIDS	Acquired Immune Deficiency Syndrome
AIFACS	All India Fine Arts and Crafts Society
AIML	All India Muslim League
AINEC	All India Newspaper Editors Conference
AIIMS	All India Institute of Medical Sciences
AILTA	All India Lawn Tennis Association
AIMO	All India Manufacturers Organization
AIR	All India Radio
AIREC	All India Railway Employees Confederation
AIRF	All India Railwaymen's Federation
AISSF	All India Sikh Students Federation
AITUC	All India Trade Union Congress
AIWC	All India Women's Conference
AJT	Advanced Jet Trainer
AM	Ante Meridian (before noon)
AMC	Army Medical Corps, Asset Management Company, Annual Maintenance Contract
AMIE	Associate Member of Institution of Engineers
ANZUS	Australia, New Zealand, US (Pacific Pact Nations)
AOC	Air Officer Commanding
AP	AssociateP ress
APC	Armoured Personnel Carrier
APEC	Asia Pacific Economic Corporation
APL	Above Poverty Line
APPLE	Ariane Passenger Payload Experiment
APM	Administered Pricing Mechanism
ARC	Administrative Reforms Commission
ARDC	Agricultural Refinance and Development Corporation
ARF	Asean Regional Forum
ASAT	Anti-Satellite
ASC	Army Service Corps
ASEAN	Association of South East Asian Nations
ASI	Archaeological Survey of India
ASLV	Augmented Satellite Launch Vehicle
ASPAC	Asian and Pacific Council
ASSOCHAM	Associated Chambers of Commerce and Industry
ATM	Automated Teller Machine

ATR	Action Taken Report
ATS	Anti-Tetanus Serum
AU	Astronomical Unit
AVC	Army Veterinary Corps
AVSM	Ati Vishist Seva Medal
AWACS	Airborne Warning and Control System

B

BA	Baccalaureus Artium (Bachelor of Arts)
BAFTA	British Academy of Film and Television Arts
BAI	Badminton Association of India
BALCO	Bharat Aluminium Company Limited
BARC	Bhabha Atomic Research Centre
B2B	Business to Business
BC	Before Christ
B2C	Business to Customer
BBC	British Broadcasting Corporation
BCCI	Board of Control for Cricket in India
BCG	Bacillus Calmette Guerin (Tuberculosis Vaccine)
BEL	Bharat Electronics Limited
BENELUX	Belgium, The Netherland and Luxembourg
BHEL	Bharat Heavy Electrical Ltd.
BIFR	The Board of Industrial and Financial Reconstruction
BIMSTEC	Bangladesh, India, Myanmar, Sri Lanka, Thailand Economic Co-oporation
BIS	Bureau of Indian Standards
BIT	Binary Digit
BJP	Bharatiya Janata Party
BKD	Bharatiya Kranti Dal
BKU	Bharatiya Kisan Union
BLD	Bharatiya Lok Dal
BOAC	British Overseas Airways Corporation (now British Airways)
BOLT	Build, Own, Lease and Transfer
BOOT	Build, Own, Operate and Transfer
BOST	Build, Own, Share and Transfer
BPCL	Bharat Petroleum Corporation Limited
BPE	Bureau of Public Enterprises
BPL	Below Poverty Line
BPO	Business Process Outsourcing

BRO	Border Roads Organization
BSE	Bombay Stock Exchange
BSF	Border Security Force
BSNL	Bharat Sanchar Nigam Limited
BSS	Bharat Sewa Samaj
BSP	Bahujan Samaj Party
BT	Bacillus Thuringiensis

C

CABE	Central Advisory Board for Education
CAD	Computer Aided Design
CAG	Comptroller and Auditor-General
CAM	Computer Aided Manufacturing
CAPES	Computer Aided Paperless Examination System
CAR	Capital Adequacy Ratio
CARE	Cooperative for American Relief Everywhere
CAS	Conditional Access System
CASE	Commission on Alternative Sources of Energy
CASTAP	Conference on Application of Science and Technology in Asia and the Pacific
CBDT	Central Board of Direct Taxes
CBFC	Central Board of Film Certification
CBI	Central Bureau of Investigation
CBM	Confidence Building Measures
CBR	Central Board of Revenue, Crude Birth Rate
CBSE	Central Board of Secondary Education
CBT	Children's Book Trust
C2C	Customer to Consumer
CCI	Cricket Club of India
CD	Compact Disc/Certificate of Deposit/Corpa Diplomatique
C-DOT	Centre for Development of Telematics
CDMA	Code Division Multiple Access
CDR	Crude Death Rate
CDRI	Central Drug Research Institute
CDS	Compulsory Deposit Scheme
CDSL	Central Depository Services (India) Ltd.
CENTO	Central Treaty Organization
CEC	Chief Election Commissioner
CEO	Chief Executive Officer
CFD	Congress for Democracy

CFC	Chlorofluoro Carbons
CFO	Chief Financial Officer
CFSI	Children's Film Society of India
CFTRI	Central Food Technological Research Institute
CGHS	Central Government Health Scheme
CHEC	Commonwealth Human Economic Council
CHOGM	Commonwealth Heads of Government Meeting
CHOGRM	Commonwealth Heads of Government Regional Meeting
CII	Confederation of Indian Industry
CIA	Central Intelligence Agency (USA)
CIS	Commonwealth of Independent States
CISF	Central Industrial Security force
C-in-C	Commander-in-Chief
CID	Criminal Investigation Department
CIET	Central Institute of Educational Technology
CIF	Cost, Insurance and Freight
CIL	Coal India Limited
CITES	Convention of International Trade in Endangered Species
CITU	Centre of Indian Trade Unions
CIWTC	Central Inland Water Transport Corporation
CLRC	Central Land Reforms Committee
CMD	Chairman and Managing Director
CMIE	Centre for Monitoring Indian Economy
CMO	Chief Medical Officer
CMN	Common Market Nations
CNG	Compressed Natural Gas
CNN	Cable News Network
COAI	Cellular Operators Association of India
COAS	Chief of Army Staff
COBOL	Common Business Oriented Language
COD	Cash on Delivery
COFEPOSA	Conservation of Foreign Exchange and Prevention of Smuggling Act
COMEX	Commonwealth Expedition
CORDET	Cooperative Rural Development Trust
CPC	Civil Procedure Code
CPF	Contributory Provident Fund
CPI	Communist Party of India
CPO	Central Para Military Organization
CPI(M)/CPM	Communist Party of India (Marxist)

CRIS	Central Railway Information Systems
CRISIL	Credit Rating Information Services of India Ltd.
CRM	Customer Relationship Management
CrPC	Criminal Procedure Code
CRPF	Central Reserve Police Force
CRR	Cash Reserve Ratio
CRRI	Central Road Research Institute
CRY	Child Relief and You
CSE	Centre for Science and Environment
CSI	Computer Society of India
CSIO	Central Scientific Instruments Organization
CSIR	Council of Scientific and Industrial Research
CSO	Central Statistical Organization
CSIRO	Commonwealth Scientific and Industrial Research Organization
CTBT	Comprehensive Test Ban Treaty
CVC	Chief Vigilance Commissioner
CVR	Cockpit Voice Recorder

