

- 1.** Multiple choice questions.
  - (i) Based on the information given below classify each of the situations as 'suffering from water scarcity' or 'not suffering from water scarcity'.
    - (a) Region with high annual rainfall.
    - (b) Region having high annual rainfall and large population.
    - (c) Region having high annual rainfall but water is highly polluted.
    - (d) Region having low rainfall and low population.
  - (ii) Which one of the following statements is not an argument in favour of multi-purpose river projects?
    - (a) Multi-purpose projects bring water to those areas which suffer from water scarcity.
    - (b) Multi-purpose projects by regulating water flow helps to control floods.
    - (c) Multi-purpose projects lead to large scale displacements and loss of livelihood.
    - (d) Multi-purpose projects generate electricity for our industries and our homes.
  - (iii) Here are some false statements. Identify the mistakes and rewrite them correctly.
    - (a) Multiplying urban centres with large and dense populations and urban lifestyles have helped in proper utilisation of water resources.
    - (b) Regulating and damming of rivers does not affect the river's natural flow and its sediment flow.
    - (c) In Gujarat, the Sabarmati basin farmers were not agitated when higher priority was given to water supply in urban areas, particularly during droughts.
    - (d) Today in Rajasthan, the practice of rooftop rainwater harvesting has gained popularity despite high water availability due to the Indira Gandhi Canal.
- 2.** Answer the following questions in about 30 words.
  - (i) Explain how water becomes a renewable resource.
  - (ii) What is water scarcity and what are its main causes?
  - (iii) Compare the advantages and disadvantages of multi-purpose river projects.
- 3.** Answer the following questions in about 120 words.
  - (i) Discuss how rainwater harvesting in semi-arid regions of Rajasthan is carried out.
  - (ii) Describe how modern adaptations of traditional rainwater harvesting methods are being carried out to conserve and store water.



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## AGRICULTURE



India is an agriculturally important country. Two-thirds of its population is engaged in agricultural activities. Agriculture is a primary activity, which produces most of the food that we consume. Besides food grains, it also produces raw material for various industries.

**Can you name some industries based on agricultural raw material?**

Moreover, some agricultural products like tea, coffee, spices, etc. are also exported.

### TYPES OF FARMING

Agriculture is an age-old economic activity in our country. Over these years, cultivation methods have changed significantly depending upon the characteristics of physical environment, technological know-how and socio-cultural practices. Farming varies from subsistence to commercial type. At present, in different parts of India, the following farming systems are practised.

#### Primitive Subsistence Farming

This type of farming is still practised in few pockets of India. Primitive subsistence agriculture is practised on small patches of land with the help of primitive tools like hoe, dao and digging sticks, and family/ community labour. This type of farming depends upon monsoon, natural fertility of the soil and suitability of other environmental conditions to the crops grown.

It is a 'slash and burn' agriculture. Farmers clear a patch of land and produce cereals and other food crops to sustain their family. When the soil fertility decreases, the farmers shift and clear a fresh patch of land for cultivation. This type of shifting allows Nature to replenish the fertility of the soil

through natural processes; land productivity in this type of agriculture is low as the farmer does not use fertilisers or other modern inputs. It is known by different names in different parts of the country.

**Can you name some such types of farmings?**

It is *jhumming* in north-eastern states like Assam, Meghalaya, Mizoram and Nagaland; *Pamlou* in Manipur, *Dipa* in Bastar district of Chhattisgarh, and in Andaman and Nicobar Islands.

**Jhumming:** The 'slash and burn' agriculture is known as 'Milpa' in Mexico and Central America, 'Conuco' in Venezuela, 'Roca' in Brazil, 'Masole' in Central Africa, 'Ladang' in Indonesia, 'Ray' in Vietnam.

In India, this primitive form of cultivation is called 'Bewar' or 'Dahiya' in Madhya Pradesh, 'Podu' or 'Penda' in Andhra Pradesh, 'Pama Dabi' or 'Koman' or 'Bringa' in Odisha, 'Kumari' in Western Ghats, 'Valre' or 'Waltre' in South-eastern Rajasthan, 'Khil' in the Himalayan belt, 'Kuruwa' in Jharkhand, and 'Jhumming' in the North-eastern region.



**Fig. 4.1**

Rinjha lived with her family in a small village at the outskirts of Diphu in Assam. She enjoys watching her family members clearing, slashing and burning a patch of land for cultivation. She often helps them in irrigating the fields with water running through a bamboo canal from the nearby spring. She loves the surroundings and wants to stay here as long as she can, but this little girl has no idea about the declining fertility of the soil and her family's search for fresh a patch of land in the next season.

*Can you name the type of farming Rinjha's family is engaged in?*

*Can you enlist some crops which are grown in such farming?*

### Intensive Subsistence Farming

This type of farming is practised in areas of high population pressure on land. It is labour-intensive farming, where high doses of biochemical inputs and irrigation are used for obtaining higher production.

*Can you name some of the states of India where such farming is practised?*

Though the 'right of inheritance' leading to the division of land among successive generations has rendered land-holding size uneconomical, the farmers continue to take maximum output from the limited land in the absence of alternative source of livelihood. Thus, there is enormous pressure on agricultural land.

### Commercial Farming

The main characteristic of this type of farming is the use of higher doses of modern inputs, e.g. high yielding variety (HYV) seeds, chemical fertilisers, insecticides and pesticides in order to obtain higher productivity. The degree of commercialisation of agriculture varies from one region to another. For example, rice is a commercial crop in Haryana and Punjab, but in Odisha, it is a subsistence crop.

*Can you give some more examples of crops which may be commercial in one region and may provide subsistence in another region?*

Plantation is also a type of commercial farming. In this type of farming, a single crop is grown on a large area. The plantation has an interface of agriculture and industry. Plantations cover large tracts of land, using capital intensive inputs, with the help of migrant labourers. All the produce is used as raw material in respective industries.

In India, tea, coffee, rubber, sugarcane, banana, etc., are important plantation crops. Tea in Assam and North Bengal coffee in Karnataka are some of the important plantation crops grown in these states. Since the production is mainly for market, a well-developed network of transport and communication connecting the plantation areas, processing industries and markets plays an important role in the development of plantations.



*Fig. 4.2: Banana plantation in Southern part of India*



*Fig. 4.3: Bamboo plantation in North-east*

## CROPPING PATTERN

You have studied the physical diversities and plurality of cultures in India. These are also reflected in agricultural practices and cropping patterns in the country. Various types of food and fibre crops, vegetables and fruits, spices and condiments, etc. constitute some of the important crops grown in the country. India has three cropping seasons — **rabi**, **kharif** and **zaid**.

Rabi crops are sown in winter from October to December and harvested in summer from April to June. Some of the important rabi crops are wheat, barley, peas, gram and mustard. Though, these crops are grown in large parts of India, states from the north and north-western parts such as Punjab, Haryana, Himachal Pradesh, Jammu and Kashmir, Uttarakhand and Uttar Pradesh are important for the production of wheat and other rabi crops. Availability of precipitation during winter months due to the western temperate cyclones helps in the success of these crops. However, the success of the green revolution in Punjab, Haryana, western Uttar Pradesh and parts of Rajasthan has also been an important factor in the growth of the above-mentioned rabi crops.

Kharif crops are grown with the onset of monsoon in different parts of the country and these are harvested in September–October. Important crops grown during this season are paddy, maize, jowar, bajra, tur (arhar), moong, urad, cotton, jute, groundnut and soyabean. Some of the most important rice-growing regions are Assam, West Bengal, coastal regions of Odisha, Andhra Pradesh, Telangana, Tamil Nadu, Kerala and Maharashtra, particularly the (Konkan coast) along with Uttar Pradesh and Bihar. Recently, paddy has also become an important crop of Punjab and Haryana. In states like Assam, West Bengal and Odisha, three crops of paddy are grown in a year. These are *Aus*, *Aman* and *Boro*.

In between the rabi and the kharif seasons, there is a short season during the summer months known as the **Zaid** season. Some of the crops produced during ‘zaid’ are

watermelon, muskmelon, cucumber, vegetables and fodder crops. Sugarcane takes almost a year to grow.

## Major Crops

A variety of food and non food crops are grown in different parts of the country depending upon the variations in soil, climate and cultivation practices. Major crops grown in India are rice, wheat, millets, pulses, tea, coffee, sugarcane, oil seeds, cotton and jute, etc.

**Rice:** It is the staple food crop of a majority of the people in India. Our country is the second largest producer of rice in the world after China. It is a kharif crop which requires high temperature, (above 25°C) and high humidity with annual rainfall above 100 cm. In the areas of less rainfall, it grows with the help of irrigation.



Fig. 4.4 (a): Rice Cultivation



Fig. 4.4 (b): Rice is ready to be harvested in the field



India: Distribution of Rice

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Rice is grown in the plains of north and north-eastern India, coastal areas and the deltaic regions. Development of dense network of canal irrigation and tubewells have made it possible to grow rice in areas of less rainfall such as Punjab, Haryana and western Uttar Pradesh and parts of Rajasthan.

**Wheat:** This is the second most important cereal crop. It is the main food crop, in north and north-western part of the country. This rabi crop requires a cool growing season and a bright sunshine at the time of ripening. It requires 50 to 75 cm of annual rainfall evenly-distributed over the growing season. There are two important wheat-growing zones in the country – the Ganga-Satluj plains in the north-west and black soil region of the Deccan. The major wheat-producing states are Punjab, Haryana, Uttar Pradesh, Madhya Pradesh, Bihar and Rajasthan.



**Fig. 4.5: Wheat Cultivation**

**Millets:** Jowar, bajra and ragi are the important millets grown in India. Though, these are known as coarse grains, they have very high nutritional value. For example, ragi is very rich in iron, calcium, other micro nutrients and roughage. Jowar is the third most important food crop with respect to area and production. It is a rain-fed crop mostly grown in the moist areas which hardly needs irrigation. Major Jowar producing States are Maharashtra, Karnataka, Andhra Pradesh and Madhya Pradesh.



**Fig. 4.6: Bajra Cultivation**

Bajra grows well on sandy soils and shallow black soil. Major Bajra producing States are Rajasthan, Uttar Pradesh, Maharashtra, Gujarat and Haryana. Ragi is a crop of dry regions and grows well on red, black, sandy, loamy and shallow black soils. Major ragi producing states are: Karnataka, Tamil Nadu, Himachal Pradesh, Uttarakhand, Sikkim, Jharkhand and Arunachal Pradesh.

**Maize:** It is a crop which is used both as food and fodder. It is a kharif crop which requires temperature between 21°C to 27°C and grows well in old alluvial soil. In some states like Bihar maize is grown in rabi season also. Use of modern inputs such as HYV seeds, fertilisers and irrigation have contributed to the increasing production of maize. Major maize-producing states are Karnataka, Madhya Pradesh, Uttar Pradesh, Bihar, Andhra Pradesh and Telangana.



**Fig. 4.7: Maize Cultivation**



*India: Distribution of Wheat*

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**Pulses:** India is the largest producer as well as the consumer of pulses in the world. These are the major source of protein in a vegetarian diet. Major pulses that are grown in India are tur (arhar), urad, moong, masur, peas and gram. Can you distinguish which of these pulses are grown in the kharif season and which are grown in the rabi season? Pulses need less moisture and survive even in dry conditions. Being leguminous crops, all these crops except arhar help in restoring soil fertility by fixing nitrogen from the air. Therefore, these are mostly grown in rotation with other crops. Major pulse producing states in India are Madhya Pradesh, Rajasthan, Maharashtra, Uttar Pradesh and Karnataka.

### Food Crops other than Grains

**Sugarcane:** It is a tropical as well as a subtropical crop. It grows well in hot and humid climate with a temperature of 21°C to 27°C and an annual rainfall between 75cm. and 100cm. Irrigation is required in the regions of low rainfall. It can be grown on a variety of soils and needs manual labour from



Fig. 4.8: Sugarcane Cultivation

sowing to harvesting. India is the second largest producer of sugarcane only after Brazil. It is the main source of sugar, gur (jaggery), khandsari and molasses. The major sugarcane-producing states are Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Telangana, Bihar, Punjab and Haryana.

**Oil Seeds:** In 2018 India was the second largest producer of groundnut in the world after China. In rapeseed production India was third largest producer in the world after Canada and China in 2018. Different oil seeds are grown covering approximately 12 per cent of the total cropped area of the country. Main oil-seeds produced in India are groundnut, mustard, coconut, sesamum (til), soyabean, castor seeds, cotton seeds, linseed and sunflower. Most of these are edible and used as cooking mediums. However, some of these are also used as raw material in the production of soap, cosmetics and ointments.

Groundnut is a kharif crop and accounts for about half of the major oilseeds produced in the country. Gujarat was the largest producer of groundnut followed by Rajasthan and Tamil Nadu in 2019–20. Linseed and mustard are rabi crops. Sesamum is a kharif crop in north and rabi crop in south India. Castor seed is grown both as rabi and kharif crop.

**Tea:** Tea cultivation is an example of plantation agriculture. It is also an important beverage crop introduced in India initially by the British. Today, most of the tea plantations are owned by Indians. The tea plant grows well in tropical and sub-tropical climates endowed with deep and fertile well-drained soil, rich in humus and organic matter. Tea bushes require warm and moist frost-free



Fig. 4.9: Groundnut, sunflower and mustard are ready to be harvested in the field

climate all through the year. Frequent showers evenly distributed over the year ensure continuous growth of tender leaves. Tea is a labour-intensive industry. It requires abundant, cheap and skilled labour. Tea is processed within the tea garden to restore its freshness. Major tea-producing states are Assam, hills of Darjeeling and Jalpaiguri districts, West Bengal, Tamil Nadu and Kerala. Apart from these, Himachal Pradesh, Uttarakhand, Meghalaya, Andhra Pradesh and Tripura are also tea-producing states in the country. In 2018 India was the second largest producer of tea after China.

**Coffee:** Indian coffee is known in the world for its good quality. The Arabica variety initially brought from Yemen is produced in the country. This variety is in great demand all over the world. Initially its cultivation was introduced on the Baba Budan Hills and even today its cultivation is confined to the Nilgiri in Karnataka, Kerala and Tamil Nadu.



**Fig. 4.10: Tea Cultivation**



**Fig. 4.11: Tea-leaves Harvesting**

**Horticulture Crops:** In 2018, India was the second largest producer of fruits and vegetables in the world after China. India is a producer of tropical as well as temperate fruits. Mangoes of Maharashtra, Andhra Pradesh, Telangana, Uttar Pradesh and West Bengal, oranges of Nagpur and Cherrapunjee (Meghalaya), bananas of Kerala, Mizoram, Maharashtra and Tamil Nadu, lichi and guava of Uttar Pradesh and Bihar, pineapples of Meghalaya, grapes of Andhra Pradesh, Telangana and Maharashtra, apples, pears, apricots and walnuts of Jammu and Kashmir and Himachal Pradesh are in great demand the world over.



**Fig. 4.12: Apricots, apple and pomegranate**



**Fig. 4.13: Cultivation of vegetables – peas, cauliflower, tomato and brinjal**

**Source:** Pocket book of agricultural statistics, 2020, Govt. of India. Directorate of Economics and Statistics.

India is an important producer of pea, cauliflower, onion, cabbage, tomato, brinjal and potato.

### Non-Food Crops

**Rubber:** It is an equatorial crop, but under special conditions, it is also grown in tropical and sub-tropical areas. It requires moist and humid climate with rainfall of more than 200 cm. and temperature above 25°C.

Rubber is an important industrial raw material. It is mainly grown in Kerala, Tamil Nadu, Karnataka and Andaman and Nicobar islands and Garo hills of Meghalaya.

#### Activity

List the items which are made of rubber and are used by us.

**Fibre Crops:** Cotton, jute, hemp and natural silk are the four major fibre crops grown in India. The first three are derived from the crops grown in the soil, the latter is obtained from cocoons of the silkworms fed on green leaves specially mulberry. Rearing of silk worms for the production of silk fibre is known as **sericulture**.

**Cotton:** India is believed to be the original home of the cotton plant. Cotton is one of the main raw materials for cotton textile industry. In 2017, India was second largest producer of cotton after China. Cotton grows well in drier parts of the black cotton soil of the Deccan plateau. It requires high temperature, light rainfall or irrigation, 210 frost-free days and bright sun-shine for its growth. It is a kharif crop and requires 6 to 8 months to mature. Major cotton-producing states are— Maharashtra, Gujarat, Madhya Pradesh,



Fig. 4.14: Cotton Cultivation

Karnataka, Andhra Pradesh, Telangana, Tamil Nadu, Punjab, Haryana and Uttar Pradesh.

**Jute:** It is known as the golden fibre. Jute grows well on well-drained fertile soils in the flood plains where soils are renewed every year. High temperature is required during the time of growth. West Bengal, Bihar, Assam, Odisha and Meghalaya are the major jute producing states. It is used in making gunny bags, mats, ropes, yarn, carpets and other artefacts. Due to its high cost, it is losing market to synthetic fibres and packing materials, particularly the nylon.

### Technological and Institutional Reforms

It was mentioned in the previous pages that agriculture has been practised in India for thousands of years. Sustained uses of land without compatible techno-institutional changes have hindered the pace of agricultural development. Inspite of development of sources of irrigation most of the farmers in large parts of the country still depend upon monsoon and natural fertility in order to carry on their agriculture. For a growing population, this poses a serious challenge. Agriculture which provides livelihood for more than 60 per cent of its population, needs some serious technical and institutional reforms. Thus, collectivisation, consolidation of holdings, cooperation and abolition of zamindari, etc. were given priority to bring about institutional reforms in the country after Independence. 'Land reform' was the main focus of our First Five Year Plan. The right of inheritance had already lead to fragmentation of land holdings necessitating consolidation of holdings.

The laws of land reforms were enacted but the implementation was lacking or lukewarm. The Government of India embarked upon introducing agricultural reforms to improve Indian agriculture in the 1960s and 1970s. The Green Revolution based on the use of package technology and the White Revolution (Operation Flood) were some of the strategies initiated to improve the lot of Indian agriculture. But, this too led to the concentration of development in few selected areas. Therefore, in the 1980s and 1990s, a comprehensive land development programme was initiated, which included both institutional and technical



*Fig. 4.15: Modern technological equipments used in agriculture*

reforms. Provision for crop insurance against drought, flood, cyclone, fire and disease, establishment of Grameen banks, cooperative societies and banks for providing loan facilities to the farmers at lower rates of interest were some important steps in this direction.