D

DA	Dearness Allowance
DAE	Department of Atomic Energy
DANICS	Delhi–Andaman Nicobar Island Civil Services
DC	Direct Current, Deputy Commissioner
DCC	District Congress Committee
DDT	Dichloro-Diphenyl Trichloro-Ethane
DMRC	Delhi Metro Rail Corporation
DOT	Dichloro Diphenyl Trichloro-ethane (Insecticide)
DGC	Director-General of Civil Aviation
DGTD	Director-General of Technical Development
DGS and D	Directorate-General of Supply and Disposals
DLF	Development Loans Fund
D. Litt	Doctor of Literature
DLO	Dead Letter Office
DMK	Dravida Munnetra Kazhagam
DMKF	Dalit Mazdoor Kisan Party
DPI	Director of Public Instruction
DPT	Diphtheria, Pertussis and Tetanus (Vaccine)
DNA	Deoxy Ribonucleic Acid
DO	Demi Official
DOD	Department of Ocean Development

DRDL	Defence Research and Development Laboratory
DRDO	Defence Research and Development Organization
DRI	Differential Rate of Interest
DSIDC	Defence Scientific Information and Documentation Centre
DTH	Direct to Home Service
DV	Deo Volente (God Willing)
DVDR	Digital Versatile Disc Recordable

E

EARC	Economic Administrative Reforms Commission
ECA	Economic Commission for Asia
ECAFE	Economic Commission for Asia and Far East
ECG	Electrocardiogram
ECGC	Export Credit and Guarantee Cooperation
ECHR	European Commission on Human Rights
ECM	European Common Market
ECOSOC	Economic and Social Council (of UN)
ECS	Electronic Clearance Services
EEC	European Economic Community
EEG	Electro Encephalogram
EFTA	European Free Trade Association
EG	Exampli Gratia (For e.g.)
ELSS	Equity Linked Saying Scheme
E-MAIL	Electronic Mailing
EMF	Electro-Motive Force
ENLF	Eelam National Liberation Front
EOU	Export Oriented Unit
EPABX	Electronic Private Automatic Branch Exchange
EPS	Earning Per Share
EPZ	Export Processing Zone
ESCAP	Economic and Social Commission for Asia and Pacific
ESI	Employees State Insurance
ESMA	Essential Services Maintenance Act
ESP	Extra Sensory Perception
ESPN	Entertainment and Sports Programming Network

F

FAO	Food and Agriculture Organization (of UN)
FBI	Federal Bureau of Investigation
FBTR	Fast Breeder Test Reactor

FCD	Fully Convertible Debenture
FCI	Food Corporation of India/Fertilizer Corporation of India
FDI	Foreign Direct Investment
FEMA	Foreign Exchange Management Act
FERA	Foreign Exchange Regulation Act
FF	Film Finance Corporation
FFI	Foreign Financial Institutions
FI	Financial Institution
FII	Foreign Institutional Investor
FIA	Federation International de Automobile
FICCI	Federation of Indian Chambers of Commerce and Industry
FIFA	International Football Federation
FIPB	Foreign Investment Promotion Board
FIR	First Information Report
FLAG	Fibre Optic Link Around the Globe
FM	Frequency Modulation
FMCG	First Moving Consumer Goods
FMCT	Fissile Material Cut-off Treaty
FOB	Freight on Board
FOR	Freight on Rail
FRCP	Fellow of the Royal College of Physicians
FRCS	Fellow of the Royal College of Surgeons
FRS	Fellow of the Royal Society
FTZ	Free Trade Zone

G

G-7	Group of Seven Nations (US, UK, Germany, France, Italy, Japan and Canada)
G-8	Group of Eight Nations (G-7 Countries plus Russia)
G-15	Group of Fifteen Nations
GAIL	Gas Authority of India Limited
GARP	Global Atmospheric Research Project
GATS	General Agreement on Trade and Services
GATT	General Agreement on Tariffs and Trade
GBS	George Bernard Shaw
GCC	Gulf Cooperation Council
GDR	Global Depository Receipt
GDP	Gross Domestic Product
GEC	General Electric Company
GHQ	General Headquarters

GIC	General Insurance Corporation
GLOBE	Global Learning and Observation to Benefit the Environment
GmbH	Gesellsheft Mit Beshrankter Haftung Liability company (German Limited Companies)
GMO	Genetically Modified Organisms
GMT	Greenwich Mean Time
GNLF	Gorkhaland National Liberation Front
GNP	Gross National Product
GOC	General Officer Commanding
GOI	Government of India
GPF	General Provident Fund/Gandhi Peace Foundation
GPO	General Post Office
GSLV	Geo-Synchronous Satellite Launch Vehicle
GSTP	Global System of Trade Practices

H

HAL	Hindustan Aeronautics Ltd.
HBV	Hepatitis-B Virus
HDFC	Housing Development and Finance Corporation
HE	His/Her Excellency
HEC	Heavy Engineering Company
HEH	His/Her Highness
HLC	Humanitarian Law Commission (Red Cross Body)
HLL	Hindustan Lever Limited
HMI	Himalayan Mountaineering Institute
HMT	Hindustan Machine Tools
HMV	His Master's Voice
HP	Harmonic Progression, Horse Power
HSD	High Speed Diesel
HSL	Hindustan Steel Ltd.
HUDCO	Housing and Urban Development Corporation
HZL	Hindustan Zinc Limited

I

IAA	International Airport Authority
IAAS	Indian Audit and Accounts Service
IAEA	International Atomic Energy Agency
IAC	Indian Airlines Corporation
IAFC	Indian Agricultural Finance Corporation

IAMC	Indian Army Medical Corps
IARI	Indian Agricultural Research Institute
IASRI	Indian Agricultural Statistical Research Institute
lATA	International Air Transport Association
IBEC	International Bank for Economic Cooperation
IBM	International Business Machines
IBRD	International Bank for Reconstruction and Development
ICAO	International Civil Aviation Organization
ICAR	Indian Council of Agricultural Research
ICBM	Inter-Continental Ballistic Missile
ICC	International Cricket Council/International Crime Court/International Control Commission
ICE	Infotech Communications and Entertainment
ICHR	Indian Council of Historical Research
ICICI	Industrial Credit and Investment Corporation of India
ICJ	International Court of Justice
ICCR	Indian Council of Cultural Relations
ICRA	Investment and Credit Rating Agency of India
ICRC	International Committee of Red Cross
ICRIER	Indian Council for Research on International Economic Relations
ICSI	Institute of Company Secretaries of India
ICSSR	Indian Council of Social Science Research
ICSW	Indian Council of Social Welfare
ICWA	Indian Council of World Affairs
ICWAI	Institute of Cost and Works Accountants of India
IDA	International Development Agency
IDC	Industrial Development Corporation
IDBI	Industrial Development Bank of India
IDPL	Indian Drugs and Pharmaceuticals Ltd.
IDRC	International Development Research Centre
IDSA	Institute of Defence Studies and Analysis
IETE	Institution of Electronics and Telecommunication Engineers
IFAD	International Fund for Agricultural Development
IFCI	Industrial Finance Corporation of India
IFFI	International Film Festival of India
IGIA	Indira Gandhi International Airport
IGNOU	Indira Gandhi National Open University
IHF	Indian Hockey Federation
IIFT	Indian Institute of Foreign Trade
IIP	Index of Industrial Production

ILO	International Labour Organization
IMA	Indian Military Academy
IMF	International Monetary Fund
INS	Indian Naval Ship
INSAT	Indian National Satellite
INTELSAT	International Telecommunication Satellite
INTERPOL	International Police
INTUC	Indian National Trade Union Congress
IOA	Indian Olympic Association
IOC	International Olympic Committee
IOCOM	Indian Ocean Commonwealth
IOJ	International Organization of Journalists
IOU	I Owe You
IPC	Indian Penal Code
IPO	Initial Public Offering
IPU	International Parliamentary Union
IQ	Intelligence Quotient
IRA	Irish Republic Army
IRBM	Intermediate Range Ballastic Missile
IRDA	Insurance Regulatory and Development Authority
IRDP	Integrated Rural Development Programme
IREDA	Indian Renewable Energy Development Agency
IRSS	Indian Remote Sensing Satellite
ISAF	International Security Assistance Force (Afghanistan)
ISBA	International Sea-Bed Authority
ISBN	International Standard Book Number
ISI	Inter Services Intelligence (Pakistan)
ISO	International Standards Organization
ISP	Internet Service Provider
ISRO	Indian Space Research Organization
IST	Indian Standard Time
ITBP	Indo-Tibetan Border Police
ITDC	Indian Tourism Development Corporation
ITF	International Tennis Federation
ITO	Income Tax Office/International Trade Organization
ITU	International Telecommunication Union
IIUTF	International Union of Trade Fairs
IVF	In-Vitro Fertilization
IYC	Indian Youth Congress

J

JCO	Junior Commissioned Officer
JP	Janata Party, Jayaprakash Narayan
JPC	Joint Parliamentary Committee
JRY	Jawahar Rozgar Yojna
JLP	Janata Legislature Party
JPP	Janata Parliamentary Party
JKLF	Jammu and Kashmir Liberation Front
JVM	Janata Vidhyarthi Morcha

K

KAL	Korean Airlines
KANU	Kenya African National Union
KBE	Knight of British Empire
KG	Kindergarten
KRIBHCO	Krishak Bharti Corporation Ltd.
KVIC	Khadi and Village Industries Commission

L

LASER	Light Amplification by Stimulated Emission of Radiation
LDC	Lower Division Clerk
LES	Lunar Escape System
LlC	Life Insurance Corporation
LSD	Lysergic Diethylamide
LTTE	Liberation Tigers of Tamil Eelam
LASIK	Laser in Situ Kerato Mileusis
LCA	Light Combat Aircraft
LIBOR	London Interbank Offer Rate
LLB	Legum Baccalaureus (Bachelor of Law)
LNG	Liquified Natural Gas
LOAC	Line of Actual Control
LOC	Line of Control
LPG	Liquified Petroleum Gas
LSE	London School of Economics

M

MA	Master of Arts (Magisites Artium)
M&A	Merger and Acquisition
MAD	Mutual Assured Destruction
MBA	Master of Business Administration

MBE	Member of the British Empire
MBT	Main Battle Tank
MCC	Marylebone Cricket Club
MMAMC	Mining and Allied Machinery Corporation
MBBS	Bachelor of Medicine and Bachelor of Surgery
MCI	Medical Council of India
MENA	Middle East News Agency
MFN	Most Favoured Nation
MI	Military Intelligence
MICR	Magnetic Ink Character Recognition
MISA	Maintenance of Internal Security Act
MLA	Member of Legislative Assembly
MLC	Member of Legislative Council
MMS	Multimedia Messaging Service
MNC	Multinational Corporation
MNF	Mizo National Front
MODEM	Modulator Demodulator
MODVAT	Modified Value Added Tax
MOU	Memorandum of Understanding
MP	Member of Parliament
MRD	Movement for Restoration of Democracy (Pakistan)
MRTPC	Monopolies and Restrictive Trade Practices Commission
MRTS	Mass Rapid Transport System
MTCR	Missile Technology Control Regime
MUL	Maruti Udyog Limited
MVC	Maha Vir Chakra

N

NAAI	National Airport Authority of India
NABARD	National Bank for Agricultural and Rural Development
NAFED	National Agricultural Co-operation Marketing Federation
NAFTA	North American Free Trade Agreement
NAG	National Air Guard
NAM	Non-Aligned Movement
NASA	National Aeronautics and Space Administration (USA)
NASDAQ	National Association of Securities Dealers Automated Quotation
NASSCOM	The National Association of Software and Service Companies
NATO	North Atlantic Treaty Organization
NAV	Net Asset Value
NB	Nota Bene (Note well/Note below)

NBFC	Non-Banking Finance Company
NBT	National Book Trust
NCA	National Commission of Agriculture
NCAER	National Council of Applied Economic Research
NCD	Non-Convertible Debenture
NCEPC	National Committee of Environmental Planning and Coordination
NCERT	National Council of Educational Research and Training
NCM	National Commission for Minorities
NCR	National Capital Territory
NCST	National Committee of Science and Technology, National Conference on Science and Technology
NDA	National Defence Academy/National Democratic Alliance
NDDB	National Dairy Development Board
NDC	National Development Council
NEERI	National Environmental Engineering Research Institute
NEFA	North-East Frontier Agency
NEPA	National Environment Protection Act
NFDC	National Film Development Corporation
NGO	Non-Governmental Organization
NGRI	National Geographical Research Institute
NHAI	National Highway Authority of India
NHDP	National Highways Development Project
NHPC	National Hydro-electric Power Corporation
NHRC	National Human Rights Commission
NIC	National Integration Council
NID	National Institute of Design
NDC	National Development Corporation
NIEO	National Economic Order
NIIT	National Institute of Information Technology
NIO	National Institute of Oceanography
NITIE	National Institute for Training in Industrial Engineering
NMDC	National Mineral Development Corporation
NOC	No Objection Certificate
NPA	Non-Performing Assets
NPC	National Productivity Council
NPL	National Physical Laboratory
NPT	Nuclear Non-Proliferation Treaty
NRC	Nuclear Regulatory Commission
NRE	Non-Resident External (Account)

NRI	Non-Resident Indian
NRSA	National Remote Sensing Agency
NSC	National Service Corps
NSE	National Stock Exchange
NTPC	National Thermal Power Corporation

O

OAPEC	Organization of Arab Petroleum Exporting Countries
OAS	Organization of American States
OAU	Organization of African Unity
OIGS	On Indian Government Service
ONGC	Oil and Natural Gas Corporation
OPEC	Organization of Petroleum Exporting Countries

P

PAC	Provincial Armed Constabulary, Public Accounts Committee, Political Affairs Committee
PAN	Permanent Account Number (Income Tax)
PBX	Private Branch Exchange (Telephone)
PDS	Public Distribution System
PEC	Projects and Equipment Corporation of India
PER	Price Earning Ratio
PET	Polyethylene Tereph Thalate
PIN	Postal Index Number
PIO	Person of Indian Origin
PCC	Pradesh Congress Committee
PDA	Preventive Detention Act
PEN	Poets, Editors and Novelists Association
PERT	Programme Evaluation and Review Technique
PFA	Press Foundation of Asia, Prevention of Food Adulteration
PHC	Primary Health Centre
PIB	Public Investment Board, Press Information Bureau
PII	Press Institute of India
PIL	Public Interest Litigation
PLOTE	People's Liberation Organization of Tamil Eelam
PLO	Palestine Liberation Organization
PLR	Prime Lending Rate
PM	Post Meridien/Prime Minister
PNR	Passenger Name Recorder