Kissan Credit Card (KCC), Personal Accident Insurance Scheme (PAIS) are some other schemes introduced by the Government of India for the benefit of the farmers. Moreover, special weather bulletins and agricultural programmes for farmers were introduced on the radio and television. The government also announces minimum support price, remunerative and procurement prices for important crops to check the exploitation of farmers by speculators and middlemen.

#### Activity

Collect information about agriculture, horticulture, agricultural schemes, etc. from *Farmers' Portal* website <https://farmer.gov.in/FarmerHome.aspx>. Discuss about the benefits of the information available on the portal.

#### Bhoodan – Gramdan

Mahatma Gandhi declared Vinoba Bhave as his spiritual heir. He also participated in

Satyagraha as one of the foremost satyagrahis. He was one of the votaries of Gandhi's concept of **gram swarajya**. After Gandhiji's martyrdom, Vinoba Bhave undertook **padyatra** to spread Gandhiji's message covered almost the entire country. Once, when he was delivering a lecture at Pochampalli in Andhra Pradesh, some poor landless villagers demanded some land for their economic well-being. Vinoba Bhave could not promise it to them immediately but assured them to talk to the Government of India regarding provision of land for them if they undertook cooperative farming. Suddenly, Shri Ram Chandra Reddy stood up and offered 80 acres of land to be distributed among 80 land-less villagers. This act was known as 'Bhoodan'. Later he travelled and introduced his ideas widely all over India. Some zamindars, owners of many villages offered to distribute some villages among the landless. It was known as **Gramdan**. However, many land-owners chose to provide some part of their land to the poor farmers due to the fear of land ceiling act. This Bhoodan-Gramdan movement initiated by Vinoba Bhave is also known as the **Blood-less Revolution**.



**1.** Multiple choice questions.

- (i) Which one of the following describes a system of agriculture where a single crop is grown on a large area?
  - (a) Shifting Agriculture
  - (b) Plantation Agriculture
  - (c) Horticulture
  - (d) Intensive Agriculture
- (ii) Which one of the following is a rabi crop?
  - (a) Rice
  - (b) Gram
  - (c) Millets
  - (d) Cotton
- (iii) Which one of the following is a leguminous crop?
  - (a) Pulses
  - (b) Jawar
  - (c) Millets
  - (d) Sesamum

**2.** Answer the following questions in 30 words.

- (i) Name one important beverage crop and specify the geographical conditions required for its growth.
- (ii) Name one staple crop of India and the regions where it is produced.
- (iii) Enlist the various institutional reform programmes introduced by the government in the interest of farmers.

**3.** Answer the following questions in about 120 words.

- (i) Suggest the initiative taken by the government to ensure the increase in agricultural production.
- (ii) Describe the geographical conditions required for the growth of rice.

**PROJECT WORK**

1. Group discussion on the necessity of literacy among farmers.
2. On an outline map of India show wheat producing areas.



## ACTIVITY

Solve the puzzle by following your search horizontally and vertically to find the hidden answers.

A	Z	M	X	N	C	B	V	N	X	A	H	D	Q
S	D	E	W	S	R	J	D	Q	J	Z	V	R	E
D	K	H	A	R	I	F	G	W	F	M	R	F	W
F	N	L	R	G	C	H	H	R	S	B	S	V	T
G	B	C	W	H	E	A	T	Y	A	C	H	B	R
H	R	T	K	A	S	S	E	P	H	X	A	N	W
J	I	E	S	J	O	W	A	R	J	Z	H	D	T
K	C	L	A	E	G	A	C	O	F	F	E	E	Y
L	T	E	F	Y	M	T	A	T	S	S	R	G	I
P	D	E	J	O	U	Y	V	E	J	G	F	A	U
O	U	M	H	Q	S	U	D	I	T	S	W	S	P
U	O	A	C	O	T	T	O	N	E	A	H	F	O
Y	O	L	F	L	U	S	R	Q	Q	D	T	W	I
T	M	U	A	H	R	G	Y	K	T	R	A	B	F
E	A	K	D	G	D	Q	H	S	U	O	I	W	H
W	Q	Z	C	X	V	B	N	M	K	J	A	S	L

1. The two staple food crops of India.
2. This is the summer cropping season of India.
3. Pulses like arhar, moong, gram, urad contain...
4. It is a coarse grain.
5. The two important beverages in India are...
6. One of the four major fibers grown on black soils.



1068CH05



## MINERALS AND ENERGY RESOURCES

Haban comes to Guwahati with his father from a remote village.

He sees people getting into strange house like objects which move along the road. He also sees a "kitchen" dragging a number of house along with it. He is amazed and asked his father "Why don't our houses move like the one we saw in Guwahati, Ba?"

Ba replies, "These are not houses, they are buses and trains. Unlike our houses these are not made of bricks and stones, metal like iron and alluminium are used in making these. They do not move on their own. They are driven by an engine which needs energy to work."

We use different things in our daily life made from metal. Can you list a number of items used in your house made of metals. Where do these metals come from?

You have studied that the earth's crust is made up of different minerals embedded in the rocks. Various metals are extracted from these minerals after proper refinement.

Minerals are an indispensable part of our lives. Almost everything we use, from a tiny pin to a towering building or a big ship, all are made from minerals. The railway lines and the tarmac (paving) of the roads, our implements and machinery too are made from minerals. Cars, buses, trains, aeroplanes are manufactured from minerals and run on power resources derived from the earth. Even the food that we eat contains minerals. In all stages of development, human beings have used minerals for their livelihood, decoration, festivities, religious and ceremonial rites.

### A bright smile from toothpaste and minerals

Toothpaste cleans your teeth. Abrasive minerals like silica, limestone, aluminium oxide and various phosphate minerals do the cleaning. Fluoride which is used to reduce cavities, comes from a mineral fluorite. Most toothpaste are made white with titanium oxide, which comes from minerals called rutile, ilmenite and anatase. The sparkle in some toothpastes comes from mica. The toothbrush and tube containing the paste are made of plastics from petroleum. Find out where these minerals are found?

### Dig a little deeper and find out how many minerals are used to make a light bulb?

### All living things need minerals

Life processes cannot occur without minerals. Although our mineral intake represents only about 0.3 per cent of our total intake of nutrients, they are so potent and so important that without them we would not be able to utilise the other 99.7 per cent of foodstuffs.

### Dig a little deeper and collect "Nutritional Facts" printed on food labels.

#### What is a mineral?

Geologists define mineral as a "homogenous, naturally occurring substance with a definable internal structure." Minerals are found in varied forms in nature, ranging from the hardest diamond to the softest talc. Why are they so varied?

You have already learnt about rocks. Rocks are combinations of homogenous substances called **minerals**. Some rocks, for instance limestone, consist of a single mineral only, but majority of the rock consist of several minerals in varying proportions. Although, over 2000 minerals have been identified, only a few are abundantly found in most of the rocks.

A particular mineral that will be formed from a certain combination of elements depends upon the physical and chemical conditions under which the material forms. This, in turn, results in a wide range of colours, hardness, crystal forms, lustre and density that a particular mineral possesses. Geologists use these properties to classify the minerals.

### Study of Minerals by Geographers and Geologists

Geographers study minerals as part of the earth's crust for a better understanding of landforms. The distribution of mineral resources and associated economic activities are of interest to geographers. A geologist, however, is interested in the formation of minerals, their age and physical and chemical composition.

However, for general and commercial purposes minerals can be classified as under.

#### MODE OF OCCURRENCE OF MINERALS

##### Where are these minerals found?

Minerals are usually found in "ores". The term ore is used to describe an accumulation of any mineral mixed with other elements. The mineral content of the ore must be in

sufficient concentration to make its extraction commercially viable. The type of formation or structure in which they are found determines the relative ease with which mineral ores may be mined. This also determines the cost of extraction. It is, therefore, important for us to understand the main types of formations in which minerals occur.

Minerals generally occur in these forms:

- (i) In igneous and metamorphic rocks minerals may occur in the cracks, crevices, faults or joints. The smaller occurrences are called **veins** and the larger are called **lodes**. In most cases, they are formed when minerals in liquid/molten and gaseous forms are forced upward through cavities towards the earth's surface. They cool and solidify as they rise. Major metallic minerals like tin, copper, zinc and lead etc. are obtained from veins and lodes.
- (ii) In sedimentary rocks a number of minerals occur in **beds or layers**. They have been formed as a result of deposition, accumulation and concentration in horizontal strata. Coal and some forms of iron ore have been concentrated as a result of long periods under great heat and pressure. Another group of sedimentary minerals include gypsum, potash salt and sodium salt. These are formed as a result of **evaporation** especially in arid regions.
- (iii) Another mode of formation involves the decomposition of surface rocks, and the removal of soluble constituents, leaving a **residual mass of weathered material** containing ores. Bauxite is formed this way.

#### CLASSIFICATION OF MINERALS

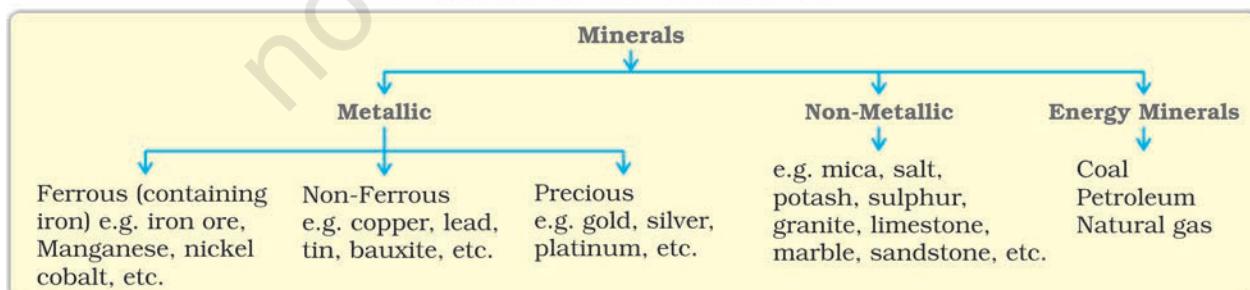


Fig. 5.1

- (iv) Certain minerals may occur as **alluvial deposits** in sands of valley floors and the base of hills. These deposits are called 'placer deposits' and generally contain minerals, which are not corroded by water. Gold, silver, tin and platinum are most important among such minerals.
- (v) The ocean waters contain vast quantities of minerals, but most of these are too widely diffused to be of economic significance. However, common salt, magnesium and bromine are largely derived from ocean waters. The ocean beds, too, are rich in manganese nodules.

#### Interesting Fact

Rat-Hole Mining. Do you know that most of the minerals in India are nationalised and their extraction is possible only after obtaining due permission from the government? But in most of the tribal areas of the north-east India, minerals are owned by individuals or communities. In Meghalaya, there are large deposits of coal, iron ore, limestone and dolomite etc. Coal mining in Jowai and Cherapunjee is done by family member in the form of a long narrow tunnel, known as 'Rat hole' mining. The National Green Tribunal has declared such activities illegal and recommended that these should be stopped forthwith.

#### Dig a little deeper: What is the difference between an open pit mine, a quarry and an underground mine with shafts?

India is fortunate to have fairly rich and varied mineral resources. However, these are unevenly distributed. Broadly speaking, peninsular rocks contain most of the reserves of coal, metallic minerals, mica and many other non-metallic minerals. Sedimentary rocks on the western and eastern flanks of the peninsula, in Gujarat and Assam have most of the petroleum deposits. Rajasthan with the rock systems of the peninsula, has reserves of many

non-ferrous minerals. The vast alluvial plains of north India are almost devoid of economic minerals. These variations exist largely because of the differences in the geological structure, processes and time involved in the formation of minerals.

Let us now study the distribution of a few major minerals in India. Always remember that the concentration of mineral in the ore, the ease of extraction and closeness to the market play an important role in affecting the economic viability of a reserve. Thus, to meet the demand, a choice has to be made between a number of possible options. When this is done a mineral 'deposit' or 'reserve' turns into a **mine**.

#### Ferrous Minerals

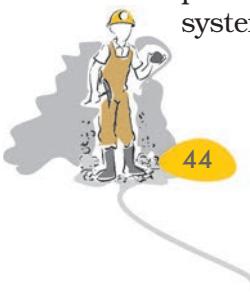
Ferrous minerals account for about three-fourths of the total value of the production of metallic minerals. They provide a strong base for the development of metallurgical industries. India exports substantial quantities of ferrous minerals after meeting her internal demands.

#### Iron Ore

Iron ore is the basic mineral and the backbone of industrial development. India is endowed with fairly abundant resources of iron ore. India is rich in good quality iron ores. Magnetite is the finest iron ore with a very high content of iron up to 70 per cent. It has excellent magnetic qualities, especially valuable in the electrical industry. Hematite ore is the most important industrial iron ore in terms of the quantity used, but has a slightly lower iron content than magnetite. (50-60 per cent). In 2018–19 almost entire production of iron ore (97%) accrued from Odisha, Chhattisgarh, Karnataka and Jharkhand. The remaining production (3%) was from other states.

#### Do you know?

Kudre in Kannada means horse. The highest peak in the western ghats of Karnataka resembles the face of a horse. The Bailadila hills look like the hump of an ox, and hence its name.





**Fig. 5.2:** Iron ore mine

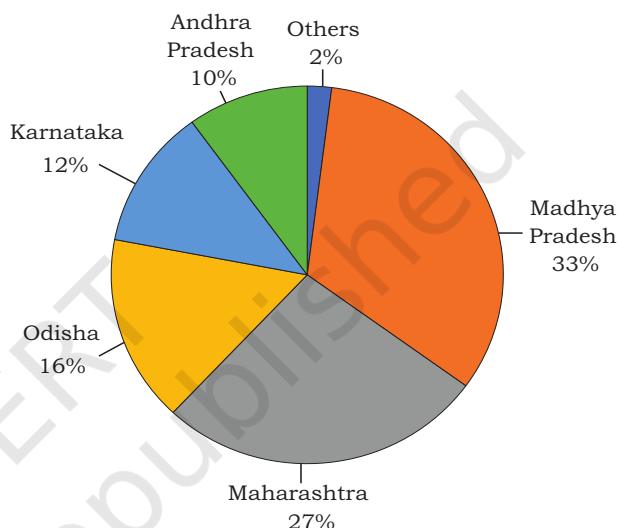
The major iron ore belts in India are:

- **Odisha-Jharkhand belt:** In Odisha high grade hematite ore is found in Badampahar mines in the Mayurbhanj and Kendujhar districts. In the adjoining Singhbhum district of Jharkhand haematite iron ore is mined in Gua and Noamundi.
- **Durg-Bastar-Chandrapur belt** lies in Chhattisgarh and Maharashtra. Very high grade hematites are found in the famous Bailadila range of hills in the Bastar district of Chhattisgarh. The range of hills comprise of 14 deposits of super high grade hematite iron ore. It has the best physical properties needed for steel making. Iron ore from these mines is exported to Japan and South Korea via Vishakhapatnam port.
- **Ballari-Chitradurga-Chikkamagaluru-Tumakuru belt** in Karnataka has large reserves of iron ore. The Kudremukh mines located in the Western Ghats of Karnataka are a 100 per cent export unit. Kudremukh deposits are known to be one of the largest in the world. The ore is transported as slurry through a pipeline to a port near Mangaluru.
- **Maharashtra-Goa belt** includes the state of Goa and Ratnagiri district of

Maharashtra. Though, the ores are not of very high quality, yet they are efficiently exploited. Iron ore is exported through Marmagao port.

### Manganese

Manganese is mainly used in the manufacturing of steel and ferro-manganese alloy. Nearly 10 kg of manganese is required to manufacture one tonne of steel. It is also used in manufacturing bleaching powder, insecticides and paints.



**Fig. 5.3:** Production of Manganese showing state-wise share in per cent, 2018–19

**Dig a little deeper:** Superimpose the maps showing distribution of iron ore, manganese, coal and iron and steel industry. Do you see any correlation. Why?

### Non-Ferrous Minerals

India's reserves and production of non-ferrous minerals is not very satisfactory. However, these minerals, which include copper, bauxite, lead, zinc and gold play a vital role in a number of metallurgical, engineering and electrical industries. Let us study the distribution of copper and bauxite.



*India: Distribution of Iron Ore, Manganese, Bauxite and Mica*

## Copper

India is critically deficient in the reserve and production of copper. Being malleable, ductile and a good conductor, copper is mainly used in electrical cables, electronics and chemical



**Fig. 5.4:** Copper mines at Malanjkhand

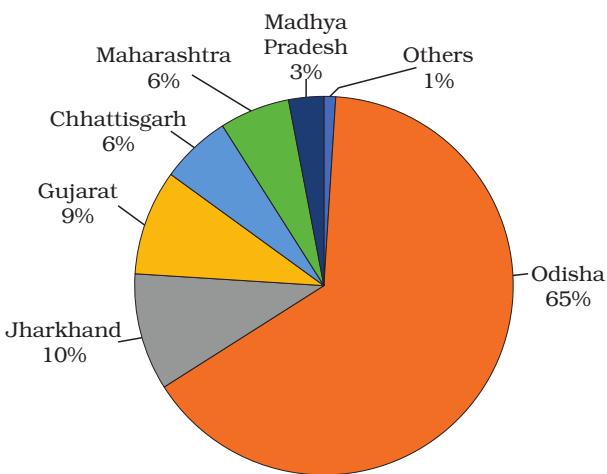
industries. The Balaghat mines in Madhya Pradesh, Khetri mines in Rajasthan and Singhbhum district of Jharkhand are leading producers of copper.

## Bauxite

Though, several ores contain aluminium, it is from bauxite, a clay-like substance that alumina and later aluminium is obtained. Bauxite deposits are formed by the decomposition of a wide variety of rocks rich in aluminium silicates.

Aluminium is an important metal because it combines the strength of metals such as iron, with extreme lightness and also with good conductivity and great malleability.

India's bauxite deposits are mainly found in the Amarkantak plateau, Maikal hills and the plateau region of Bilaspur-Katni.



**Fig. 5.5:** Production of Bauxite showing state-wise share in per cent, 2018-19

Odisha was the largest bauxite producing state in India in 2016-17. Panchpatmali deposits in Koraput district are the most important bauxite deposits in the state.



**Fig. 5.6:** Bauxite Mine

**Dig a little deeper:** Locate the mines of Bauxite on the physical map of India.



### Interesting Fact

After the discovery of aluminium Emperor Napoleon III wore buttons and hooks on his clothes made of aluminium and served food to his more illustrious guests in aluminium utensils and the less honourable ones were served in gold and silver utensils. Thirty years after this incident aluminium bowls were most common with the beggars in Paris.