POK	Pakistan Occupied Kashmir
POTA	Prevention of Terrorist Activities Act
POW	Prisoner of War
PPP	Pakistan People's Party/Purchasing Power Parity
PREPAK	People's Revolutionary Party of Kangleipak (Imphal)
PRO	Public Relations Officer
PS	Post Script
PSC	Public Service Commission
PSLV	Polar Satellite Launch Vehicle
PSP	Praja Socialist Party
PTA	Parent-Teacher Association
PTI	Press Trust of India
PVC	Param Vir Chakra
PVSM	Param Vishisht Seva Medal
PWD	Public Works Department

Q

QED	Quod Erat Demonstrandum (That which was to be demonstrated)
QMG	Quarter Master General
QMT	Quantitative Management Technique
QR	Quarterly Report/Quantitative Restrictions

R

RADAR	Radio Detecting and Ranging
RAM	Random Access Memory
RAW	Research and Analysis Wing
RBI	Reserve Bank of India
RCD	Regional Cooperation for Development
R&D/RND	Research and Development
RAF	Rapid Action Force
RDX	Research Developed Explosive
REC	Rural Electrification Corporation/Regional Engineering College
RITES	Rail India Technical and Economic Services
RLEGS	Rural Landless Employment Guarantee Scheme
RPM	Revolutions Per Minute
RSM	Rashtriya Sanjay Manch
RSS	Rashtriya Swayam Sewak Sangh
RSVP	Repondez Sil Vous Plait (Reply if you please)
RTC	Round Table Conference

S

SAARC	South Asian Association for Regional Cooperation
SAFTA	South Asian Free Trade Agreement
SAIL	Steel Authority of India Ltd.
SALT	Strategic Arms Limitation Talks
SAPTA	SAARC Preferential Trading Agreement
SARS	Severe Acute Respiratory Syndrome
SC	Scheduled Caste, Supreme Court
SCI	Shipping Corporation of India
SCOPE	Standing Conference on Public Enterprises
SCUBA	Self-Contained Underwater Breathing Apparatus
SDR	Special Drawing Rights
SEBI	Securities and Exchange Board of India
SENSEX	Sensitivity Index (of Bombay Stock Exchange)
SEZ	Special Economic Zone
SITE	Satellite Instructional Television Experiment
SEATO	South-East Asia Treaty Organization
SERC	Structural Engineering Research Centre
SFF	Special Frontier Force
SFI	Students Federation of India
SHCIL	Stock Holding Corporation of India Ltd.
SGPC	Shiromani Gurudwara Prabandhak Committee
SIDBI	Small Industries Development Bank of India
SIDC	State Industrial Development Corporation
SIPRI	Stockholm International Peace Research Institute
SITA	Suppression of Immoral Traffic in Women and Girls Act
SOS	Save Our Souls
SLV	Satellite Launch Vehicle
SLR	Self Loading Rifle, Statutory Liquidity Ratio
SLFP	Sri Lanka Freedom Party
SMS	Short Messaging Services
SNIPES	Society of National Institutes for Physical Education and Sports
SPCA	Society for Prevention of Cruelty to Animals
SPDC	State Peace and Development Council (Myanmar)
SSC	Staff Selection Commission
SSI	Small Scale Industries
STC	State Trading Corporation
STD	Subscriber Trunk Dialling

STAR-TV	Satellite Television Asian Region Ltd.
STARS	Satellite Tracking and Ranging Station
START	Strategic Arms Reduction Treaty
SUNFED	Special United Nations Fund for Economic Development
SVD	Samyukta Vidhayak Dal
SWAPO	South-West African People's Organization

T

TA	Travelling Allowance, Territorial Army
TADA	Terrorist and Disruptive Activities (Prevention) Act
TAX	Trunk Automatic Exchange
TDA	Trade Development Authority
TDP	Telugu Desam Party
TDS	Tax Deducted at Source
TELCO	Tata Engineering and Locomotive Company
TELEX	Teleprinter Exchange
TELO	Tamil Eelam Liberation Organization
TERLS	Thumba Equatorial Rocket Launching Station
THI	Temperature Humidity Index
TIFR	Tata Institute of Fundamental Research
TISCO	Tata Iron and Steel Company
TMO	Telegraph Money Order
TMT	Technology Media Telecom
TRYSEM	(National Scheme) Training of Rural Youth for Self-Employment
TNC	Trans National Corporation
TNT	Tri-nitro toluene (highly explosive material)
TQM	Total Quality Management
TRAI	Telecom Regulatory Authority of India
TRIMS	Trade Related Investment Measures
TRIPS	Trade Related Intellectual Property Rights
TRP	Television Rating Points
TSP	Total Suspended Particles
TULF	Tamil United Liberation Front
TUC	Trade Union Congress
TWA	Trans World Airlines

U

UAE	United Arab Emirates
UANC	United African National Council

UAR	United Arab Republic
UCTA	United Chamber of Trade Association
UDC	Upper Division Clerk
UDF	United Democratic Front
UFO	Unidentified Flying Object
ULFA	United Liberation Front of Assam
UNCIP	United Nations Commission for India and Pakistan
UNCITRAL	United Nations Conference on International Trade Law
UNCLOS	United Nations Conference on the Law of the Sea
UNCNRSE	United Nations Conference for New and Renewable Sources of Energy
UNCOD	United Nations Conference on Desertification
UNCST	United Nations Conference on Science and Technology
UNCTAD	United Nations Conference on Trade and Development
UNDOF	United Nations Disengagement Observer Force
UNDC	United Nations Disarmament Commission
UNDP	United Nations Development Programme
UNEF	United Nations Emergency Force
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organization
UNFPA	United Nations Fund for Population Activities
UNHCR	United Nations High Commissioner for Refugees
UNI	United News of India
UNIC	United Nations Information Centre
UNICEF	United Nations International Children's Education Fund
UNIDO	United Nations Industrial Development Organization
UNIFIL	United Nations Interim Force in Lebanon
UNISPACE	United Nations Conference on Peaceful Uses of Space
UNITAR	United Nations Institute for Training and Research
UNITC	United Nations International Trade Centre
UFO	Unidentified Flying Object
UGC	University Grants Commission
ULFA	United Liberation Front of Assam
UNCSW	United Nations Commission on the Status of Women
UPS	Uninterrupted Power Supply
USP	Unique Selling Proposition
UNLA	Uganda National Liberation Army
UNMOGIP	United Nations Military Observer Group in India and Pakistan
UNRRA	United Nations Relief and Rehabilitation Administration
UPI	United Press International

UPSC	Union Public Service Commission
USAID	United States Agency for International Development
USIS	United States Information Service

V

VAT	Value Added Tax
VABAL	Value Based Advanced Licence
VSAT	Very Small Aperture Terminal
VSNL	Videsh Sanchar Nigam Ltd.
VPP	Value Payable Post
VIP	Very Important Person
VSSC	Vikram Sarabhai Space Centre
VRDE	Vehicle Research and Development Establishment

W

WAPCOS	Water and Power Development Consultancy Services (I) Ltd.
WASME	World Assembly of Small and Medium Enterprises
WEF	World Economic Forum
WLL	Wireless in Local Loop
WMD	Weapons of Mass Destruction
WPI	Wholesale Price Index
WWW	World Wide Web
WFC	World Food Council
WFP	World Food Programme
WFTU	World Federation of Trade Unions
WHO	World Health Organization
WMO	World Meteorological Organization
WTO	World Trade Organization
WWF	World Wildlife Fund

Y

Y2K	Year 2000
Y-O-Y	Year on Year
YMCA	Young Men's Christian Association
YWCA	Young Women's Christian Association
YMIA	Young Men's Indian Association

Table 16.3 Indian Political Parties

Political Party	*Abbreviation*
Aam Aadmi Party	AAP
Akhil Bharatiya Loktantrik Congress	ABLC
All India Anna Dravida Munnetra Kazhagam	AIADMK
All India Forward Bloc	AIFB
All India Majlis-(e)-Ittehadul Muslimeen	AIMEIM
All India Trinamool Congress	AITC
Asom Gana Parishad	AGP
Bahujan Samaj Party	BSP
Bhartiya Janata Party	BJP
Bhartiya Navshakti Party	BNP
Bharipa Bahujan Mahasangh	BBM
Biju Janata Dal	BJD
Communist Party of India	CPI
Communist Party of India (Marxist)	CPI (M)
Communist Party of India (ML) Liberation	CPI (ML) L
Dravida Munnetra Kazhagam	DMK
Haryana Vikas Party	HVP
Himachal Vikas Congress	HVC
Indian Federal Democratic Party	IFDP
Indian National Congress	INC
Indian National Lok Dal	INLD
Jammu and Kashmir National Conference	J&KNC
Janata Dal (JP)	JD (JP)
Janata Dal (Secular)	JD (S)
Janata Dal (United)	JD (U)
Jharkhand Mukti Morcha	JMM
Kerela Congress	KC
Karnataka Janta Party (B5 Yeddyureppa)	KJP
Lok Dal (Secular)	LD (S)
Lok Jan Shakti Party	LJP
Maharashtra Navnirman Sena	MNS
Marumalarchi Dravida Munnetra Kazhagam	MDMK
Mizo National Front	MNF
Muslim League	ML
Nagaland Peoples Front	NPF
Nationalist Congress Party	NCP
Pattali Makkal Katchi	PMK
Peasants and Workers Party of India	PWP
Peoples Democratic Party	PDP
Rashtriya Janata Dal	RJD
Rashtriya Janata Dal (Democratic)	RJD (D)
Rashtriya Lok Dal	RLD
Republican Party of India (A)	RPI (A)
Revolutionary Socialist Party	RSP

(*Continued*)

Political Party	*Abbreviation*
Samajwadi Janata Party (Rashtriya)	SJP(R)
Samajwadi Party	SP
Shiromani Akali Dal	SAD
Shiromani Akali Dal (SS Mann)	SAD (M)
Shiv Sena	SS
Sikkim Democratic Front	SDF
Swatantra Bharat Paksh	SBP
Telangana Rashtra Samiti	TRS
Telugu Desam Party	TDP
Independent	IND
Nominated	NOM
YSR Congress Party	YSRCP
All India Trinamool Congress	TMC
Maharashtrawadi Gomantak Party	MGP
Haryana Janhit Congress (BL)	MJC
Mizoram People's Conference	HPC
Zoram National Party	ZNP
Pattali Makkal Katchi	PMK
Desiya Murpokku Dravida Kazhagam	DMDK
Revolutionary Socialist Party	RSP

Table 16.4 Presidents of India

S. No	*Name*	*Tenure*	
1.	Dr Rajendra Prasad (1884–1963)	26 Jan 1950–13 May 1962	First President; longest tenure
2.	Dr S. Radhakrishnan (1888–1975)	13 May 1962–13 May 1967	
3.	Dr Zakir Hussain (1897–1969)	13 May 1967–3 May 1969	President with shortest tenure; first Muslim President of India and first to die in harness
4.	Varahagiri Venkatagiri (1884–1980)	3 May 1969–20 July 1969	First to become Acting President
5.	Justice M. Hidayatullah (1905–1992)	20 July1969–24 Aug 1969	
6.	Varahagiri Venkatagiri (V. V. Giri, 1884–1980)	24 Aug 1969–24 Aug 1974	Only person to become President of India twice
7.	Fakhruddin Ali Ahmed (1905–1977)	24 Aug 1974–11 Feb 1977	Died in harness
8.	B. D. Jatti (1913–2002)	11 Feb 1977–15 July 1977	Acting President
9.	Neelam Sanjeeva Reddy (1913–1996)	25 July 1997–25 July 1982	Youngest to become President (64 yrs)
10.	Giani Zail Singh (1916–1994)	25 July 1982–25 July 1987	First Sikh President of India

(*Continued*)

S. No	*Name*	*Tenure*	
11.	R. Venkataraman (b. 1910)	25 July 1987–25 July 1992	Oldest to become President (76 yrs)
12.	Dr S. D. Sharma (1918–1999)	25 July 1992–25 July 1997	
13.	K. R. Narayanan (1920–2005)	25 July 1997–25 July 2002	
14.	Dr A. P. J. Kalam (b. 1931)	25 July 2002–25 July 2007	
15.	Pratibha Devi Patil (b. 1934)	25 July 2007–25 July 2012	
16.	Pranab Mukherjee (b. 1935)	25 July 2007–till date	

Table 16.5 Vice-Presidents of India

S. No	*Name*	*Tenure*
1.	Dr S. Radhakrishnan (1888–1975)	1952–1962
2.	Dr Zakir Hussain (1897–1969)	1962–1967
3.	Varahagiri Venkata Giri (1884–1980)	1967–1969
4.	Gopal Swaroop Pathak (1896–1982)	1969–1974
5.	B. D. Jatti (1913–2002)	1974–1979
6.	Justice M. Hidayatullah (1905–1992)	1979–1984
7.	R. Venkataraman (b. 1910)	1984–1987
8.	Dr Shankar Dayal Sharma (1918–1999)	1987–1992
9.	K. R. Narayanan (1920–2005)	1992–1997
10.	Krishan Kant (1927–2002)	1997–2002
11.	Bhairon Singh Shekhawat (b. 1923)	2002–2007
12.	Mohammad Hamid Ansari (b. 1937)	2007–till date

Table 16.6 Prime Ministers of India

S. No	*Name*	*Tenure*	
1.	Pt Jawaharlal Nehru (1889–1964)	15 Aug 1947–27 May 1964	First Prime Minister; also the longest tenure (17 years)
2.	Gulzari Lal Nanda 1898–1997)	27 May 1964–9 June 1964	First Acting Prime Minister
3.	Lal Bahadur Shastri (1904–1966)	9 June 1964–11 Jan 1966	First Prime Minister to die abroad during an official visit
4.	Gulzari Lal Nanda 1898–1997	11 Jan 1966–24 Jan 1966	First to become Acting Prime Minister twice
5.	Indira Gandhi (1917–1984)	24 Jan 1966–24 March 1977	First lady Prime Minister; First to lose elections

(*Continued*)