### Non-Metallic Minerals

**Mica** is a mineral made up of a series of plates or leaves. It splits easily into thin sheets. These sheets can be so thin that a thousand can be layered into a mica sheet of a few centimeters high. Mica can be clear, black, green, red yellow or brown. Due to its excellent di-electric strength, low power loss factor, insulating properties and resistance to high voltage, mica is one of the most indispensable minerals used in electric and electronic industries.

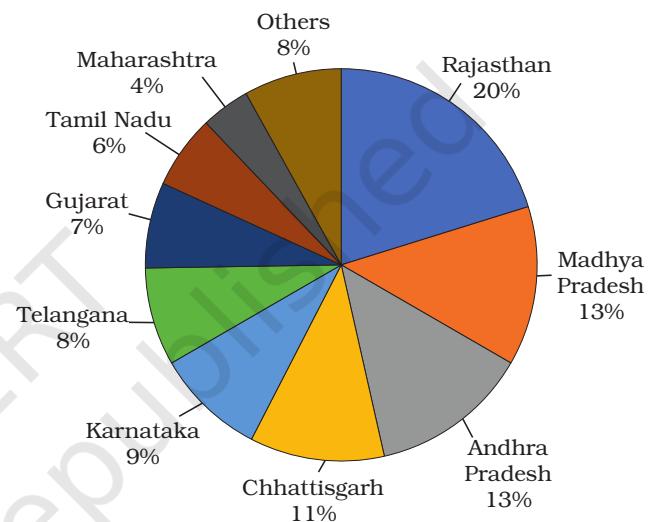
Mica deposits are found in the northern edge of the Chota Nagpur plateau. Koderma Gaya – Hazaribagh belt of Jharkhand is the leading producer.

In Rajasthan, the major mica producing area is around Ajmer. Nellore mica belt of Andhra Pradesh is also an important producer in the country.

### Rock Minerals

**Limestone** is found in association with rocks composed of calcium carbonates or calcium and magnesium carbonates. It is found in sedimentary rocks of most geological formations. Limestone is the basic raw material for the cement industry and essential for smelting iron ore in the blast furnace.

**Dig a little deeper:** Study the maps to explain why Chota Nagpur is a storehouse of minerals.



**Fig. 5.7:** Production of Limestone showing state-wise share in per cent, 2018–19

### Hazards of Mining

Have you ever wondered about the efforts the miners make in making life comfortable for you? What are the impacts of mining on the health of the miners and the environment?

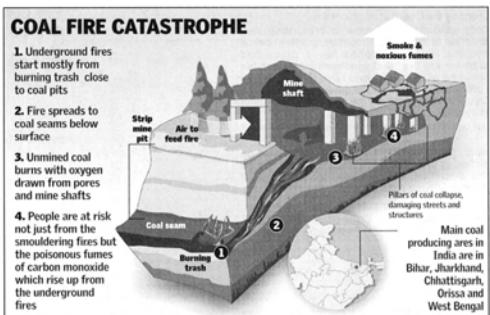
The dust and noxious fumes inhaled by miners make them vulnerable to pulmonary diseases. The risk of collapsing mine roofs, inundation and fires in coalmines are a constant threat to miners.

The water sources in the region get contaminated due to mining. Dumping of waste and slurry leads to degradation of land, soil, and increase in stream and river pollution.



**Fig. 5.8:** Air pollution due to generation of dust in mining areas

# Jharia to be shifted



Law Kumar Mishra | TNN

**Dhanbad:** The government has decided to relocate an entire township—Jharia—because of the uncontrollable spread of underground fires that have been burning for years in the coal belt.

**Coal unit fined Rs 300 cr in damages**

Debananjay Mahapatra | TNN

**New Delhi:** The Supreme Court has asked India's largest coal producing company—South Eastern Coalfields Ltd—to pay within a month Rs 300 crore as compensation for using forest land in Chhattisgarh. This is in addition to Rs 50 crore already paid by the PSU, which is a subsidiary of Coal India Ltd, to continue its operations in the state.

SECL will have to pay Rs 100 crore within a week and the rest within a month, the forest Bench comprising CJY K Sabharwal and Justices Arijit Pasayat and SH Kapadia directed on Friday.

The court, in its earlier judgment, had said that all companies were liable to pay Penal Compensation Aforestation cost and amount of Net Present Value to continue operations in forest land already allotted to them by the states.

Appearing for the PSU, solicitor general G EVahanwati argued that the company had one of the best records for protection of environment and had won awards at the national and state level. He said the Rs 50 crore already deposited by the company was compensation enough for it to be allowed coal mining operations. Appearing for the ministry of environment and forests, counsel A N Das

"The Centre has already sanctioned Rs 14 crore for the first phase of shifting."

Claiming it to be one of the world's major evacuation drives, Soren said the shifting would be done in three phases in five years and he also as-

sued.

1990. According to the Rana panel, the cost of shifting people will be at Rs 20,000 crore. The Rana panel had also said, "It is profitable to shift people from Jharia since coal worth Rs 60,000 crore is lying unutilised beneath the Jharia

## 'Over 50% of coal-belt mines unsafe'

Law Kumar Mishra | TNN

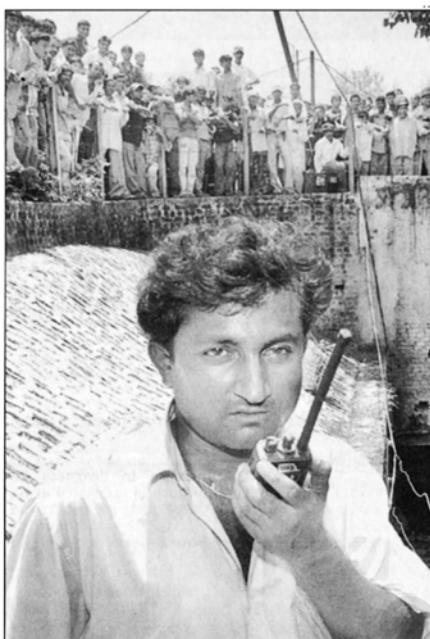
**Dhanbad:** Three days after one of the worst mining disasters in decades left 54 people dead, the chief of the company which owns these mines, said no less than half the mines in the area did not meet the basic safety standards.

Bharat Coking Coal Ltd (BCC) chairman Partha S Bhattacharya, however, said on Saturday the company shouldn't be blamed for operating unsafe mines because workers and trade unions had blocked moves to shut these for fear of losing jobs. He said only one out of 41 mines was operated scientifically and of the rest, the many were functioning against the advice of the Directorate General of Mines Safety. He described safety standards in 24 mines as poor.

Bhattacharya said workers were aware that they would have to seek voluntary retirement if unsafe mines were shut.

Bharat Coking Coal management on Saturday also handed over employment letters to the immediate people nominated by families of victims. Ironically, these people, most likely, would go to work in mines deemed unsafe by the company.

BCC's audit of the safety status of mines, graded second and third degrees,



**WAIT AND WATCH:** A crowd watches the ongoing rescue operation outside the Bharat Coking Coal Ltd mine at Bhatdih in Jharkhand on Thursday

## 'Safety standards were not in place'

Law Kumar Mishra | TNN

**Dhanbad:** Union coal minister Shibu Soren on Thursday announced an ex gratia of Rs 3 lakh to the families of the mine tragedy victims. Soren said: "Dependents of the victims will be provided employment by the Bharat Coking Coal from today. A probe by the director general of mines safety and the labour commissioner will also be initiated."

Soren also held discussions with Bharat Coking Coal officials and promised medical help to the four survivors.

tained, even though the director general of mine safety carries out surveys of the safety norms," an expert said.

Some agitating miners alleged that "there is no emergency measures inside the mine. We go deep — between 400 feet and 1,500 ft — into the mines with only an oxygen mask." The tragedy points to the lack of security measures by Bharat Coking Coal despite previous instances of disasters due to methane leak.

At least 48 people were killed in explosions in Jeetpur mine, 43 in Sudamdeeh and 30 in

Stricter safety regulations and implementation of environmental laws are essential to prevent mining from becoming a "killer industry".

### CONSERVATION OF MINERALS

We all appreciate the strong dependence of industry and agriculture upon mineral deposits and the substances manufactured from them. The total volume of workable mineral deposits is an insignificant fraction i.e. one per cent of the earth's crust. We are rapidly consuming mineral resources that

required millions of years to be created and concentrated. The geological processes of mineral formation are so slow that the rates of replenishment are infinitely small in comparison to the present rates of consumption. Mineral resources are, therefore, finite and non-renewable. Rich mineral deposits are our country's extremely valuable but short-lived possessions. Continued extraction of ores leads to increasing costs as mineral extraction comes from greater depths along with decrease in quality.



A concerted effort has to be made in order to use our mineral resources in a planned and sustainable manner. Improved technologies need to be constantly evolved to allow use of low grade ores at low costs. Recycling of metals, using scrap metals and other substitutes are steps in conserving our mineral resources for the future.

**Dig a little deeper:** Make a list of items where substitutes are being used instead of minerals.  
Where are these substitutes obtained from?

### Energy Resources

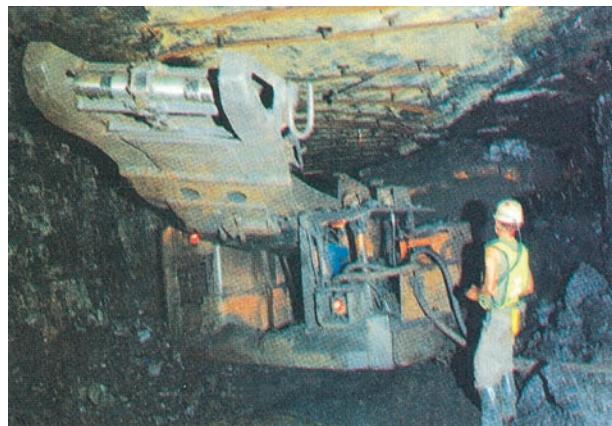
Energy is required for all activities. It is needed to cook, to provide light and heat, to propel vehicles and to drive machinery in industries.

Energy can be generated from fuel minerals like coal, petroleum, natural gas, uranium and from electricity. Energy resources can be classified as conventional and non-conventional sources. Conventional sources include: firewood, cattle dung cake, coal, petroleum, natural gas and electricity (both hydel and thermal). Non-conventional sources include solar, wind, tidal, geothermal, biogas and atomic energy. Firewood and cattle dung cake are most common in rural India. According to one estimate more than 70 per cent energy requirement in rural households is met by these two ; continuation of these is increasingly becoming difficult due to decreasing forest area. Moreover, using dung cake too is being discouraged because it consumes most valuable manure which could be used in agriculture.

### Conventional Sources of Energy

**Coal:** In India, coal is the most abundantly available fossil fuel. It provides a substantial part of the nation's energy needs. It is used for power generation, to supply energy to industry as well as for domestic needs. India is highly dependent on coal for meeting its commercial energy requirements.

As you are already aware that coal is formed due the compression of plant material over millions of years. Coal, therefore, is found in a variety of forms depending on the degrees of compression and the depth and



**Fig. 5.9 (a):** A view from inside of a coal mine



**Fig. 5.9 (b):** A view from outside of a coal mine

time of burial. Decaying plants in swamps produce peat. Which has a low carbon and high moisture contents and low heating capacity. **Lignite** is a low grade brown coal, which is soft with high moisture content. The principal lignite reserves are in Neyveli in Tamil Nadu and are used for generation of electricity. Coal that has been buried deep and subjected to increased temperatures is **bituminous** coal. It is the most popular coal in commercial use. Metallurgical coal is high grade bituminous coal which has a special value for smelting iron in blast furnaces. **Anthracite** is the highest quality hard coal.

In India coal occurs in rock series of two main geological ages, namely Gondwana, a little over 200 million years in age and in tertiary deposits which are only about 55 million years old. The major resources of Gondwana coal, which are metallurgical coal, are located in Damodar valley (West Bengal-



*India: Distribution of Coal, Oil and Natural Gas*

#### Activity

Collect information about cross country natural gas pipelines laid by GAIL (India) under "One Nation One Grid".

Jharkhand). Jharia, Raniganj, Bokaro are important coalfields. The Godavari, Mahanadi, Son and Wardha valleys also contain coal deposits.

Tertiary coals occur in the north eastern states of Meghalaya, Assam, Arunachal Pradesh and Nagaland.

Remember coal is a bulky material, which loses weight on use as it is reduced to ash. Hence, heavy industries and thermal power stations are located on or near the coalfields.

### Petroleum

Petroleum or mineral oil is the next major energy source in India after coal. It provides fuel for heat and lighting, lubricants for machinery and raw materials for a number of manufacturing industries. Petroleum refineries act as a “nodal industry” for synthetic textile, fertiliser and numerous chemical industries.

Most of the petroleum occurrences in India are associated with anticlines and fault traps in the rock formations of the tertiary age. In regions of folding, anticlines or domes, it occurs where oil is trapped in the crest of the upfold. The oil bearing layer is a porous limestone or sandstone through which oil may flow. The oil is prevented from rising or sinking by intervening non-porous layers.

Petroleum is also found in fault traps between porous and non-porous rocks. Gas, being lighter usually occurs above the oil.

Mumbai High, Gujarat and Assam are major petroleum production areas in India. From the map locate the 3 major off shore fields of western India. Ankeleshwar is the most important field of Gujarat. Assam is the oldest oil producing state of India. Digboi, Naharkatiya and Moran-Hugrijan are the important oil fields in the state.

### Natural Gas

Natural Gas is found with petroleum deposits and is released when crude oil is brought to the surface. It can be used as a domestic and industrial fuel. It is used as fuel in power sector to generate electricity, for heating purpose in industries, as raw material in chemical, petrochemical and fertilizer industries, as transport fuel and as cooking fuel. With the expansion of gas infrastructure and local city

gas distribution (COD) networks, natural gas is also emerging as a preferred transport fuel (CNG) and cooking fuel (PNG) at homes. India's major gas reserves are found in the Mumbai High and allied fields along the west coast which are supplemented by finds in the Cambay basin. Along the East Coast, new reserves of natural gas have been discovered in the Krishna-Godavari basin.

The first 1,700 km long Hazira-Vijaipur-Jagdishpur (HVJ) cross country gas pipeline, constructed by GAIL (India), linked Mumbai High and Bassein gas fields with various fertilizer, power and industrial complexes in western and northern India. This artery provided impetus to Indian gas market development. Overall, India's gas infrastructure has expanded over ten times from 1,700 km to 18,500 km of cross-country pipelines and is expected to soon reach over 34,000 km as Gas Grid by linking all gas sources and consuming markets across the country including North Eastern states.

### Electricity

Electricity has such a wide range of applications in today's world that, its per capita consumption is considered as an index of development. Electricity is generated mainly in two ways: by running water which drives hydro turbines to generate *hydro electricity*; and by burning other fuels such as coal, petroleum and natural gas to drive turbines to produce *thermal power*. Once generated the electricity is exactly the same.

#### Activity

Name some river valley projects and write the names of the dams built on these rivers.

*Hydro electricity* is generated by fast flowing water, which is a renewable resource. India has a number of multi-purpose projects like the Bhakra Nangal, Damodar Valley corporation, the Kopili Hydel Project etc. producing hydroelectric power.

*Thermal electricity* is generated by using coal, petroleum and natural gas. The thermal power stations use non-renewable fossil fuels for generating electricity.



*India: Distribution of Nuclear and Thermal Power Plants*

**Collect information about thermal/hydel power plants located in your state. Show them on the map of India.**

### **Non-Conventional Sources of Energy**

The growing consumption of energy has resulted in the country becoming increasingly dependent on fossil fuels such as coal, oil and gas. Rising prices of oil and gas and their potential shortages have raised uncertainties about the security of energy supply in future, which in turn has serious repercussions on the growth of the national economy. Moreover, increasing use of fossil fuels also causes serious environmental problems. Hence, there is a pressing need to use renewable energy sources like solar energy, wind, tide, biomass and energy from waste material. These are called non-conventional energy sources.

India is blessed with an abundance of sunlight, water, wind and biomass. It has the largest programmes for the development of these renewable energy resources.

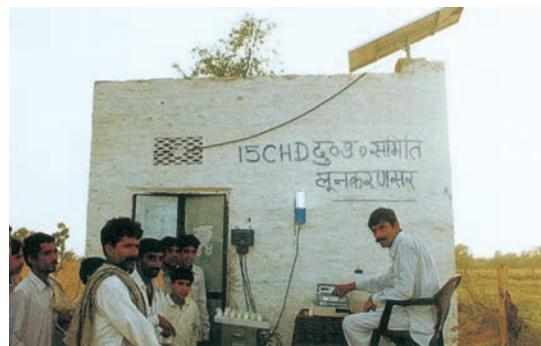
### **Nuclear or Atomic Energy**

It is obtained by altering the structure of atoms. When such an alteration is made, much energy is released in the form of heat and this is used to generate electric power. Uranium and Thorium, which are available in Jharkhand and the Aravalli ranges of Rajasthan are used for generating atomic or nuclear power. The Monazite sands of Kerala is also rich in Thorium.

**Locate the 6 nuclear power stations and find out the state in which they are located.**

### **Solar Energy**

India is a tropical country. It has enormous possibilities of tapping solar energy. Photovoltaic technology converts sunlight directly into electricity. Solar energy is fast becoming popular in rural and remote areas. Some big solar power plants are being established in different parts of India which will minimise the dependence of rural households on firewood and dung cakes, which in turn will contribute to environmental conservation and adequate supply of manure in agriculture.



**Fig. 5.10: Solar operated electronic milk testing equipment**

### **Activity**

Collect information about newly established solar power plants in India.

### **Wind power**

India has great potential of wind power. The largest wind farm cluster is located in Tamil Nadu from Nagarcoil to Madurai. Apart from these, Andhra Pradesh, Karnataka, Gujarat, Kerala, Maharashtra and Lakshadweep have important wind farms. Nagarcoil and Jaisalmer are well known for effective use of wind energy in the country.

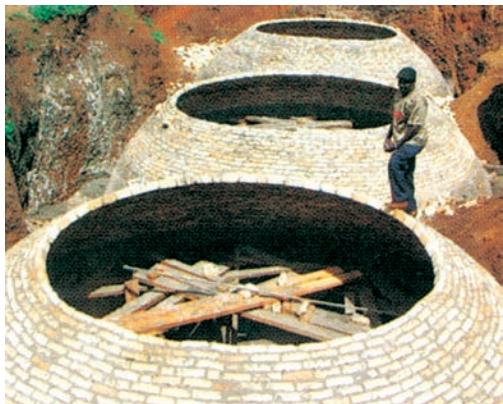


**Fig. 5.11: Wind mills – Nagarcoil**

### **Biogas**

Shrubs, farm waste, animal and human waste are used to produce biogas for domestic consumption in rural areas. Decomposition of organic matter yields gas, which has higher thermal efficiency in comparison to kerosene, dung cake and charcoal. Biogas plants are set up at municipal, cooperative and individual levels. The plants using cattle dung are known as 'Gobar gas plants' in rural India. These provide twin benefits to the farmer in the form of energy and improved quality of

manure. Biogas is by far the most efficient use of cattle dung. It improves the quality of manure and also prevents the loss of trees and manure due to burning of fuel wood and cow dung cakes.