S. No	*Name*	*Tenure*	
6.	Morarji Desai (1869–1995)	24 March 1977–28 June 1979	Oldest to become Prime Minister and the first to resign from office
7.	Charan Singh (1902–1987)	28 July 1979–14 Jan 1980	The only Prime Minister who did not face the Parliament
8.	Indira Gandhi (1917–1984)	14 Jan 1980–31 Oct 1984	First Prime Minister to be assassinated
9.	Rajiv Gandhi (1944–1991)	31 Oct 1984–November 1989	Youngest to become Prime Minister (40 years)
10.	V. P. Singh (b. 1931)	Dec 1989–7 Nov 1990	First Prime Minister to step down after vote of no-confidence
11.	Chandra Shekhar (b. 1927)	10 Nov 1990–June 1992	
12.	P. V. Narasimha Rao (b. 1921)	20 June 1992–16 May 1996	First Prime Minister from South India
13.	A. B. Vajpayee (b. 1926)	16 May 1996–1 June 1996	Shortest tenure–13 days
14.	H. D. Deve Gowda (b. 1933)	1 June 1996–21 April 1997	Leader of United Front Parliamentary Group
15.	Inder Kumar Gujral (b. 1933)	21 April 1999–18 March 1998	
16.	A. B. Vajpayee (b. 1926)	19 March 1998–13 October 1999	
17.	A. B. Vajpayee (b. 1926)	13 Oct 1999–22 May 2004	Only one to become PM of India thrice
18.	Dr Manmohan Singh (b. 1932)	22 May 2004–18 May 2009	First Non-Hindu Prime Minister of India
19.	Dr Manmohan Singh (b. 1932)	22 May 2009–17 May 2014	Second term as Prime Minister of India
20.	Narendra Modi (b. 1950)	26 May 2014–till date	

Table 16.7 Speakers of the Lok Sabha

Name	*Tenure*
G. V. Mavalankar	1952–1956
M. Ananthasayanam Ayyangar	1956–1962
Sardar Hukam Singh	1962–1967
Neelam Sanjeeva Reddy	1967–1969
Gurdayal Singh Dhillon	1969–1975
Bali Ram Bhagat	1976–1977
Neelam Sanjeeva Reddy	1977 (March–July)
K. S. Hegde	1977–1979
Balram Jakhar	1980–1989
Rabi Ray	1989–1991
Shivraj Patil	1991–1996
P. A. Sangma	1996–1998 (March)

(*Continued*)

Name	*Tenure*
G. M. C. Balayogi	24 March 1998–2002
Manohar Joshi	10 May 2002–2004
Somnath Chatterjee	2 June 2004–2009
Meira Kumar	30 May 2009–May 2014
Kamal Nath	Appointed on 4 June 2014 (Pro tem speaker)
Sumitra Mahajan	6 June 2014–till date

Table 16.8 Chief Justices of India

Name	*Tenure*
H. J. Kania	August 1947–November 1951
M. Patanjali Sastri	November 1951–January 1954
Mehar Chand Mahajan	January 1954–December 1954
B. K. Mukherjee	December 1954–January 1956
S. R. Das	February 1956–September 1959
B. P. Sinha	October 1959–January 1964
P. B. Gajendragadkar	February 1964–March 1966
A. K. Sarkar	March 1966–June 1966
K. Subba Rao	June 1966–April 1967
K. N. Wanchoo	April 1967–February 1968
M. Hidayatullah	February 1968–December 1970
J. C. Shah	December 1970–January 1971
S. M. Sikri	January 1971–April 1973
A. N. Ray	April 1973–January 1977
M. H. Beg	January 1977–February 1978
Y. V. Chandrachud	February 1978–July 1985
P. N. Bhagwati	July 1985–December 1986
R. S. Pathak	December 1986–June 1989
E. S. Venkataramiah	June 1989–December 1989
Sabyasachi Mukherjee	December 1989–September 1990
Ranganath Mishra	September 1990–November 1991
K. N. Singh	November 1991–December 1991
M. H. Kania	December 1991–November 1992
I. M. Sharma	November 1992–February 1993
M. N. Venkatachaliah	February 1993–October 1994
Aziz Mushabbar Ahmadi	October 1994–March 1997
J. S. Verma	March 1997–January 1998
M. M. Punchi	January 1998–October 1998
A. S. Anand	October 1998–November 2001
S. P. Bharucha	November 2001–May 2002
Bhupinder Nath Kirpal	May 2002–November 2002
Mr G. B. Patnaik	November 2002–December 2002
Mr V. N. Khare	December 2002–May 2004
Mr S. Rajendra Babu	May 2004–June 2004
R. C. Lahoti	June 2004–31 October 2005
Y. K. Sabharwal	2 Nov 2005–14 January 2007
K. G. Balakrishnan	15 January 2007–11 May 2010

(*Continued*)

Name	*Tenure*
S. H. Kapadia	12 May 2010–28 September 2012
Altamas Kabir	29 September 2012–18 July 2013
P. Sathasivam	19 July 2013–26 April 2014
Rajendra Mal Lodha	27 April 2104–till date

Table 16.9 Chief Election Commissioners

Name	*Tenure*
Sukumar Sen	March 1950–December 1958
K. V. K. Sundaram	December 1958–September 1967
S. P. Sen Verma	October1967–September 1972
Dr Nagendra Singh	October 1972–February 1973
T. Swaminathan	February 1973–June 1977
S. L. Shakdhar	June 1977–June 1982
R. K. Trivedi	June 1982–December 1985
R. V. S. Peri Sastri	January 1986–November 1990
Smt V. S. Rama Devi	November 1990–December 1990
T. N. Seshan	December 1990–December 1996
M. S. Gill	December 1996–June 2001
J. M. Lyngdoh	June 2001–Febrary 2004
T. S. Krishnamurthy	February 2004–May 2005
B. B. Tandon	May 2005–June 2006
N. Gopalaswami	June 2006–April 2009
Navin Chawla	April 2009–July 2010
Sahabuddin Yaqoob Quraishi	July 2010–June 2012
V. S. Sampath	June 2012–till date

Table 16.10 Commanders-in-Chief

Name	*Tenure*
Gen. Sir Roy Bucher	1 January 1948–14 January 1949
Gen. K. M. Cariappa	15 January 1949–14 January 1953
Gen. Maharaj Rajendra Singhji	15 January 1953–31 March 1955

Table 16.11 Chiefs of Army Staff

Name	*Tenure*
Gen. Maharaj Rajendra Singhji	April 1955–May 1955
Gen. S. M. Srinagesh	May 1955–May 1957
Gen. K. S. Thimayya	May 1957–May 1961
Gen. P. N. Thapar	May 1961–November 1962
Gen. J. N. Chaudhuri	November 1962–June 1966
Gen P. K. Kumaramangalam	June 1966–June 1969
Gen. S. H. F. J. Manekshaw	June 1969–December 1972
Field Marshal S. H. F. J. Manekshaw	January 1972–January 1973

(*Continued*)

Name	*Tenure*
Gen. G. G. Bewoor	January 1973–May 1975
Gen. T. N. Raina	June 1975–May 1978
Gen. O. P. Malhotra	June 1978–May 1981
Gen. K. V. Krishna Rao	June 1981–July 1983
Gen. A. S. Vaidya	August 1983–January 1986
Gen. K. Sundarjee	February 1986–April 1988
Gen. V. N. Sharma	May 1988–June 1990
Gen. S. F. Rodrigues	July 1990–June 1993
Gen. B. C. Joshi	July 1993–November 1994
Gen. Shankar Roy Choudhury	November 1994–September 1997
Gen. V. P. Malik	October 1997–September 2000
Gen. S. Padmanashan	October 2000–December 2002
Gen. N. C. Vij	January 2003–January 2005
Gen. J. J. Singh	February 2005–September 2007
Gen. Deepak Kapoor	September 2007–March 2010
Gen. V. K. Singh	March 2010–May 2012
Gen. Bikram Singh	May 2012–July 2014
Gen. Dalbir Singh Suhag	August 2014–till date

Note: 1. Gen. (later, Field Marshal) K. M. Cariappa took over from the British C-in-C, Gen. Sir Roy Bucher on 15 January 1949 and held the office till 14 January 1953. The armed forces had only one more C-in-C, Gen. M. Rajendra Singh. In April 1955, when the post of C-in-C was abolished, Gen. Rajendra Singh became the first Chief of Army Staff.