**Fig. 5.12: Biogas Plant**

### Tidal Energy

Oceanic tides can be used to generate electricity. Floodgate dams are built across inlets. During high tide water flows into the inlet and gets trapped when the gate is closed. After the tide falls outside the flood gate, the water retained by the floodgate flows back to the sea via a pipe that carries it through a power-generating turbine.

In India the Gulf of Khambhat, the Gulf of Kuchchh in Gujarat on the western coast and Gangetic delta in Sunderban regions of West Bengal provide ideal conditions for utilising tidal energy.

### Geo Thermal Energy

Geo thermal energy refers to the heat and electricity produced by using the heat from the interior of the Earth. Geothermal energy exists because, the Earth grows progressively hotter with increasing depth. Where the

geothermal gradient is high, high temperatures are found at shallow depths. Groundwater in such areas absorbs heat from the rocks and becomes hot. It is so hot that when it rises to the earth's surface, it turns into steam. This steam is used to drive turbines and generate electricity.

There are several hundred hot springs in India, which could be used to generate electricity. Two experimental projects have been set up in India to harness geothermal energy. One is located in the Parvati valley near Manikarn in Himachal Pradesh and the other is located in the Puga Valley, Ladakh.

### Conservation of Energy Resources

Energy is a basic requirement for economic development. Every sector of the national economy – agriculture, industry, transport, commercial and domestic – needs inputs of energy. The economic development plans implemented since Independence necessarily required increasing amounts of energy to remain operational. As a result, consumption of energy in all forms has been steadily rising all over the country.

In this background, there is an urgent need to develop a sustainable path of energy development. Promotion of energy conservation and increased use of renewable energy sources are the twin planks of sustainable energy.

India is presently one of the least energy efficient countries in the world. We have to adopt a cautious approach for the judicious use of our limited energy resources. For example, as concerned citizens we can do our bit by using public transport systems instead of individual vehicles; switching off electricity when not in use, using power-saving devices and using non-conventional sources of energy. After all, “energy saved is energy produced”.

### EXERCISES   EXERCISES   EXERCISES   EXERCISES   EXERCISES

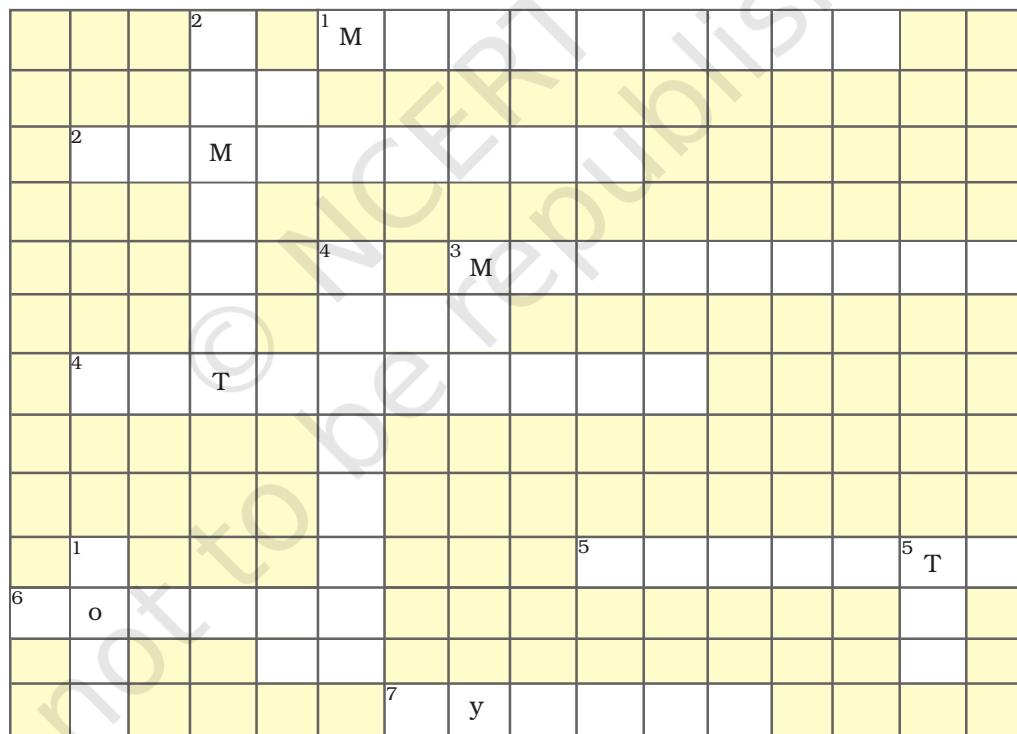
#### 1. Multiple choice questions.

- (i) Which one of the following minerals is formed by decomposition of rocks, leaving a residual mass of weathered material?  
(a) coal                  (b) bauxite                  (c) gold                  (d) zinc
- (ii) Koderma, in Jharkhand is the leading producer of which one of the following minerals?  
(a) bauxite                  (b) mica                  (c) iron ore                  (d) copper



## ACTIVITY

Fill the name of the correct mineral in the crossword below:



**ACROSS**

1. A ferrous mineral (9)
2. Raw material for cement industry (9)
3. Finest iron ore with magnetic properties (9)
4. Highest quality hard coal (10)
5. Aluminium is obtained from this ore (7)
6. Khetri mines are famous for this mineral (6)
7. Formed due to evaporation (6)

**DOWN**

1. Found in placer deposit (4)
2. Iron ore mined in Bailadila (8)
3. Indispensable for electrical industry (4)
4. Geological Age of coal found in north east India (8)
5. Formed in veins and lodes (3)

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## MANUFACTURING INDUSTRIES



On the occasion of Diwali, Harish went to a market with his parents. They purchased shoes and clothes for him. His mother purchased utensils, sugar, tea and diyas (earthen lamps). Harish observed that the shops in the market were flooded with items for sale. He wondered how so many items could be made in such large quantities. His father explained that shoes, clothes, sugar etc. are manufactured by machines in large industries, some utensils are manufactured in small industries, while items like **diyas** are made by individual artisans in household industry.

*Do you have some ideas about these industries?*

Production of goods in large quantities after processing from raw materials to more valuable products is called manufacturing. Do you know that paper is manufactured from wood, sugar from sugarcane, iron and steel from iron ore and aluminium from bauxite? Do you also know that some types of clothes are manufactured from yarn which itself is an industrial product?

People employed in the secondary activities manufacture the primary materials into finished goods. The workers employed in steel factories, car, breweries, textile industries, bakeries etc. fall into this category. Some people are employed in providing services. In this chapter, we are mainly concerned with manufacturing industries which fall in the secondary sector.

The economic strength of a country is measured by the development of manufacturing industries.

### IMPORTANCE OF MANUFACTURING

Manufacturing sector is considered the backbone of development in general and economic development in particular mainly because—

- Manufacturing industries not only help in modernising agriculture, which forms the backbone of our economy, they also reduce the heavy dependence of people on agricultural income by providing them jobs in secondary and tertiary sectors.
- Industrial development is a precondition for eradication of unemployment and poverty from our country. This was the main philosophy behind public sector industries and joint sector ventures in India. It was also aimed at bringing down regional disparities by establishing industries in tribal and backward areas.
- Export of manufactured goods expands trade and commerce, and brings in much needed foreign exchange.
- Countries that transform their raw materials into a wide variety of finished goods of higher value are prosperous. India's prosperity lies in increasing and diversifying its manufacturing industries as quickly as possible.

Agriculture and industry are not exclusive of each other. They move hand in hand. For instance, the agro-industries in India have given a major boost to agriculture by raising its productivity. They depend on the latter for raw materials and sell their products such as irrigation pumps, fertilisers, insecticides, pesticides, plastic and PVC pipes, machines and tools, etc. to the farmers. Thus, development and competitiveness of

manufacturing industry has not only assisted agriculturists in increasing their production but also made the production processes very efficient.

In the present day world of globalisation, our industry needs to be more efficient and competitive. Self-sufficiency alone is not enough. Our manufactured goods must be at par in quality with those in the international market. Only then, will we be able to compete in the international market.

### Classification of Industries

List the various manufactured products you use in your daily life such as – transistors, electric bulbs, vegetable oil, cement, glassware, petrol, matches, scooters, automobiles, medicines and so on. If we classify the various industries based on a particular criterion then we would be able to understand their manufacturing better. Industries may be classified as follows:

On the basis of source of raw materials used:

- Agro based: cotton, woollen, jute, silk textile, rubber and sugar, tea, coffee, edible oil.
- Mineral based: iron and steel, cement, aluminium, machine tools, petrochemicals.

According to their main role:

- Basic or key industries are those which supply their products as raw materials to manufacture other goods e.g. iron and steel and copper smelting, aluminum smelting.
- Consumer industries that produce goods for direct use by consumers – sugar, toothpaste, paper, sewing machines, fans etc.

On the basis of capital investment:

- A small scale industry is defined with reference to the maximum investment

allowed on the assets of a unit. This limit has changed over a period of time. At present the maximum investment allowed is rupees one crore.

On the basis of ownership:

- Public sector, owned and operated by government agencies – BHEL, SAIL etc.
- Private sector industries owned and operated by individuals or a group of individuals – TISCO, Bajaj Auto Ltd., Dabur Industries.
- Joint sector industries which are jointly run by the state and individuals or a group of individuals. Oil India Ltd. (OIL) is jointly owned by public and private sector.
- Cooperative sector industries are owned and operated by the producers or suppliers of raw materials, workers or both. They pool in the resources and share the profits or losses proportionately. Such examples are the sugar industry in Maharashtra, the coir industry in Kerala.

Based on the bulk and weight of raw material and finished goods:

- Heavy industries such as iron and steel
- Light industries that use light raw materials and produce light goods such as electrical goods industries.

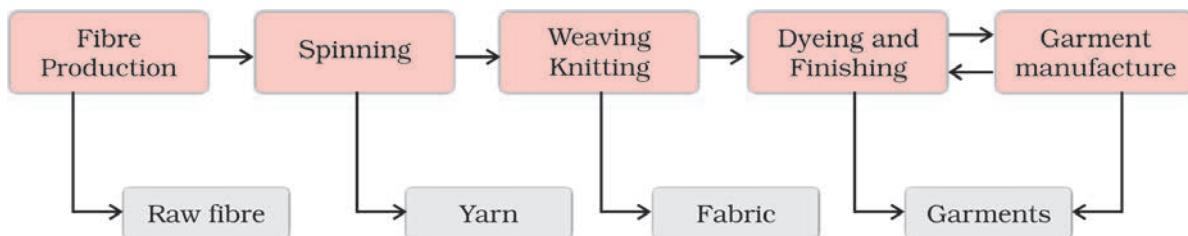
### Activity

Classify the following into two groups on the basis of bulk and weight of raw material and finished goods.

- |                       |                       |
|-----------------------|-----------------------|
| (i) Oil               | (vi) Sewing Machines  |
| (ii) Knitting needles | (vii) Shipbuilding    |
| (iii) Brassware       | (viii) Electric Bulbs |
| (iv) Fuse wires       | (ix) Paint brushes    |
| (v) Watches           | (x) Automobiles       |

### Agro-based Industries

Cotton, jute, silk, woollen textiles, sugar and edible oil, etc. industries are based on agricultural raw materials.



*Fig. 6.1: Value addition in the textile industry*

**Textile Industry:** The textile industry occupies unique position in the Indian economy, because it contributes significantly to industrial production, employment generation and foreign exchange earnings. It is the only industry in the country, which is self-reliant and complete in the value chain i.e., from raw material to the highest value added products.

**Cotton Textiles:** In ancient India, cotton textiles were produced with hand spinning and handloom weaving techniques. After the 18<sup>th</sup> century, power-looms came into use. Our traditional industries suffered a setback during the colonial period because they could not compete with the mill-made cloth from England.

- The first successful textile mill was established in Mumbai in 1854.
- The two world wars were fought in Europe, India was a British colony. There was a demand for cloth in U.K. hence, they gave a boost to the development of the cotton textile industry.

In the early years, the cotton textile industry was concentrated in the cotton growing belt of Maharashtra and Gujarat. Availability of raw cotton, market, transport including accessible port facilities, labour, moist climate, etc. contributed towards its localisation. This industry has close links with agriculture and provides a living to farmers, cotton boll pluckers and workers engaged in ginning, spinning, weaving,

dyeing, designing, packaging, tailoring and sewing. The industry by creating demands supports many other industries, such as, chemicals and dyes, packaging materials and engineering works.

While spinning continues to be centralised in Maharashtra, Gujarat and Tamil Nadu, weaving is highly decentralised to provide scope for incorporating traditional skills and designs of weaving in cotton, silk, zari, embroidery, etc. India has world class production in spinning, but weaving supplies low quality of fabric as it cannot use much of the high quality yarn produced in the country. Weaving is done by handloom, powerloom and in mills.

The handspun khadi provides large scale employment to weavers in their homes as a cottage industry.

**Why did Mahatma Gandhi lay emphasis on spinning yarn and weaving khadi?**

**Why is it important for our country to keep the mill sector loomage lower than power loom and handloom?**

#### **Jute Textiles**

India is the largest producer of raw jute and jute goods and stands at second place as an exporter after Bangladesh. Most of the mills are located in West Bengal, mainly along the banks of the Hugli river, in a narrow belt.

The first jute mill was set up near Kolkata in 1855 at Rishra. After Partition in 1947, the jute mills remained in India but three-fourth of the jute producing area went to Bangladesh (erstwhile East Pakistan).



*India: Distribution of cotton, woollen and silk industries*

MANUFACTURING INDUSTRIES



Factors responsible for their location in the Hugli basin are: proximity of the jute producing areas, inexpensive water transport, supported by a good network of railways, roadways and waterways to facilitate movement of raw material to the mills, abundant water for processing raw jute, cheap labour from West Bengal and adjoining states of Bihar, Odisha and Uttar Pradesh. Kolkata as a large urban centre provides banking, insurance and port facilities for export of jute goods.

### Sugar Industry

India stands second as a world producer of sugar but occupies the first place in the production of *gur* and *khandsari*. The raw material used in this industry is bulky, and in haulage its sucrose content reduces. The mills are located in Uttar Pradesh, Bihar, Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Gujarat, Punjab, Haryana and Madhya Pradesh. Sixty per cent mills are in Uttar Pradesh and Bihar. This industry is seasonal in nature so, it is ideally suited to the cooperative sector. Can you explain why this is so?

In recent years, there is a tendency for the mills to shift and concentrate in the southern and western states, especially in Maharashtra. This is because the cane produced here has a higher sucrose content. The cooler climate also ensures a longer crushing season. Moreover, the cooperatives are more successful in these states.

### Mineral-based Industries

Industries that use minerals and metals as raw materials are called mineral-based industries. Can you name some industries that would fall in this category?

#### Iron and Steel Industry

The iron and steel industry is the basic industry since all the other industries — heavy, medium and light, depend on it for their machinery. Steel is needed to manufacture a variety of engineering goods, construction material, defence, medical, telephonic, scientific equipment and a variety of consumer goods.

#### Activity

Make a list of all such goods made of steel that you can think of.

Production and consumption of steel is often regarded as the index of a country's development. Iron and steel is a heavy industry because all the raw materials as well as finished goods are heavy and bulky entailing heavy transportation costs. Iron ore, coking coal and lime stone are required in the ratio of approximately 4 : 2 : 1. Some quantities of manganese, are also required to harden the steel. Where should the steel plants be ideally located? Remember that the finished products also need an efficient transport network for their distribution to the markets and consumers.

#### Processes of Manufacture of Steel

##### Blast Furnace

Transport of raw material to plant

Iron ore is melted. Lime stone is fluxing material which is added. Slag is removed. Coke is burnt to heat the ore.

##### Pig Iron

Molten materials poured into moulds called pigs

##### Shaping Metal

Rolling, pressing, casting and forging

##### Steel Making

Pig iron is further purified by melting and oxidising the impurities. Manganese, nickel, chromium are added

Fig. 6.2





India: Iron and Steel Plants

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Chhotanagpur plateau region has the maximum concentration of iron and steel industries. It is largely, because of the relative advantages this region has for the development of this industry. These include, low cost of iron ore, high grade raw materials in proximity, cheap labour and vast growth potential in the home market.

### **Aluminium Smelting**

Aluminium smelting is the second most important metallurgical industry in India. It is light, resistant to corrosion, a good conductor of heat, malleable and becomes strong when it is mixed with other metals. It is used to manufacture aircraft, utensils and wires. It has gained popularity as a substitute of steel, copper, zinc and lead in a number of industries.



**Fig. 6.3:** Strip coating mill at smelter of NALCO

Aluminium smelting plants in the country are located in Odisha, West Bengal, Kerala, Uttar Pradesh, Chhattisgarh, Maharashtra and Tamil Nadu.

Bauxite, the raw material used in the smelters is a very bulky, dark reddish coloured rock. The flow chart given below shows the process of manufacturing aluminium. Regular supply of electricity and an assured source of raw material at minimum cost are the two prime factors for location of the industry.

### **Chemical Industries**

The Chemical industry in India is fast growing and diversifying. It comprises both large and small scale manufacturing units. Rapid growth has been recorded in both inorganic and organic sectors. Inorganic chemicals include sulphuric acid (used to manufacture fertilizers, synthetic fibres, plastics, adhesives, paints, dyes stuffs), nitric acid, alkalies, soda ash (used to make glass, soaps and detergents, paper) and caustic soda. These industries are widely spread over the country.