2. Gen. S. H. F. J. Manekshaw became the first Field Marshal in 1971.

Table 16.12 Chiefs of Naval Staff

Name	*Tenure*
Rear Admiral J. T. S. Hall	15 August 1947–August 1948
Admiral Sir Edward Parry	August 1948–October 1951
Admiral Sir Mark Pizey	October 1951–July 1955
Vice-Admiral Sir Stephen Carlill	July 1955–April 1958
Vice-Admiral R. D. Katari	April 1958–June 1962
Vice-Admiral B. S. Soman	June 1962–March 1966
Admiral A. K. Chatterjee	March 1966–February 1970
Admiral S. M. Nanda	February 1970–February 1973
Admiral S. N. Kohli	March 1973–February 1976
Admiral J. L. Cursetji	March 1976–February 1979
Admiral R. L. Pereira	March 1979–February 1982
Admiral O. S. Dawson	March 1982–November 1984
Admiral R. H. Tahiliani	December 1984–November 1987
Admiral J. G. Nadkarni	December 1987–November 1990
Admiral L. Ramdas	December 1990–September 1993
Admiral V. S. Shekhawat	October 1993–September 1996
Admiral Vishnu Bhagwat	October 1996–December 1998
Admiral Sushil Kumar	December 1998–December 2001
Admiral Madhvendra Singh	December 2001–July 2004

(*Continued*)

Name	*Tenure*
Admiral Arun Prakash	August 2004–October 2006
Admiral Sureesh Mehta	October 2006–August 2009
Admiral Nirmal Verma	August 2009–August 2012
Admiral Devendra Kumar Joshi	August 2012–February 2014
Admiral Robin K. Dhowan	Acting Chief of Naval Staff (with rand of Vice-Admiril) from 26 February 2014–17 April 2014; From 17 April 2014–till date as Chief of Naval Staff.

Table 16.13 Chiefs of Air Staff

Name	*Tenure*
Air Marshal Sir Thomas Emhirst	15 August 1947–February 1950
Air Marshal Sir R. L. Chapman	February 1950–December 1951
Air Marshal Sir Gerald Gibbs	December 1951–March 1954
Air Marshal S. Mukherjee	April 1954–November 1960
Air Marshal A. M. Engineer	December 1960–July 1964
Air Chief Marshal Arjan Singh	August 1964–July 1969
Air Chief Marshal P. C. Lal	July 1969–January 1973
Air Chief Marshal O. P. Mehra	January 1973–January 1976
Air Chief Marshal H. Moolgaonkar	February 1976–August 1978
Air Chief Marshal I. H. Latif	September 1978–August 1981
Air Chief Marshal Dilbagh Singh	September 1981–September 1984
Air Chief Marshal L. K. Katre	September 1984–July 1985
Air Chief Marshal D. A. La Fontaine	July 1985–July 1988
Air Chief Marshal S. K. Mehra	August 1988–July 1991
Air Chief Marshal N. C. Suri	August 1991–July 1993
Air Chief Marshal S. K. Kaul	August 1993–December 1998
Air Chief Marshal Satish Kr. Sareen	January 1996–December 1998
Air Chief Marshal A. Y. Tipnis	January 1999–December 2001
Air Chief Marshal S. Krishnaswamy	December 2001–December 2004
Air Chief Marshal S. P. Tyagi	December 2004–March 2007
Air Chief Marshal Fali Homi Major	March 2007–May 2009
Air Chief Marshal Pradeep Vasant Naik	June 2009–July 2011
Air Chief Marshal NAK Browne	July 2011–December 2013
Air Cheif Marshal Arun Raha	December 2013–present

Table 16.14 World's Superlatives—Largest, Biggest, Highest, Smallest Structures

Structure	*Name*	*Location*
Largest Airport	King Khaled International Airport (223 km^2)	Riyadh, Saudi Arabia
Largest Airport (roofed)	King Abdul Aziz International Airport (103 km^2)	Jeddah, Saudi Arabia
Highest Airport	Lhasa Airport at 4363 m	Tibet, China
Busiest Airport	Chicago, O'Hare International Airport	Chicago, Illinois (USA)

(*Continued*)

Structure	*Name*	*Location*
Lowest Airport	Schipol lnternational Airport	Amsterdam
Longest Steel Arch Bridge	Chaotianmen Bridge, built in 2009 (552 m long)	China
Longest Bridge (i.e. stretch of bridging of any kind)	The bridged stretch carrying Interstate 55 and Interstate 10 highways on twin concrete trestles (over 52.21 km)	Manchac, Louisiana, USA
Longest Floating Bridge	'Evergreen Point' is 3,839 m long, of which 2,310 m floats.	Seattle, Washington USA
Longest Bridge-by Suspension Spans	Akashi-Kaikyo, (1,991 m long)	Japan
Longest Bridge-by Cantilever Spans	Pont de Quebec (rail-road), built in 1917 is 548.6 m long	St. Lawrence, Canada
Tallest Bridge Towers	Millau Bridge, built in 2004 (336 m high).	France
Longest Railway Bridge	Huey P. Long Bridge (7009 m)	Metairie, Louisiana, US
Highest Bridge	A Bailey bridge built by the Indian army (30 m long at an altitude of 5600 m)	Khardungla, Ladakh
Highest Road Bridge	Royal Gorge (321 m abovesea level)	River Arkansas, Colorado
Highest Railway Bridge	Fades Bridge (144 m long 132.5 m above sea level)	River Sioule, France
Longest Rail Line	Trans-Siberian line from Moscow to Nakhodka (9438 km)	Russia
Tallest Office Building	Sear Towers (110 storeys, 443 m high)	Chicago, Ilinois
Tallest Building	Burj Khalifa (built in 2010)—828 m	Dubai, UAE
Tallest Building (inhabitated)	Burj Khalifa (built in 2010)—828 m	Dubai, UAE
Tallest Tower	Tokyp Skytree, (634 m high), scheduled to be completed in 2011 [KVLY (formely KTHI)-TV Mast, North Dakota (guyed), USA built in 1963 (height 629 m)].	Metro Centre, Toronto
Twin Towers	Petronas Towers (452 m and 96 storeys) built in 1997	Kuala lumpur, malaysia
Largest Church	Basilica of St Peter built in 1492–1612 (15,142 m^2)	Vatican City, Rome
Tallest Church	Sagrada Familia, 170 m (scheduled completion date is 2026 but open for worship following its consecration by Pope Benedict XVI in 2010). [Ulm Cathedral, Ulm, Germany built in 1890 is the highest church at 162 m]	Barcelona, Spain
Largest Cathedral	Diocese of New York, area 11,240 m^2	New York

(*Continued*)