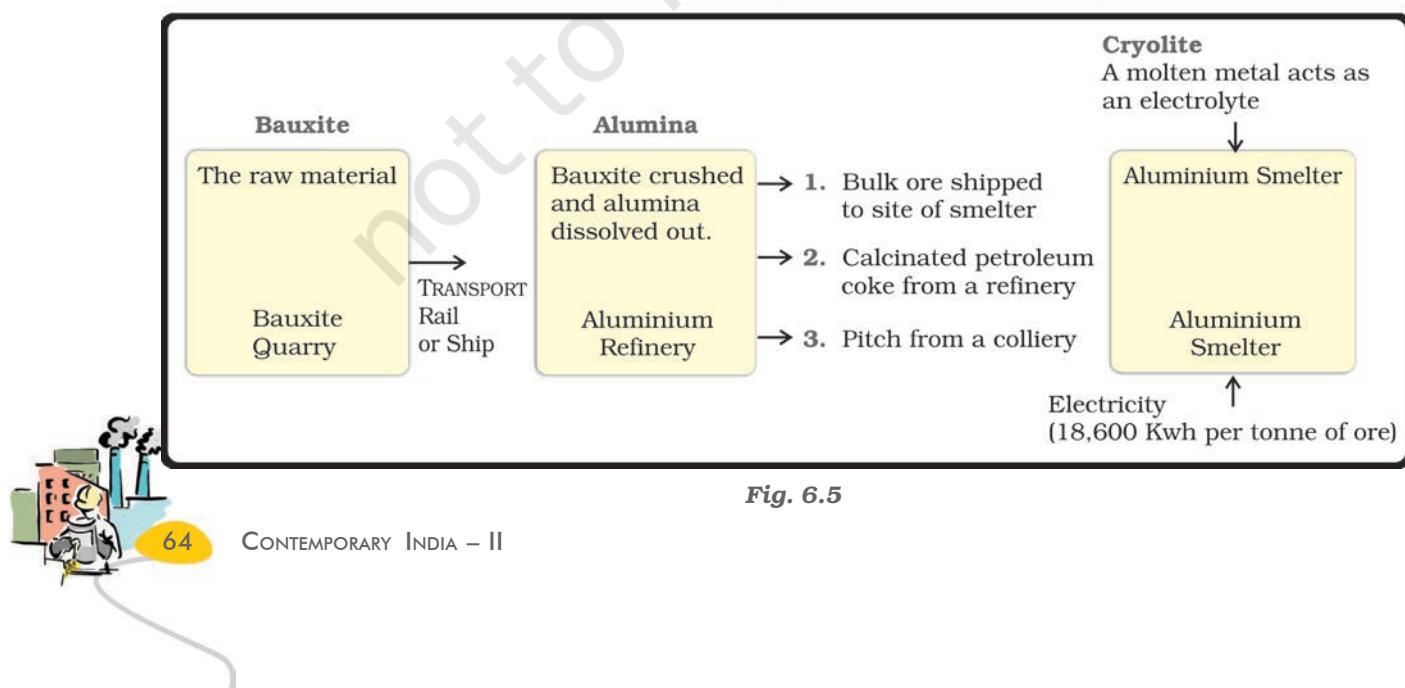
### **Why do you think it is so?**

Organic chemicals include petrochemicals, which are used for manufacturing of synthetic fibers, synthetic rubber, plastics, dye-stuffs, drugs and pharmaceuticals. Organic chemical

4 to 6 tonnes of bauxite → 2 tonnes of alumina → 1 tonne of aluminium

**Fig. 6.4**

### **Process of Manufacturing in Aluminium Industry**



plants are located near oil refineries or petrochemical plants.

The chemical industry is its own largest consumer. Basic chemicals undergo processing to further produce other chemicals that are used for industrial application, agriculture or directly for consumer markets. Make a list of the products you are aware of.

### Fertilizer Industry

The fertilizer industry is centred around the production of nitrogenous fertilizers (mainly urea), phosphatic fertilizers and ammonium phosphate (DAP) and complex fertilizers which have a combination of nitrogen (N), phosphate (P), and potash (K). The third, i.e. potash is entirely imported as the country does not have any reserves of commercially usable potash or potassium compounds in any form.

After the Green Revolution the industry expanded to several other parts of the country. Gujarat, Tamil Nadu, Uttar Pradesh, Punjab and Kerala contribute towards half of the fertilizer production. Other significant producers are Andhra Pradesh, Odisha, Rajasthan, Bihar, Maharashtra, Assam, West Bengal, Goa, Delhi, Madhya Pradesh and Karnataka.

### Cement Industry

Cement is essential for construction activity such as building houses, factories, bridges, roads, airports, dams and for other commercial establishments. This industry requires bulky and heavy raw materials like limestone, silica and gypsum. Coal and electric power are needed apart from rail transportation.

#### Activity

Where would it be economically viable to set up the cement manufacturing units?

The industry has strategically located plants in Gujarat that have suitable access to the market in the Gulf countries.

#### Activity

Find out where the plants are located in other States of India. Find their names.

### Automobile Industry

Automobiles provide vehicle for quick transport of goods and passengers. Trucks, buses, cars, motor cycles, scooters, three-wheelers and multi-utility vehicles are manufactured in India at various centres. After the liberalisation, the coming in of new and contemporary models stimulated the demand for vehicles in the market, which led to the healthy growth of the industry including passenger cars, two and three-wheelers. The industry is located around Delhi, Gurugram, Mumbai, Pune, Chennai, Kolkata, Lucknow, Indore, Hyderabad, Jamshedpur and Bengaluru.

### Information Technology and Electronics Industry

The electronics industry covers a wide range of products from transistor sets to television, telephones, cellular telecom, telephone exchange, radars, computers and many other equipments required by the telecommunication industry. Bengaluru has emerged as the electronic capital of India. Other important centres for electronic goods are Mumbai, Delhi, Hyderabad, Pune, Chennai, Kolkata, Lucknow and Coimbatore. The major industry concentration is at Bengaluru, Noida, Mumbai, Chennai, Hyderabad and Pune. A major impact of this industry has been on employment generation. The continuing growth in the hardware and software is the key to the success of IT industry in India.



Fig. 6.6: Cable manufacturing facilities at HCL, Rupnarainpur (West Bengal)

## **Industrial Pollution and Environmental Degradation**

Although industries contribute significantly to India's economic growth and development, the increase in pollution of land, water, air, noise and resulting degradation of environment that they have caused, cannot be overlooked. Industries are responsible for four types of pollution: (a) Air (b) Water (c) Land (d) Noise. The polluting industries also include thermal power plants.

**Air pollution** is caused by the presence of high proportion of undesirable gases, such as sulphur dioxide and carbon monoxide. Air-borne particulate materials contain both solid and liquid particles like dust, sprays mist and smoke. Smoke is emitted by chemical and paper factories, brick kilns, refineries and smelting plants, and burning of fossil fuels in big and small factories that ignore pollution norms. Toxic gas leaks can be very hazardous with long-term effects. Are you aware of the Bhopal Gas tragedy that occurred? Air pollution adversely affects human health, animals, plants, buildings and the atmosphere as a whole.

**Water pollution** is caused by organic and inorganic industrial wastes and effluents discharged into rivers. The main culprits in this regard are paper, pulp, chemical, textile and dyeing, petroleum refineries, tanneries and electroplating industries that let out dyes, detergents, acids, salts and heavy metals like lead and mercury pesticides, fertilisers, synthetic chemicals with carbon, plastics and rubber, etc. into the water bodies. Fly ash, phospho-gypsum and iron and steel slags are the major solid wastes in India.

**Thermal pollution** of water occurs when hot water from factories and thermal plants is drained into rivers and ponds before cooling. What would be the effect on aquatic life?

Wastes from nuclear power plants, nuclear and weapon production facilities cause cancers, birth defects and miscarriages. Soil and water pollution are closely related.

Dumping of wastes specially glass, harmful chemicals, industrial effluents, packaging, salts and garbage renders the soil useless. Rain water percolates to the soil carrying the pollutants to the ground and the ground water also gets contaminated.

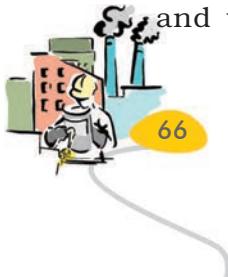
**Noise pollution** not only results in irritation and anger, it can also cause hearing impairment, increased heart rate and blood pressure among other physiological effects. Unwanted sound is an irritant and a source of stress. Industrial and construction activities, machinery, factory equipment, generators, saws and pneumatic and electric drills also make a lot of noise.

## **Control of Environmental Degradation**

Every litre of waste water discharged by our industry pollutes eight times the quantity of freshwater. How can the industrial pollution of fresh water be reduced? Some suggestions are-

- (i) minimising use of water for processing by reusing and recycling it in two or more successive stages
- (ii) harvesting of rainwater to meet water requirements
- (iii) treating hot water and effluents before releasing them in rivers and ponds. Treatment of industrial effluents can be done in three phases
  - (a) Primary treatment by mechanical means.  
This involves screening, grinding, flocculation and sedimentation.
  - (b) Secondary treatment by biological process
  - (c) Tertiary treatment by biological, chemical and physical processes. This involves recycling of wastewater.

Overdrawing of ground water reserves by industry where there is a threat to ground water resources also needs to be regulated legally. Particulate matter in the air can be reduced by fitting smoke stacks to factories with electrostatic precipitators, fabric filters, scrubbers and inertial separators. Smoke can be reduced by using oil or gas instead





*India: Some Software Technology Parks*

MANUFACTURING INDUSTRIES

of coal in factories. Machinery and equipment can be used and generators should be fitted with silencers. Almost all machinery can be redesigned to increase energy efficiency and reduce noise. Noise absorbing material may be used apart from personal use of earplugs and earphones.

The challenge of sustainable development requires integration of economic development with environmental concerns.



*Fig. 6.7: Sewage Treatment plant under Yamuna action plan at Faridabad*

#### NTPC shows the way

NTPC is a major power providing corporation in India. It has ISO certification for EMS (Environment Management System) 14001. The corporation has a proactive approach for preserving the natural environment and resources like water, oil and gas and fuels in places where it is setting up power plants. This has been possible through-

- Optimum utilisation of equipment adopting latest techniques and upgrading existing equipment.
- Minimising waste generation by maximising ash utilisation.
- Providing greenbelts for nurturing ecological balance and addressing the question of special purpose vehicles for afforestation.
- Reducing environmental pollution through ash pond management, ash water recycling system and liquid waste management.
- Ecological monitoring, reviews and on-line database management for all its power stations.



*Fig. 6.8: Ramagundam plant*

#### EXERCISES EXERCISES EXERCISES EXERCISES EXERCISES

- Multiple choice questions.
  - Which one of the following industries uses bauxite as a raw material?
    - Aluminium Smelting
    - Cement
    - Paper
    - Steel
  - Which one of the following industries manufactures telephones, computer, etc.
    - Steel
    - Electronic
    - Aluminium Smelting
    - Information Technology
- Answer the following briefly in not more than 30 words.
  - What is manufacturing?
  - What are basic industries? Give an example.



- 3.** Write the answers of the following questions in 120 words.
- How do industries pollute the environment?
  - Discuss the steps to be taken to minimise environmental degradation by industry?

### **ACTIVITY**

Give one word for each of the following with regard to industry. The number of letters in each word are hinted in brackets.

- |                                    |             |
|------------------------------------|-------------|
| (i) Used to drive machinery        | (5) P.....  |
| (ii) People who work in a factory  | (6) W.....  |
| (iii) Where the product is sold    | (6) M.....  |
| (iv) A person who sells goods      | (8) R.....  |
| (v) Thing produced                 | (7) P.....  |
| (vi) To make or produce            | (11) M..... |
| (vii) Land, Water and Air degraded | (9) P.....  |

### **PROJECT WORK**

Select one agro-based and one mineral-based industry in your area.

- What are the raw materials they use?
- What are the other inputs in the process of manufacturing that involve transportation cost?
- Are these factories following environmental norms?

### **ACTIVITY**

Solve the puzzle by following your search horizontally and vertically to find the hidden answers.

- Textiles, sugar, vegetable oil and plantation industries deriving raw materials from agriculture are called...
- The basic raw material for sugar industry.
- This fibre is also known as the 'Golden Fibre'.
- Iron-ore, coking coal, and limestone are the chief raw materials of this industry.
- A public sector steel plant located in Chhattisgarh.

## ACTIVITY

Solve the puzzle by following your search horizontally and vertically to find the hidden answers.

G	G	G	P	V	A	R	A	N	A	S	I
U	O	J	I	P	G	X	K	M	Q	W	V
K	S	U	G	A	R	C	A	N	E	E	N
O	T	T	O	N	O	Z	V	O	P	T	R
A	U	E	L	U	B	H	I	L	A	I	U
T	K	O	C	R	A	Q	N	T	R	L	N
E	I	R	O	N	S	T	E	E	L	S	J
E	N	A	N	O	E	P	I	T	L	R	Y
G	A	N	U	J	D	R	A	G	D	T	A
N	T	A	R	P	O	A	P	U	E	P	Y
A	S	N	A	E	N	J	D	I	Y	S	K
S	M	H	V	L	I	A	J	H	S	K	G

1. Textiles, sugar, vegetable oil and plantation industries deriving raw materials from agriculture are called...
2. The basic raw material for sugar industry.
3. This fibre is also known as the 'Golden Fibre'.
4. Iron-ore, coking coal, and limestone are the chief raw materials of this industry.
5. A public sector steel plant located in Chhattisgarh.
6. Railway diesel engines are manufactured in Uttar Pradesh at this place.





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## LIFELINES OF NATIONAL ECONOMY

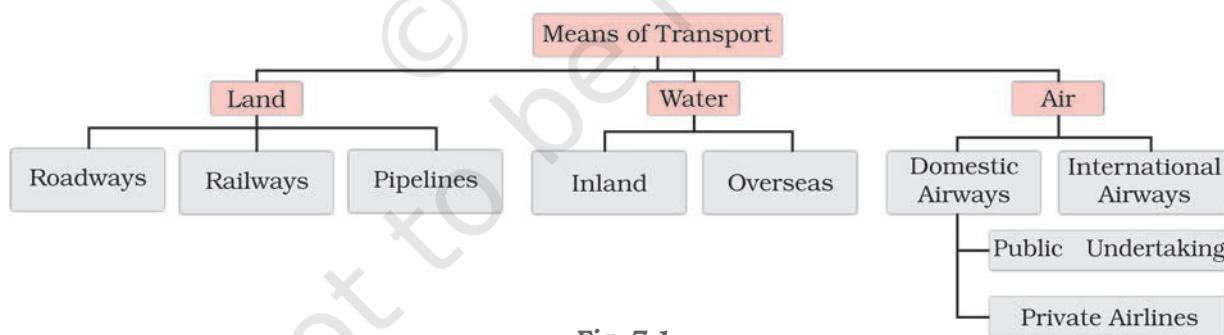
We use different materials and services in our daily life. Some of these are available in our immediate surroundings, while other requirements are met by bringing things from other places. Goods and services do not move from supply locales to demand locales on their own. The movement of these goods and services from their supply locations to demand locations necessitates the need for transport. Some people are engaged in facilitating these movements. These are known to be traders who make the products come to the consumers by transportation. Thus, the pace of development of a country depends upon the production of goods and services as well as their movement over space. Therefore, efficient means of transport are prerequisites for fast development.

Movement of these goods and services can be over three important domains of our earth i.e. land, water and air. Based on these, transport can also be classified into land, water and air transport.

the help of equally developed communication system. Therefore, transport, communication and trade are complementary to each other.

Today, India is well-linked with the rest of the world despite its vast size, diversity and linguistic and socio-cultural plurality. Railways, airways, waterways, newspapers, radio, television, cinema and internet, etc. have been contributing to its socio-economic progress in many ways. The trades from local to international levels have added to the vitality of its economy. It has enriched our life and added substantially to growing amenities and facilities for the comforts of life.

In this chapter, you will see how modern means of transport and communication serve as lifelines of our nation and its modern economy. It is thus, evident that a dense and efficient network of transport and communication is a prerequisite for local, national and global trade of today.



**Fig. 7.1**

For a long time, trade and transport were restricted to a limited space. With the development in science and technology, the area of influence of trade and transport expanded far and wide. Today, the world has been converted into a large village with the help of efficient and fast moving transport. Transport has been able to achieve this with

### TRANSPORT

#### Roadways

India has second largest road networks in the world, aggregating to about 62.16 lakh km (2020–21). In India, roadways have preceded railways. They still have an edge over railways in view of the ease with which they can be built

and maintained. The growing importance of road transport vis-à-vis rail transport is rooted in the following reasons; (a) construction cost of roads is much lower than that of railway lines, (b) roads can traverse comparatively more dissected and undulating topography, (c) roads can negotiate higher gradients of slopes and as such can traverse mountains such as the Himalayas, (d) road transport is economical in transportation of few persons and relatively smaller amount of goods over short distances, (e) it also provides door-to-door service, thus the cost of loading and unloading is much lower, (f) road transport is also used as a feeder to other modes of transport such as they provide a link between railway stations, air and sea ports.

In India, roads are classified in the following six classes according to their capacity. Look at the map of the National Highways and find out about the significant role played by these roads.

- **Golden Quadrilateral Super Highways:** The government has launched a major road development project linking Delhi-Kolkata-Chennai-Mumbai and Delhi by six-lane Super Highways. The North-South corridors linking Srinagar (Jammu & Kashmir) and Kanniyakumari (Tamil Nadu), and East-West Corridor connecting Silchar (Assam) and Porbander (Gujarat) are part of this project. The major objective of these Super Highways is to reduce the time and distance between the mega cities of India. These highway projects are being implemented by the National Highway Authority of India (NHAI).
- **National Highways:** National Highways link extreme parts of the country. These are the primary road systems. A number of major National Highways run in North-South and East-West directions.
- **State Highways:** Roads linking a state capital with different district headquarters are known as State Highways.

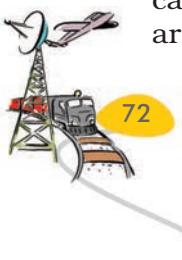


Fig. 7.2: Ahmedabad- Vadodara Expressway

#### Activity

Collect information of National Highway numbers (old and new) from the website [morth.nic.in/national-highway-details](http://morth.nic.in/national-highway-details). The historical Sher-Shah Suri Marg between Delhi and Amritsar is known by which National Highway ?

- **District Roads:** These roads connect the district headquarters with other places of the district.
- **Other Roads:** Rural roads, which link rural areas and villages with towns, are classified under this category. These roads received special impetus under the *Pradhan Mantri Grameen Sadak Yojana*. Under this scheme special provisions are made so that every village in the country is linked to a major town in the country by an all season motorable road.
- **Border Roads:** Apart from these, Border Roads Organisation a Government of India undertaking constructs and maintains roads in the bordering areas of the country. This organisation was established in 1960 for the development of the roads of strategic importance in the northern and north-eastern border areas. These roads have improved accessibility in areas of difficult terrain and have helped in the economic development of these area.





## **India: National Highways**

## LIFELINES OF NATIONAL ECONOMY

### Do you Know?

The World's longest Highway tunnel-Atal Tunnel (9.02 Km) has been built by Border Road Organisation. This tunnel connects Manali to Lahul-Spiti valley throughout the year. Earlier the valley was cut off for about 6 months each year owing to heavy snowfall. The tunnel is built with ultra-modern specifications in the Pir Panjal range of Himalayas at an altitude of 3000 metres from the Mean Sea Level (MSL).

**Source:** <http://www.bro.gov.in/pagefimg.asp?imid=144>, And PIBdelhi03October2020



*Fig. 7.3: Hilly Tracts*



*Fig. 7.4: Traffic on north-eastern border road (Arunachal Pradesh)*

Roads can also be classified on the basis of the type of material used for their construction such as metalled and unmetalled roads. Metalled roads may be made of cement, concrete or even bitumen or coal, therefore,

and narrow. However, in recent years fast development of road network has taken place in different parts of the country

### Railways

Railways are the principal mode of transportation for freight and passengers in India. Railways also make it possible for people to conduct multifarious activities like business, sightseeing, pilgrimage along with transportation of goods over longer distances. Apart from an important means of transport the Indian Railways have been a great integrating force for more than 150 years. Railways in India bind the economic life of the country as well as accelerate the development of the industry and agriculture.

The Indian Railways is the largest public sector undertaking in the country. The first train steamed off from Mumbai to Thane in 1853, covering a distance of 34 km.

The Indian Railway is now reorganised into 16 zones.

#### Activity

Find out the current Railway zones and their headquarters. Also locate the headquarters of Railway zones on the map of India.

The distribution pattern of the Railway network in the country has been largely influenced by physiographic, economic and administrative factors. The northern plains with their vast level land, high population density and rich agricultural resources provided the most favourable condition for their growth. However, a large number of rivers requiring construction of bridges across their wide beds posed some obstacles. In the hilly terrains of the peninsular region, railway tracts are laid through low hills, gaps or tunnels. The Himalayan mountainous regions too are unfavourable for the construction of railway lines due to high relief, sparse population and lack of economic opportunities. Likewise, it was difficult to lay railway lines on



**Table 7.1: India: Railway Track**

The Indian Railway network runs on multiple gauge operations extending over 67,956 km.

Gauge in metres	Route (Km)
Broad Gauge (1.676)	63950
Metre Gauge (1.000)	2,402
Narrow Gauge (0.762 and 0.610)	1,604
<b>Total</b>	<b>67,956</b>

**Source:** Railway Yearbook 2019–20, Ministry of Railways, Government of India.

Website: [www.indianrailways.gov.in](http://www.indianrailways.gov.in)

the sandy plain of western Rajasthan, swamps of Gujarat, forested tracks of Madhya Pradesh, Chhattisgarh, Odisha and Jharkhand. The contiguous stretch of Sahyadri could be crossed only through gaps or passes (Ghats). In recent times, the development of the Konkan railway along the west coast has facilitated the movement of passengers and goods in this most important economic region of India. It has also faced a number of problem such as sinking of track in some stretches and landslides.

Today, the railways have become more important in our national economy than all other means of transport put together. However, rail transport suffers from certain problems as well. Many passengers travel without tickets. Thefts and damaging of railway property has not yet stopped completely. People stop the trains, pull the chain unnecessarily and this causes heavy damage to the railway. Think over it, how we can help our railway in running as per the scheduled time?

### Pipelines

Pipeline transport network is a new arrival on the transportation map of India. In the past, these were used to transport water to cities and industries. Now, these are used for transporting crude oil, petroleum products and natural gas from oil and natural gas fields to refineries, fertilizer factories and big thermal power plants. Solids can also be transported through a pipeline when converted into slurry. The far inland locations of refineries like Barauni, Mathura, Panipat and gas based fertilizer plants could be thought of only because of pipelines. Initial cost of laying pipelines is high but

subsequent running costs are minimal. It rules out trans-shipment losses or delays.

There are three important networks of pipeline transportation in the country.

- From oil field in upper Assam to Kanpur (Uttar Pradesh), via Guwahati, Barauni and Allahabad. It has branches from Barauni to Haldia, via Rajbandh, Rajbandh to Maurigram and Guwahati to Siliguri.
- From Salaya in Gujarat to Jalandhar in Punjab, via Viramgam, Mathura, Delhi and Sonipat. It has branches to connect Koyali (near Vadodara, Gujarat) Chakshu and other places.
- The first 1,700 km long Hazira-Vijaipur-Jagdishpur (HVJ) cross country gas pipeline, linked Mumbai High and Bassein gas fields with various fertilizer, power and industrial complexes in western and northern India. Overall, India's gas pipeline infrastructure has expanded from 1,700 km to 18,500 km of cross-country pipelines.

### Waterways

Since the ancient period, India was one of the seafaring countries. Its seamen sailed far and near, thus, carrying and spreading Indian commerce and culture. Waterways are the cheapest means of transport. They are most suitable for carrying heavy and bulky goods. It is a fuel-efficient and environment friendly mode of transport. India has inland navigation waterways of 14,500 km in length. Out of these only 5685 km are navigable by mechanised vessels. The following waterways have been declared as the National Waterways by the Government.





### Activity

Railway line has been extended from Banihal to Baramula in the Kashmir Valley. Locate these two towns on the map of India.



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CONTEMPORARY INDIA – II



**Fig. 7.5:** Inland waterways widely used in north-eastern states

- The Ganga river between Allahabad and Haldia (1620 km)-N.W. No.1
- The Brahmaputra river between Sadiya and Dhubri (891 km)-N.W. No.2
- The West-Coast Canal in Kerala (Kottapurma-Kollam, Udyogamandal and Champakkara canals-205 km) – N.W. No.3
- Specified stretches of Godavari and Krishna rivers along with Kakinada Puducherry stretch of canals (1078 km) – N.W. No.4
- Specified stretches of river Brahmani along with Matai river, delta channels of Mahanadi and Brahmani rivers and East Coast Canal (588 km) – N.W. No.5

There are some other inland water ways on which substantial transportation takes place. These are Mandavi, Zuari and Cumberjua, Sunderbans, Barak and backwaters of Kerala.

Apart from these, India's trade with foreign countries is carried from the ports located along the coast. 95 per cent of the country's trade volume (68 per cent in terms of value) is moved by sea.

#### Major Sea Ports

With a long coastline of 7,516.6 km, India is dotted with 12 major and 200 notified non-majors (minor/intermediate) ports. These major ports handle 95 per cent of India's foreign trade.

Kandla in Kuchchh was the first port developed soon after Independence to ease the volume of trade on the Mumbai port, in the wake of loss of Karachi port to Pakistan after the Partition. Kandla also known as the

Deendayal Port, is a tidal port. It caters to the convenient handling of exports and imports of highly productive granary and industrial belt stretching across UT of Jammu and Kashmir, and the states of Himachal Pradesh, Punjab, Haryana, Rajasthan and Gujarat.



**Fig. 7.6:** Trucks being driven into the vessel at Mumbai port

Mumbai is the biggest port with a spacious natural and well-sheltered harbour. The Jawaharlal Nehru port was planned with a view to decongest the Mumbai port and serve as a hub port for this region. Marmagao port (Goa) is the premier iron ore exporting port of the country. This port accounts for about fifty per cent of India's iron ore export. New Mangalore port, located in Karnataka caters to the export of iron ore concentrates from Kudremukh mines. Kochchi is the extreme south-western port, located at the entrance of a lagoon with a natural harbour.



**Fig. 7.7:** Tanker discharging crude oil at New Mangalore port

Moving along the east coast, you would see the extreme south-eastern port of Tuticorin, in Tamil Nadu. This port has a natural harbour and rich hinterland. Thus, it has a flourishing trade handling of a large variety of cargoes to

even our neighbouring countries like Sri Lanka, Maldives, etc. and the coastal regions of India. Chennai is one of the oldest artificial ports of the country. It is ranked next to Mumbai in terms of the volume of trade and cargo. Vishakhapatnam is the deepest landlocked and well-protected port. This port was, originally, conceived as an outlet for iron ore exports. Paradwip port located in Odisha, specialises in the export of iron ore. Kolkata is an inland riverine port. This port serves a very large and rich hinterland of Ganga-Brahmaputra basin. Being a tidal port, it requires constant dredging of Hoogly. Haldia port was developed as a subsidiary port, in order to relieve growing pressure on the Kolkata port.



*Fig. 7.8: Handling of oversize cargo at Tuticorin port*

#### Airways

The air travel, today, is the fastest, most comfortable and prestigious mode of transport. It can cover very difficult



*Why is air travel preferred in the north-eastern states?*

*Fig. 7.9*

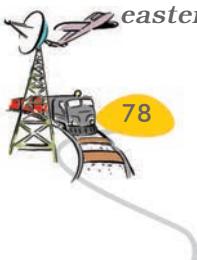
terrains like high mountains, dreary deserts, dense forests and also long oceanic stretches with great ease. Think of the north-eastern part of the country, marked with the presence of big rivers, dissected relief, dense forests and frequent floods and international frontiers, etc. in the absence of air transport. Air travel has made access easier.

Pawan Hans Helicopters Ltd. provides helicopter services to Oil and Natural Gas Corporation in its off-shore operations, to inaccessible areas and difficult terrains like the north-eastern states and the interior parts of Jammu and Kashmir, Himachal Pradesh and Uttarakhand.

Air travel is not within the reach of the common people. It is only in the north-eastern states that special provisions are made to extend the services to the common people.

#### Communication

Ever since humans appeared on the earth, they have used different means of communication. But, the pace of change, has been rapid in modern times. Long distance communication is far easier without physical movement of the communicator or receiver. Personal communication and mass communication including television, radio, press, films, etc. are the major means of communication in the country. The Indian postal network is the largest in the world. It handles parcels as well as personal written communications. Cards and envelopes are considered first-class mail and are airlifted between stations covering both land and air. The second-class mail includes book packets, registered newspapers and periodicals. They are carried by surface mail, covering land and water transport. To facilitate quick delivery of mails in large towns and cities, six mail channels have been introduced recently. They are called Rajdhani Channel, Metro Channel, Green Channel, Business Channel, Bulk Mail Channel and Periodical Channel.





India: Major Ports and Some International Airports

LIFELINES OF NATIONAL ECONOMY

## Do you know?

Digital India is an umbrella programme to prepare India for a knowledge based transformation. The focus of Digital India Programme is on being transformative to realise – IT (Indian Talent) + IT (Information Technology)=IT (India Tomorrow) and is on making technology central to enabling change.



**Fig. 7.10 : Emergency call box on NH-8**

India has one of the largest telecom networks in Asia. Excluding urban places more than two-thirds of the villages in India have already been covered with Subscriber Trunk Dialling (STD) telephone facility. In order to strengthen the flow of information from the grassroot to the higher level, the government has made special provision to extend twenty-four hours STD facility to every village in the country. There is a uniform rate of STD facilities all over India. It has been made possible by integrating the development in space technology with communication technology.

Mass communication provides entertainment and creates awareness among people about various national programmes and policies. It includes radio, television, newspapers, magazines, books and films. All India Radio (Akashwani) broadcasts a variety of programmes in national, regional and local languages for various categories of people, spread over different parts of the country. Doordarshan, the national television channel

of India, is one of the largest terrestrial networks in the world. It broadcasts a variety of programmes from entertainment, educational to sports, etc. for people of different age groups.

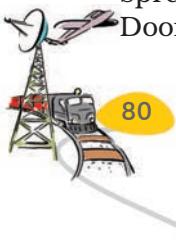
India publishes a large number of newspapers and periodicals annually. They are of different types depending upon their periodicity. Newspapers are published in about 100 languages and dialects. Did you know that the largest number of newspapers published in the country are in Hindi, followed by English and Urdu? India is the largest producer of feature films in the world. It produces short films; video feature films and video short films. The Central Board of Film Certification is the authority to certify both Indian and foreign films.

## International Trade

The exchange of goods among people, states and countries is referred to as trade. The market is the place where such exchanges take place. Trade between two countries is called international trade. It may take place through sea, air or land routes. While local trade is carried in cities, towns and villages, state level trade is carried between two or more states. Advancement of international trade of a country is an index to its economic prosperity. It is, therefore, considered the economic barometer for a country.

As the resources are space bound, no country can survive without international trade. Export and import are the components of trade. The balance of trade of a country is the difference between its export and import. When the value of export exceeds the value of imports, it is called a favourable balance of trade. On the contrary, if the value of imports exceeds the value of exports, it is termed as unfavourable balance of trade.

India has trade relations with all the major trading blocks and all geographical regions of the world. The commodities exported from India to other countries include gems and jewellery, chemicals and related products, agriculture and allied products, etc.



The commodities imported to India include petroleum crude and products, gems and jewellery, chemicals and related products, base metals, electronic items, machinery, agriculture and allied products. India has emerged as a software giant at the international level and it is earning large foreign exchange through the export of information technology.

## Tourism as a Trade

Tourism in India has grown substantially over the last three decades.

More than 15 million people are directly engaged in the tourism industry. Tourism also promotes national integration, provides support to local handicrafts and cultural pursuits. It also helps in the development of international understanding about our culture and heritage. Foreign tourists visit India for heritage tourism, eco tourism,

adventure tourism, cultural tourism, medical tourism and business tourism.

There is a vast potential for development of tourism in all parts of the country. Efforts are being made to promote different types of tourism for this upcoming industry.

## - Activity

On the map of India show important tourist places of your State/UT and its connectivity with other parts of the country by railways/ roadways/airways.

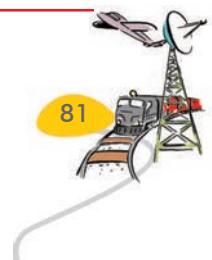
**Discuss in the class:**

- What type of tourism may be developed in your state/UT and why?
  - Which areas in your state/UT you find more attractive for development of tourism and why?
  - How tourism may be helpful for the economic development of a region adopting sustainable development approach?



*Prepare a project on the heritage tourism in India.*

**\*Source:** Annual Report 2016–17, Ministry of Commerce and Industry, Government of India.



**1.** Multiple choice questions.

- (i) Which two of the following extreme locations are connected by the east-west corridor?
 

(a) Mumbai and Nagpur	(c) Mumbai and Kolkata
(b) Silchar and Porbandar	(d) Nagpur and Siliguri
- (ii) Which mode of transportation reduces trans-shipment losses and delays?
 

(a) Railways	(c) Pipeline
(b) Roadways	(d) Waterways
- (iii) Which one of the following states is not connected with the H.V.J. pipeline?
 

(a) Madhya Pradesh	(c) Gujarat
(b) Maharashtra	(d) Uttar Pradesh
- (iv) Which one of the following ports is the deepest land-locked and well-protected port along the east coast?
 

(a) Chennai	(c) Tuticorin
(b) Paradwip	(d) Vishakhapatnam
- (v) Which one of the following is the most important modes of transportation in India?
 

(a) Pipeline	(c) Roadways
(b) Railways	(d) Airways
- (vi) Which one of the following terms is used to describe trade between two or more countries?
 

(a) Internal trade	(c) External trade
(b) International trade	(d) Local trade

**2.** Answer the following questions in about 30 words.

- (i) State any three merits of roadways.
- (ii) Where and why is rail transport the most convenient means of transportation?
- (iii) What is the significance of the border roads?
- (iv) What is meant by trade? What is the difference between international and local trade?

**3.** Answer the following questions in about 120 words.

- (i) Why are the means of transportation and communication called the lifelines of a nation and its economy?
- (ii) Write a note on the changing nature of the international trade in the last fifteen years.

### **QUIZ DRIVE**

1. Northern terminal of the North-south corridor.
2. The name of National Highway No.2.
3. The headquarter of the southern railway zone.
4. The rail gauge with a track width of 1.676 m.
5. The southern terminal of the National Highway No.7.
6. A Riverine Port.
7. Busiest railway junction in Northern India.



## ACTIVITY

Start your search vertically, horizontally or diagonally and reach various destinations across the country!

S	H	E	R	S	H	A	H	S	U	R	I	M	A	R	G
A	R	T	P	R	N	X	E	L	A	T	A	D	L	A	Y
J	M	M	X	I	P	O	R	A	Y	M	P	G	H	T	X
Y	C	H	E	N	N	N	A	I	I	K	M	C	A	I	M
O	D	C	D	A	L	M	C	S	O	T	P	O	R	C	P
A	P	T	R	G	S	K	J	M	J	L	E	A	N	E	R
R	A	E	T	A	J	P	O	R	M	W	M	A	S	X	O
I	L	S	B	R	O	A	D	G	A	U	G	E	L	O	T
A	S	N	L	C	M	E	C	U	K	Z	M	A	A	J	E
L	M	U	G	H	A	L	S	A	R	A	I	B	S	N	A
G	O	E	T	V	R	A	Y	F	T	O	R	E	A	J	M
K	Q	A	I	P	M	N	Y	R	Y	A	Y	H	L	I	N
Q	K	O	L	K	A	T	A	E	U	I	T	W	B	E	A
N	I	T	N	K	D	E	M	O	U	R	P	N	P	J	D

## APPENDIX-I

### Websites you can see

Bombay Natural History Society: <http://www.bnhs.org/>

Birding in India and South Asia: <http://www.birding.in/>

Website of Project Tiger: <http://projecttiger.nic.in/>

Nature Conservation Foundation: <http://www.ncf-india.org/>

Wildlife Conservation Society of India: <http://www.wildlife.in/>

Wildlife Trust of India: <http://www.wildlifetrustofindia.org/>

Kalpavriksh Environment Action Group: <http://www.kalpavriksh.org/>

Down to Earth Magazine: <http://www.downtoearth.org.in/>

Centre for Environment Education, India: <http://www.ceeindia.org/cee/index.html>

World Steel Association : <http://www.worldsteel.org>



## APPENDIX-II

<b>Steel Plants</b>	<b>Year of Establishment</b>	<b>Collaborating Country</b>	<b>Location</b>
IISCO	1870-1913 (Private initially)	(Nationalised in 1972)	Kulti and Burnpur (W.B.)
TISCO	1907 (Private ownership)	Jamshedji Tata	Jamshedpur (Jharkhand)
VISL	1923 Private as MISCO	Nationalised later	Bhadrapur (Karnataka)
Bhilai	1959 (Public Sector)	Soviet Union	Bhilai (M.P.)
Bokaro	1972 (Public Sector)	Soviet Union	Bokaro (Jharkhand)
Durgapur	1959 (Public Sector)	U.K.	Durgapur (W.B.)
Rourkela	— (Public Sector)	Germany	Rourkela (Odisha)
Vishakhapatnam	— (Public Sector)	—	Vishakhapatnam Andhra Pradesh
Salem	— (Public Sector)	—	Salem (T. Nadu)
Vijay Nagar	— Public Sector	—	Karnataka



# GLOSSARY

**Anticline:** A fold in sedimentary strata that resembles an arch.

**Gross Domestic Product:** It is a monetary measure of the value of goods and services produced within a natural economy at a given period of time. Normally it is one year.