Structure	*Name*	*Location*
Largest Mosque (in ruins)	at Malawiya Mosque (238.9 m × 156 m)	Smarra, Iraq
Largest Mosque (in use)	Al-Masjid al-Haram (also known as 'The Sacred Mosque' or the 'Grand Mosque'). Area: 88.2 acres. Capacity: 4 million (worshippers during the Hajj). It surrounds the Kabba, the place which Muslims worldwide turn towards while performing daily Namaz.	City of Mecca
Largest Temple	Angkor Vat (162.6 ha)	Cambodia
Largest Railway Station	Grand Central Terminal	Park Avenue, New York
Highest Railway	Condor Station (4786 m height)	Bolivia
Longest Railway Platform	Kharagpur Railway Platform (833 m length)	Kharagpur, West Bengal
Longest Wall	The Great Wall of China	China
Tallest Building	Taipei 101 (509 m 101 storeys)	Taipei, Taiwan
Largest Stadium	Strahov Stadium	Prague, Czech
Largest Seaport	Port of New York and New Jersey	
Largest Library	The Library of Congress	Capital Hill, Washington DC
Oldest University	University of Karueein (founded AD 859)	Morocco
Largest Open University	Indira Gandhi National Open University	New Delhi
Longest Road	Pan-American Highway 27,387 km	North-west Alaska to Southern-most Chile
Highest Road	13 km stretch between Kangti-suu and Khaleb Hsin-Chi-Fu	Tibet
Longest Vehicular Tunnel (rail)	Seikan, Tsugaru (sub-aqueous) Channel—53.85 kms [**Important**: St. Gotthard (rail) tunnel in Switzerland will be 57.07 km long when complted in 2018]	Japan
Longest Vehicular Tunnel (non-rail)	Laerdal-Aurland Road Link—24.51 kms	Norway
Longest Non-Vehicular Tunnel	Dalware Aqueduct, constructed in 1937–44 to a length of 168.9 km.	New York, USA
Longest Ship Canal	White Sea-Baltic (formerly Stalin), built in 1933. Total length of canal—235 km of which canalized river 51.5 km. (min. depth of 5 m only) [**Important**: Suez Canal (built in 1969) links Red Sea and Mediteranean Seas, is 162 km long (min depth 12.9 m only), is the third longest, whereas Rhine-Main-Danube Canal of Germany (built in 1992) is the second longest ship canal, 171 km long (min. depth of 4.0 m only)].	

(*Continued*)

Structure	*Name*	*Location*
Tallest Dam	Jinping-I (it is 305 m high and scheduled for completion by 2014). Nurek Dam in Tajikistan, built in 1980, is presently the completed and functional highest dam (300 m high).	China

Table 16.15 Natural World

Structure	*Name*
Largest Bird	North American Ostrich
Smallest Bird	Bee Hummingbird
Largest Egg	Ostrich egg
Largest Reptile	Estuarine or salt-water crocodile found in SouthEast Asia, northern Australia and New Guinea
Longest Snake	Reticulated Python, found in South-East Asia, Indonesia and Philippines
Largest Animal (in water)	Blue Whale
Largest Animal (living on land)	African bush elephant
Tallest Animal	Giraffe
Largest Ocean	Pacific
Deepest Part of the Ocean	Mariana Trench in the Pacific Ocean
Largest Sea	South China Sea
Largest Gulf	Gulf of Mexico
Largest Bay	Hudson Bay, Northern Canada
Largest Glacier	Lambert-Fisher Ice Passage, mac Robertson Land, East Antartica (length: 515 km)
Largest Glaciated Area	South Polar Regions (Area: 1,38,30,000 km^2)
Largest Continent	Asia (Area: 4,39,98,000 km^2)
Smallest Continent	Australia (Area: 76,18,493 km^2)
Deepest Depression	Dead Sea, Jordan/Israel (max depth below sea level: 408m) **Important**: —The world's largest exposed depression is the 'Prikaspiyskaya Nizmennost' covering the hinterland of the northern third of the Caspian Sea, which is itself 28 m below sea level. —Western Antartica and central Greenland largely comprise of crypto-depressions under ice burdens. The Antartic Bentley subglacial trench has a bedrock 2,538 m below sea level. In the Greenland the bedrock at some locations is 365 m below sea level. —Nearly one quarter of the area of the Netherlands lies marginally below sea level, an area of more than 10,000 km^2. —No part of the Maldives is higher than 2.4 m of sea-level. —No place in Lesotho is lower than 1,381 m.

(*Continued*)

Structure	*Name*
Largest Island	Greenland (renamed Kalaallit Nunaat), Arctic (Area: 21,75,500 km^2).
Highest Mountain Peak	Mount Everest on the Tibet-Nepal border [Height: 8,848 m]
Highest Active Volcano	San Pedro, Andes, Chile (most recent activity was ion 1960) [Height: 6,145]
Highest Mountain Range	Himalaya-Karakoram-Hindu Kush in Central Asia (the world's twelve 8,000 m mountains are all in this range)
Longest Mountain Range	Cordillera de Los Andes, South America (length 7,200 km) [Rocky Mountains, North America is second longest (length 4,800 km) and Himalaya-Karakoram-Hindu Kush range of Central Asia is the third longest (length 3,850 km)].
Longest Cave System	Mammoth Cave System, Kentucky, USA (total known length is 590.6 km)
Deepest Cave	Krubera (Voronya), Georgia (Depth: 2,191 m). [The world's deepest cave was discoved in January 2001 by a team of Ukarinian cave explorers in the Arabikskaya system in the western Caucasus mountains of Georgia. It is a branch of the Voronya or 'Crow's Cave'.]
Largest River	Amazon in South America (6,448 km)
Longest River	Nile in Africa (6,725 km)
Smallest River (shortest)	Roe River in Montana
Largest Delta	Sunderbans, created by the Ganga and Brahmaputra in Bangladesh and West Bengal
Largest Lake	Caspian Sea—Iran/ Azerbaijan/ Russia/ Turkmenistan/ Kazakhstan (Area: 3,71,000 km^2)
Largest Man-made Lake	Owen Falls (Uganda/Kenya/Tanzania) made in year 1954. (Volume: 204.80 km^3)
Deepest Lake	Baikal, Russia (Greatest depth: 1,637 m)
Greatest Waterfall—by height	Salto Angel, Venezuela (Total drop—979 m; Greatest single leap—807 m)
Greatest Waterfall—by Volume	Khone, Mekong, Laos (Mean annual flow: 11,610 m^3/sec)
Largest Desert	The Sahara, North Africa (Area: 90,00,000 km^2). [Gobi, Mongolia/China is the second largest (area: 13,00,000 km^2) and Arabian (Eastern) Desert, Egypt is the third largest (10,00,000 km^2)].
Largest Glacier (Non-Polar regions)	Siachen, Indo-Pak border
Driest Place	Atacama Desert, Chile
Hottest Place	Aziza, Libya
Rainiest Place	Mawsynram, near Cherrapunji (Meghalaya)

Table 16.16 Top 20 Indian Peaks

S. No	*Peak*	*Height (in m above mean sea level)*
1.	K-2	8611
2.	Kanchenjunga	8598
3.	Nanga Parbat	8126
4.	Gasher Brum	8068
5.	Broad Peak	8047
6.	Disteghil Sar	7885
7.	Masher Brum-E	7820
8.	Nanda Devi	7817
9.	Masher Brum-W	7806
10.	Rakaposhi	7788
11.	Kamet	7756
12.	Saser Kangri	7672
13.	Skyang Kangri	7544
14.	Sia Kangri	7422
15.	Chaukhamba (Badrinath Peak)	7138
16.	Trishul West	7138
17.	Nunkun	7135
18.	Pauhunri	7128
19.	Kangto	7090
20.	Dunagiri	7066