**Gross Value Added (GVA):** The GVA is estimated from GDP by adding subsidies on production and subtracting indirect taxes.

**Geologist:** A scientist who studies the composition, structure and history of the earth.

**Geothermal Gradient:** The gradual increase in temperature with depth in the crust. The average is 30°C per kilometer in the upper crust.

**Humus:** Dead and decayed organic matter adds to the fertility of the top soil.

**Igneous Rocks:** Rocks which have solidified from molten magma.

**Manganese Nodules:** A type of sediment scattered on the ocean floor, consisting mainly of manganese and iron, and usually containing small amounts of copper, nickel and cobalt.

**Metamorphic Rocks:** Rocks which were originally igneous or sedimentary, but have changed in character and appearance.

**Oil Trap:** A geological structure that allows for significant amounts of oil and gas to accumulate.

**Rock:** A consolidated mixture of minerals

**Sedimentary Rocks:** Rocks which have been deposited as beds and layers of sediments.

## **NOTES**

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## NOTES

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# **INDIA**

# **PHYSICAL ENVIRONMENT**

TEXTBOOK IN GEOGRAPHY FOR CLASS XI



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# **INDIA**

# **PHYSICAL ENVIRONMENT**

TEXTBOOK IN GEOGRAPHY FOR CLASS XI



**राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्**  
**NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING**

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## FOREWORD

The National Curriculum Framework (NCF), 2005, recommends that children's life at school must be linked to their life outside the school. This principle marks a departure from the legacy of bookish learning which continues to shape our system and causes a gap between the school, home and community. The syllabi and textbooks developed on the basis of NCF signify an attempt to implement this basic idea. They also attempt to discourage rote learning and the maintenance of sharp boundaries between different subject areas. We hope these measures will take us significantly further in the direction of a child-centred system of education outlined in the National Policy on Education (1986).

The success of this effort depends on the steps that school principals and teachers will take to encourage children to reflect on their own learning and to pursue imaginative activities and questions. We must recognise that, given space, time and freedom, children generate new knowledge by engaging with the information passed on to them by adults. Treating the prescribed textbook as the sole basis of examination is one of the key reasons why other resources and sites of learning are ignored. Inculcating creativity and initiative is possible if we perceive and treat children as participants in learning, not as receivers of a fixed body of knowledge.

These aims imply considerable change in school routines and mode of functioning. Flexibility in the daily time-table is as necessary as rigour in implementing the annual calendar so that the required number of teaching days are actually devoted to teaching. The methods used for teaching and evaluation will also determine how effective this textbook proves for making children's life at school a happy experience, rather than a source of stress or boredom. Syllabus designers have tried to address the problem of curricular burden by restructuring and reorienting knowledge at different stages with greater consideration for child psychology and the time available for teaching. The textbook attempts to enhance this endeavour by giving higher priority and space to opportunities for contemplation and wondering, discussion in small groups, and activities requiring hands-on experience.

The National Council of Educational Research and Training (NCERT) appreciates the hard work done by the textbook development committee responsible for this book. We wish to thank the Chairperson of the advisory committee for textbooks in Social Sciences, at the higher secondary level, Professor Hari Vasudevan and the Chief Advisor for this book, Professor M.H. Qureshi for guiding the work of this committee. Several teachers contributed to the development of this textbook; we are grateful to their principals for making this possible. We are indebted to the institutions and organisations

which have generously permitted us to draw upon their resources, material and personnel. We are especially grateful to the members of the National Monitoring Committee, appointed by the Department of Secondary and Higher Education, Ministry of Human Resource Development under the Chairpersonship of Professor Mrinal Miri and Professor G.P. Deshpande, for their valuable time and contribution. As an organisation committed to systemic reform and continuous improvement in the quality of its products, NCERT welcomes comments and suggestions which will enable us to undertake further revision and refinement.

New Delhi  
20 December 2005

*Director*  
National Council of Educational  
Research and Training

## **RATIONALISATION OF CONTENT IN THE TEXTBOOKS**

In view of the COVID-19 pandemic, it is imperative to reduce content load on students. The National Education Policy 2020, also emphasises reducing the content load and providing opportunities for experiential learning with creative mindset. In this background, the NCERT has undertaken the exercise to rationalise the textbooks across all classes. Learning Outcomes already developed by the NCERT across classes have been taken into consideration in this exercise.

**Contents of the textbooks have been rationalised in view of the following:**

- Overlapping with similar content included in other subject areas in the same class
- Similar content included in the lower or higher class in the same subject
- Difficulty level
- Content, which is easily accessible to students without much interventions from teachers and can be learned by children through self-learning or peer-learning
- Content, which is irrelevant in the present context

**This present edition, is a reformatted version after carrying out the changes given above.**

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The Council is thankful to the Survey of India for Certification of Maps given in the textbook. It also gratefully acknowledges the support of individuals and organisations as listed below for providing various photographs used in this textbook — M.H. Qureshi, *Professor*, CSRD, JNU for Figure 5.4 and 5.5; B.S. Butola, *Professor*, CSRD, JNU for Figure 6.1, 6.5, 6.7 and 6.9; M.V. Srinivasan, *Lecturer*, DESSH, NCERT for Figure 6.3; ITDC/Ministry of Tourism, Government of India for Figure 2.1, 2.3, 2.8, 2.5, 2.6, 2.7, 2.8, 3.1, 3.3, 4.4, 5.7; Ministry of Environment and Forest, Government of India for Figure 5.1 and 5.6; *Social Science Textbook* for Class VII, Part II (NCERT, 2005), for Figure 5.3 and *Social Science Textbook* for Class VIII, Part II (NCERT, 2005), for Figure 2.10.

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**The following are applicable to all the maps of India used in this book**

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1. The responsibility for the correctness of internal details rests with the publisher.
2. The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.
3. The administrative headquarters of Chandigarh, Haryana and Punjab are at Chandigarh.
4. The interstate boundaries amongst Arunachal Pradesh, Assam and Meghalaya shown on this map are as interpreted from the "North-Eastern Areas (Reorganisation) Act.1971," but have yet to be verified.
5. The external boundaries and coastlines of India agree with the Record/Master Copy certified by Survey of India.
6. The State boundaries between Uttaranchal and Uttar Pradesh, Bihar and Jharkhand, and Chhattisgarh and Madhya Pradesh have not been verified by the Governments concerned.
7. The spellings of names in this map, have been taken from various sources.

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# **CONSTITUTION OF INDIA**

## **Part III (Articles 12 – 35)**

(Subject to certain conditions, some exceptions  
and reasonable restrictions)

guarantees these

## **Fundamental Rights**

### **Right to Equality**

- before law and equal protection of laws;
- irrespective of religion, race, caste, sex or place of birth;
- of opportunity in public employment;
- by abolition of untouchability and titles.

### **Right to Freedom**

- of expression, assembly, association, movement, residence and profession;
- of certain protections in respect of conviction for offences;
- of protection of life and personal liberty;
- of free and compulsory education for children between the age of six and fourteen years;
- of protection against arrest and detention in certain cases.

### **Right against Exploitation**

- for prohibition of traffic in human beings and forced labour;
- for prohibition of employment of children in hazardous jobs.

### **Right to Freedom of Religion**

- freedom of conscience and free profession, practice and propagation of religion;
- freedom to manage religious affairs;
- freedom as to payment of taxes for promotion of any particular religion;
- freedom as to attendance at religious instruction or religious worship in educational institutions wholly maintained by the State.

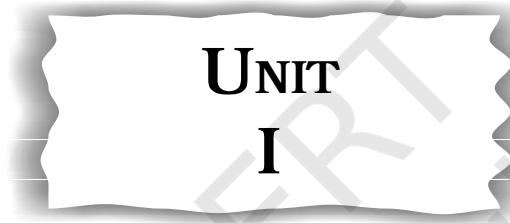
### **Cultural and Educational Rights**

- for protection of interests of minorities to conserve their language, script and culture;
- for minorities to establish and administer educational institutions of their choice.

### **Right to Constitutional Remedies**

- by issuance of directions or orders or writs by the Supreme Court and High Courts for enforcement of these Fundamental Rights.





## ***INTRODUCTION***

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---

*This unit deals with*

- *Location — space relations and India's place in the world*

## Do you Remember?

### CHAPTER

1



11094CH01

## INDIA – LOCATION

You have already seen the map of India in the previous classes. Now you closely examine the map of India (Figure 1.1). Mark the southernmost and northernmost latitudes and the easternmost and westernmost longitudes.

The mainland of India, extends from Kashmir in the north to Kanniyakumari in the south and Arunachal Pradesh in the east to Gujarat in the west. India's territorial limit further extends towards the sea upto 12 nautical miles (about 21.9 km) from the coast. (See the box for conversion).

Statute mile	=	63,360 inches
Nautical mile	=	72,960 inches
1 Statute mile	=	about 1.6 km (1.584 km)
1 Nautical mile	=	about 1.8 km (1.852 km)

Our southern boundary extends upto 6°45' N latitude in the Bay of Bengal. Let us try to analyse the implications of having such a vast longitudinal and latitudinal extent.

If you work out the latitudinal and longitudinal extent of India, they are roughly about 30 degrees, whereas the actual distance measured from north to south extremity is 3,214 km, and that from east to west is only 2,933 km. What is the reason for this difference? Consult Chapter 3 on the topic Latitude, Longitude and Time in the book

There is a general understanding among the countries of the world to select the standard meridian in multiples of 7°30' of longitude. That is why 82°30' E has been selected as the 'standard meridian' of India. Indian Standard Time is ahead of Greenwich Mean Time by 5 hours and 30 minutes.

There are some countries where there are more than one standard meridian due to their vast east-to-west extent. For example, the USA has seven time zones.

*Practical Work in Geography – Part I (NCERT, 2006)* to find out.

This difference is based on the fact that the distance between two longitudes decreases towards the poles whereas the distance between two latitudes remains the same everywhere. Find out the distance between two latitudes?

From the values of latitude, it is understood that the southern part of the country lies within the tropics and the northern part lies in the sub-tropical zone or the warm temperate zone. This location is responsible for large variations in land forms, climate, soil types and natural vegetation in the country.

Now, let us observe the longitudinal extent and its implications on the Indian people. From the values of longitude, it is quite discernible that there is a variation of nearly 30 degrees, which causes a time difference of nearly two hours between the easternmost and the westernmost parts of our country. You are familiar with the concept of Indian Standard Time (IST). What is the use of the standard meridian? While the sun rises in the northeastern states about two hours earlier as compared to Jaisalmer, the watches in Dibrugarh, Imphal in the east and Jaisalmer, Bhopal or Chennai in the other parts of India show the same time. Why does this happen?



Figure 1.1 : India : Administrative Divisions

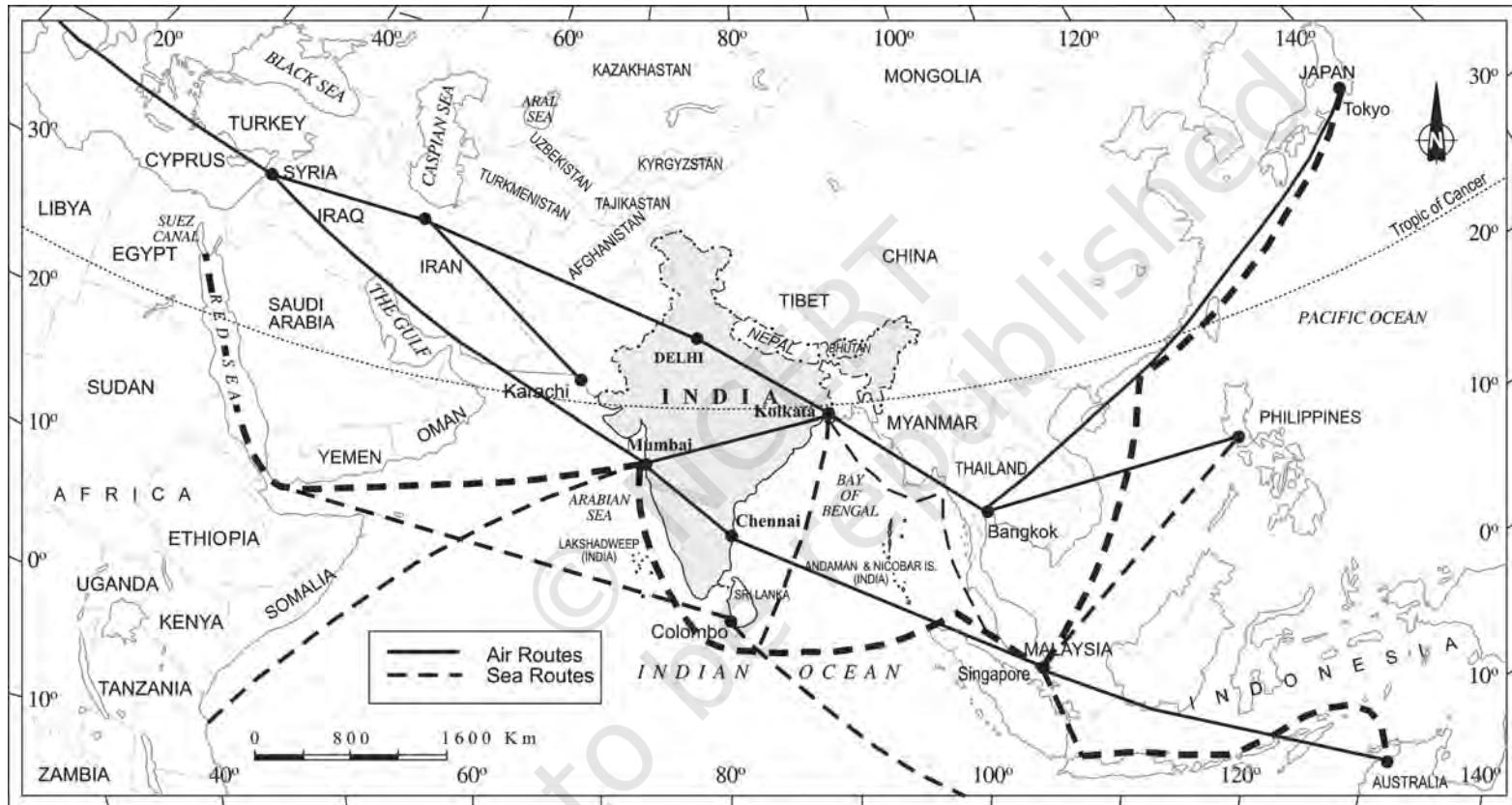


Figure 1.2 : Location of India in the Eastern World

Name a few places in India through which the standard meridian passes?

India with its area of 3.28 million sq. km accounts for 2.4 per cent of the world's land surface area and stands as the seventh largest country in the world. Find out the names of the countries which are larger than India.

### SIZE

The size of India has endowed her with great physical diversity. Thus, you may appreciate the presence of lofty mountains in the north; large rivers such as Ganga, Brahmaputra, Mahanadi, Krishna, Godavari and Kaveri; green forested hills in northeast and south India; and the vast sandy expanse of *Marusthali*. You may further appreciate that bounded by the Himalayas in the north, Hindukush and Sulaiman ranges in the northwest, Purvachal hills in the north-east and by the large expanse of the Indian ocean in the south, it forms a great geographic entity known as the *Indian subcontinent*. It includes the countries — Pakistan, Nepal, Bhutan, Bangladesh and India. The Himalayas, together with other ranges, have acted as a formidable physical barrier in the past. Except for a few mountain passes such as the Khyber, the Bolan, the Shipkila, the Nathula, the Bomdila, etc. it was difficult to cross it. It has contributed towards the evolving of a unique regional identity of the Indian subcontinent.

By referring to the physical map of India you can now describe the physical variations which you would come across while travelling from Kashmir to Kanniyakumari and from Jaisalmer in Rajasthan to Imphal in Manipur.

Peninsular part of India extends towards the Indian Ocean. This has provided the country with a coastline of 6,100 km in the mainland and 7,517 km in the entire

geographical coast of the mainland plus the island groups Andaman and Nicobar located in the Bay of Bengal and the Lakshadweep in the Arabian Sea. Thus India, as a country, is a physically diverse land providing occurrence of varied resources.

### Do you Remember?

School Bhuvan NCERT is a portal providing map-based learning to bring awareness among the students about country's natural resources, environment and their role in sustainable development. It is an initiative of Bhuvan-NRSC/ISRO, based on NCERT syllabus. You can explore various maps of India on [http://bhuvan-app1.nrsc.gov.in/mhrd\\_ncert/](http://bhuvan-app1.nrsc.gov.in/mhrd_ncert/)

### INDIA AND ITS NEIGHBOURS

Examine the location map of India (Figure 1.2). You will notice that India is located in the south-central part of the continent of Asia, bordering the Indian ocean and its two arms extending in the form of Bay of Bengal and the Arabian Sea. This maritime location of Peninsular India has provided links to its neighbouring regions through the sea and air routes.

Prepare a list of India's neighbouring countries by consulting the map.

Sri Lanka and Maldives are the two island countries located in the Indian Ocean, which are our neighbours. Sri Lanka is separated from India by the Gulf of Mannar and Palk Strait.

**Differentiate between a Gulf and a Strait.**

Do you think that physical barrier is a hindrance in interaction with our neighbouring countries in modern times? Give some examples how we have overcome these difficulties in the present day.

**Activity:** Observe the map of India on an atlas/School Bhuvan NCERT portal and collect information about states/districts/villages located near the international border of India.

**EXERCISES**

1. Choose the right answer from the four alternatives given below.
  - (i) Which one of the following latitudinal extent is relevant for the extent of India's area?
 

(a) 8°41'N - 35°7'N	(c) 8°4'N - 35°6'N
(b) 8°4'N - 37°6'N	(d) 6°45'N - 37°6'N
  - (ii) Which one of the following countries shares the longest land frontier with India?
 

(a) Bangladesh	(c) Pakistan
(b) China	(d) Myanmar
  - (iii) Which one of the following countries is larger in area than India?
 

(a) China	(c) France
(b) Egypt	(d) Iran
  - (iv) Which one of the following longitudes is the standard meridian for India?
 

(a) 69°30'E	(c) 75°30'E
(b) 82°30'E	(d) 90°30'E
2. Answer the following questions in about 30 words.
  - (i) Does India need to have more than one standard time? If yes, why do you think so?
  - (ii) What are the implications of India having a long coastline?
  - (iii) How is the latitudinal spread of India advantageous to her?
  - (iv) While the sun rises earlier in the east, say Nagaland and also sets earlier, how do the watches at Kohima and New Delhi show the same time?

**Project/Activity**

*Activity based on Appendix I (Teachers may help in the exercises by explaining and getting it done by the students).*

- (i) On a graph paper, plot the number of districts in Madhya Pradesh, Karnataka, Meghalaya, Goa, Kerala, Haryana. Do the number of districts have some relationship with the area of the state?
- (ii) Which state amongst Uttar Pradesh, West Bengal, Gujarat, Arunachal Pradesh, Tamil Nadu, Tripura and Rajasthan is the most thickly populated and which one is the least densely populated?
- (iii) Find out the relationship between the area of the state and the number of districts.
- (iv) Identify the states with coastal boundaries.
- (v) Arrange the states from west to east which have only land boundary.

*Activity based on Appendix II*

- (i) List the Union Territories which have coastal location.
- (ii) How do you explain the variation in the area and population of NCT Delhi and the Andaman and Nicobar Islands?
- (iii) On a graph paper, draw a bar diagram to show the area and population of all the Union Territories.



**UNIT  
II**

## ***PHYSIOGRAPHY***

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*This unit deals with*

- *Structure and Relief; physiographic divisions*
- *Drainage systems: concept of water sheds — the Himalayan and the Peninsular*



11094CH02

## STRUCTURE AND PHYSIOGRAPHY

**D**o you know that our earth also has a history. The earth and its landforms that we see today have evolved over a very long time. Current estimation shows that the earth is approximately 460 million years old. Over these long years, it has undergone many changes brought about primarily by the endogenic and exogenic forces. These forces have played a significant role in giving shape to various surface and subsurface features of the earth. You have already studied about the Plate Tectonics and the movement of the Earth's plates in the book *Fundamentals of Physical Geography* (NCERT, 2006). Do you know that the Indian plate was to the south of the equator millions of years ago? Do you also know that it was much larger in size and the Australian plate was a part of it? Over millions of years, this plate broke into many parts and the Australian plate moved towards the southeastern direction and the Indian plate to the north. Can you map different phases in the movement of the Indian plate? This northward movement of the Indian plate is still continuing and it has significant consequences on the physical environment of the Indian subcontinent. Can you name some important consequences of the northward movement of the Indian plate?

It is primarily through the interplay of these endogenic and exogenic forces and lateral movements of the plates that the present geological structure and geomorphologic processes active in the Indian subcontinent came into existence. Based on the variations in its geological structure and formations, India can be divided into three geological divisions. These

geological regions broadly follow the physical features:

- (i) The Peninsular Block
- (ii) The Himalayas and other Peninuslar Mountains
- (iii) Indo-Ganga-Brahmaputra Plain.

### THE PENINSULAR BLOCK

The northern boundary of the Peninsular Block may be taken as an irregular line running from Kachchh along the western flank of the Aravali Range near Delhi and then roughly parallel to the Yamuna and the Ganga as far as the Rajmahal Hills and the Ganga delta. Apart from these, the Karbi Anglong and the Meghalaya Plateau in the northeast and Rajasthan in the west are also extensions of this block. The northeastern parts are separated by the Malda fault in West Bengal from the Chotanagpur plateau. In Rajasthan, the desert and other desert-like features overlay this block.

The Peninsula is formed essentially by a great complex of very ancient gneisses and granites, which constitutes a major part of it. Since the Cambrian period, the Peninsula has been standing like a rigid block with the exception of some of its western coast which is submerged beneath the sea and some other parts changed due to tectonic activity without affecting the original basement. As a part of the Indo-Australian Plate, it has been subjected to various vertical movements and block faulting. The rift valleys of the Narmada, the Tapi and the Mahanadi and the Satpura block

mountains are some examples of it. The Peninsula mostly consists of relict and residual mountains like the Aravali hills, the Nallamala hills, the Javadi hills, the Veliconda hills, the Palkonda range and the Mahendragiri hills, etc. The river valleys here are shallow with low gradients.

You are aware of the method of calculating the gradient as a part of your study of the book *Practical Work in Geography- Part I* (NCERT, 2006). Can you calculate the gradient of the Himalayan and the Peninsular rivers and draw the comparisons?

Most of the east flowing rivers form deltas before entering into the Bay of Bengal. The deltas formed by the Mahanadi, the Krishna, the Kaveri and the Godavari are important examples.

### THE HIMALAYAS AND OTHER PENINSULAR MOUNTAINS

The Himalayas along with other Peninsular mountains are young, weak and flexible in their geological structure unlike the rigid and stable Peninsular Block. Consequently, they are still subjected to the interplay of exogenic and endogenic forces, resulting in the development of faults, folds and thrust plains. These



Figure 2.1 : A Gorge

mountains are tectonic in origin, dissected by fast-flowing rivers which are in their youthful stage. Various landforms like gorges, V-shaped valleys, rapids, waterfalls, etc. are indicative of this stage.

### INDO-GANGA-BRAHMAPUTRA PLAIN

The third geological division of India comprises the plains formed by the river Indus, the Ganga and the Brahmaputra. Originally, it was a geo-synclinal depression which attained its maximum development during the third phase of the Himalayan mountain formation approximately about 64 million years ago. Since then, it has been gradually filled by the sediments brought by the Himalayan and Peninsular rivers. Average depth of alluvial deposits in these plains ranges from 1,000-2,000 m.

It is evident from the above discussion that there are significant variations among the different regions of India in terms of their geological structure, which has far-reaching impact upon other related aspects. Variations in the physiography and relief are important among these. The relief and physiography of India has been greatly influenced by the geological and geomorphological processes active in the Indian subcontinent.

### PHYSIOGRAPHY

'Physiography' of an area is the outcome of structure, process and the stage of development. The land of India is characterised by great diversity in its physical features. The north has a vast expanse of rugged topography consisting of a series of mountain ranges with varied peaks, beautiful valleys and deep gorges. The south consists of stable table land with highly dissected plateaus, denuded rocks and developed series of scarps. In between these two lies the vast north Indian plain.

Based on these macro variations, India can be divided into the following physiographic divisions:

- (1) The Northern and North-eastern Mountains
- (2) The Northern Plain

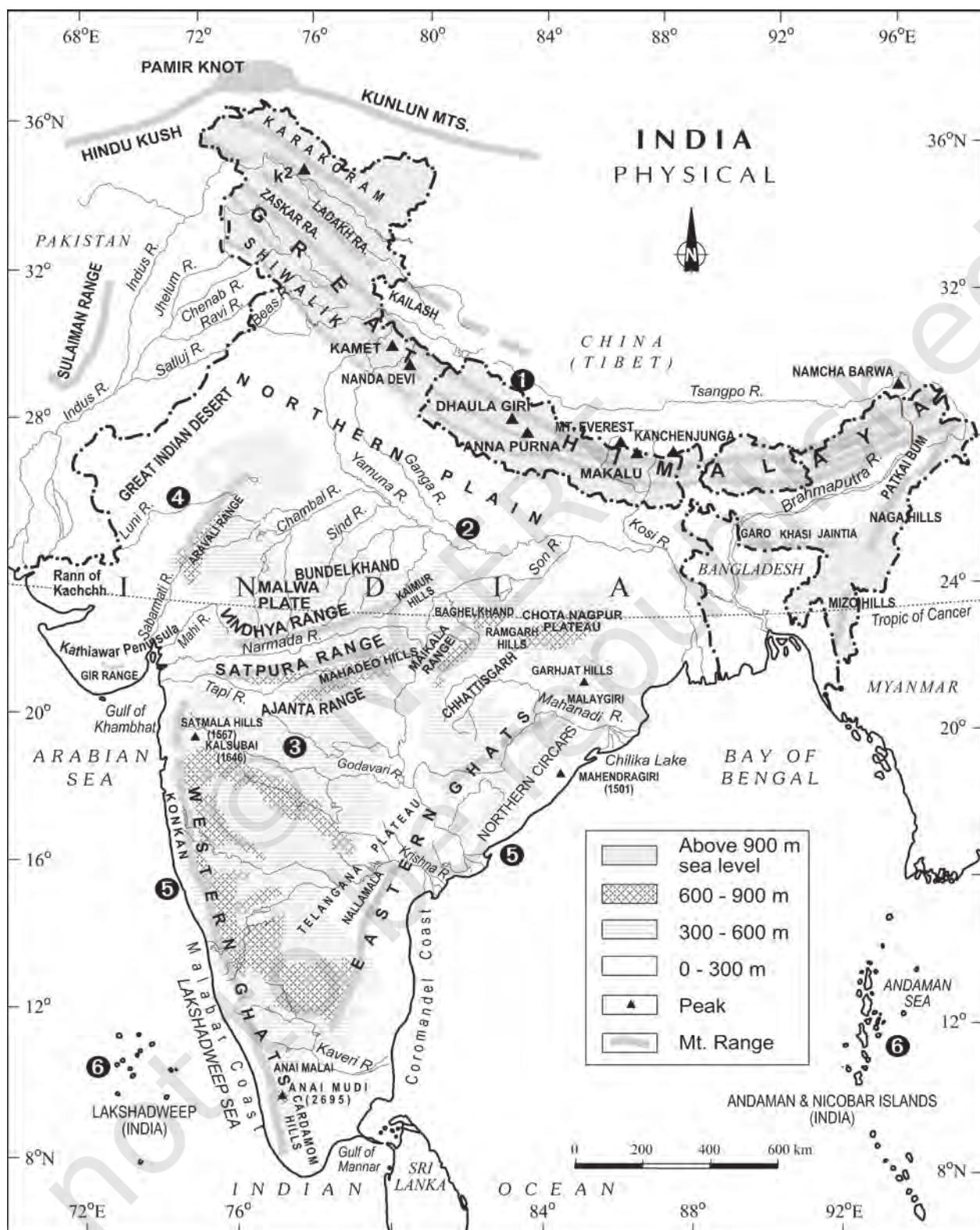


Figure 2.2 : India : Physical

- (3) The Peninsular Plateau
- (4) The Indian Desert
- (5) The Coastal Plains
- (6) The Islands.

### The North and Northeastern Mountains

The North and Northeastern Mountains consist of the Himalayas and the Northeastern hills. The Himalayas consist of a series of parallel mountain ranges. Some of the important ranges are the Greater Himalayan range, which includes the Great Himalayas and the Shiwalik. The general orientation of these ranges is from northwest to the southeast direction in the northwestern part of India. Himalayas in the Darjiling and Sikkim regions lie in an eastwest direction, while in Arunachal Pradesh they are from southwest to the northwest direction. In Nagaland, Manipur and Mizoram, they are in the northsouth direction. The approximate length of the Great Himalayan range, also known as the central axial range, is 2,500 km from east to west, and their width varies between 160-400 km from north to south. It is also evident from the map that the Himalayas stand almost like a strong and long wall between the Indian subcontinent and the Central and East Asian countries.

Himalayas are not only the physical barrier, they are also a climatic, drainage and cultural divide. Can you identify the impact of Himalayas on the geoenvironment of the countries of South Asia? Can you find some other examples of similar geoenvironmental divide in the world?



Figure 2.3 : The Himalayas

### The Northern Plains

The northern plains are formed by the alluvial deposits brought by the rivers –

the Indus, the Ganga and the Brahmaputra. These plains extend approximately 3,200 km from the east to the west. The average width of these plains varies between 150-300 km. The maximum depth of alluvium deposits varies between 1,000-2,000 m. From the north to the south, these can be divided into three major zones: the *Bhabar*, the *Tarai* and the alluvial plains. The alluvial plains can be further divided into the *Khadar* and the *Bhangar*.

*Bhabar* is a narrow belt ranging between 8-10 km parallel to the Shiwalik foothills at the break-up of the slope. As a result of this, the streams and rivers coming from the mountains deposit heavy materials of rocks and boulders, and at times, disappear in this zone. South of the *Bhabar* is the *Tarai* belt, with an approximate width of 10-20 km where most of the streams and rivers re-emerge without having any properly demarcated channel, thereby, creating marshy and swampy conditions known as the *Tarai*. This has a luxurious growth of natural vegetation and houses a varied wildlife.

The south of *Tarai* is a belt consisting of old and new alluvial deposits known as the *Bhangar* and *Khadar* respectively. These plains have characteristic features of mature stage of fluvial erosional and depositional landforms such as sand bars, meanders, oxbow lakes and braided channels. The Brahmaputra plains are known for their riverine islands and sand bars. Most of these areas are subjected to periodic floods



Figure 2.4 : Northern Plain

and shifting river courses forming braided streams.

The mouths of these mighty rivers also form some of the largest deltas of the world, for example, the famous Sunderbans delta. Otherwise, this is a featureless plain with a general elevation of 50-150 m above the mean sea level. The states of Haryana and Delhi form a water divide between the Indus and the Ganga river systems. As opposed to this, the Brahmaputra river flows from the northeast to the southwest direction before it takes an almost 90° southward turn at Dhubri before it enters into Bangladesh. These river valley plains have a fertile alluvial soil cover which supports a variety of crops like wheat, rice, sugarcane and jute, and hence, supports a large population.

### **The Peninsular Plateau**

Rising from the height of 150 m above the river plains up to an elevation of 600-900 m is the irregular triangle known as the Peninsular plateau. Delhi ridge in the northwest, (extension of Aravalis), the Rajmahal hills in the east, Gir range in the west and the Cardamom hills in the south constitute the outer extent of the Peninsular plateau. However, an extension of this is also seen in the northeast, in the form of Shillong and Karbi-Anglong plateau. The Peninsular India is made up of a series of plateau such as the Hazaribagh



**Figure 2.5 : A Part of Peninsular Plateau**

plateau, the Palamu plateau, the Ranchi plateau, the Malwa plateau, the Coimbatore plateau and the Karnataka plateau, etc. This is one of the oldest and the most stable landmass of India. The general elevation of the plateau is from the west to the east, which is also proved by the pattern of the flow of rivers. Name some rivers of the Peninsular plateau which have their confluence in the Bay of Bengal and the Arabian sea and mention some landforms which are typical to the east flowing rivers but are absent in the west flowing rivers. Some of the important physiographic features of this region are tors, block mountains, rift valleys, spurs, bare rocky structures, series of hummocky hills and wall-like quartzite dykes offering natural sites for water storage. The western and northwestern part of the plateau has an emphatic presence of black soil.

This Peninsular plateau has undergone recurrent phases of upliftment and submergence accompanied by crustal faulting and fractures. (The Bhima fault needs special mention, because of its recurrent seismic activities). These spatial variations have brought in elements of diversity in the relief of the Peninsular plateau. The northwestern part of the plateau has a complex relief of ravines and gorges. The ravines of Chambal, Bhind and Morena are some of the well-known examples.

On the basis of the prominent relief features, the Peninsular plateau can be divided into three broad groups:

- (i) The Deccan Plateau
- (ii) The Central Highlands
- (iii) The Northeastern Plateau.

#### ***The Deccan Plateau***

This is bordered by the Western Ghats in the west, Eastern Ghats in the east and the Satpura, Maikal range and Mahadeo hills in the north. Western Ghats are locally known by different names such as Sahyadri in Maharashtra, Nilgiri hills in Karnataka and Tamil Nadu and Anaimalai hills and Cardamom hills in Kerala. Western Ghats are

comparatively higher in elevation and more continuous than the Eastern Ghats. Their average elevation is about 1,500 m with the height increasing from north to south. 'Anaimudi' (2,695 m), the highest peak of Peninsular plateau is located on the Anaimalai hills of the Western Ghats followed by Dodabetta (2,637 m) on the Nilgiri hills. Most of the Peninsular rivers have their origin in the Western Ghats. Eastern Ghats comprising the discontinuous and low hills are highly eroded by the rivers such as the Mahanadi, the Godavari, the Krishna, the Kaveri, etc. Some of the important ranges include the Javadi hills, the Palconda range, the Nallamala hills, the Mahendragiri hills, etc. The Eastern and the Western Ghats meet each other at the Nilgiri hills.

### *The Central Highlands*

They are bounded to the west by the Aravali range. The Satpura range is formed by a series of scarped plateaus on the south, generally at an elevation varying between 600-900 m above the mean sea level. This forms the northernmost boundary of the Deccan plateau. It is a classic example of the relict mountains which are highly denuded and form discontinuous ranges. The extension of the Peninsular plateau can be seen as far as Jaisalmer in the West, where it has been covered by the longitudinal sand ridges and crescent-shaped sand dunes called *barchans*. This region has undergone metamorphic processes in its geological history, which can be corroborated by the presence of metamorphic rocks such as marble, slate, gneiss, etc.

The general elevation of the Central Highlands ranges between 700-1,000 m above the mean sea level and it slopes towards the north and northeastern directions. Most of the tributaries of the river Yamuna have their origin in the Vindhyan and Kaimur ranges. Banas is the only significant tributary of the river Chambal that originates from the Aravalli in the west. An eastern extension of the Central Highland is formed by the Rajmahal hills, to the south of

which lies a large reserve of mineral resources in the Chotanagpur plateau.

### *The Northeastern Plateau*

In fact it is an extension of the main Peninsular plateau. It is believed that due to the force exerted by the northeastward movement of the Indian plate at the time of the Himalayan origin, a huge fault was created between the Rajmahal hills and the Meghalaya plateau. Later, this depression got filled up by the deposition activity of the numerous rivers. Today, the Meghalaya and Karbi Anglong plateau stand detached from the main Peninsular Block. The Meghalaya plateau is further sub-divided into three: (i) The Garo Hills; (ii) The Khasi Hills; (iii) The Jaintia Hills, named after the tribal groups inhabiting this region. An extension of this is also seen in the Karbi Anglong hills of Assam. Similar to the Chotanagpur plateau, the Meghalaya plateau is also rich in mineral resources like coal, iron ore, sillimanite, limestone and uranium. This area receives maximum rainfall from the south west monsoon. As a result, the Meghalaya plateau has a highly eroded surface. Cherrapunji displays a bare rocky surface devoid of any permanent vegetation cover.

### *The Indian Desert*

To the northwest of the Aravali hills lies the Great Indian desert. It is a land of undulating topography dotted with longitudinal dunes and *barchans*. This region receives low rainfall below 150 mm per year; hence, it has arid climate with low vegetation cover. It is because of these characteristic features that this is also known as *Marusthali*. It is believed that during the Mesozoic era, this region was under the sea. This can be corroborated by the evidence available at wood fossils park at Aakal and marine deposits around Brahmsar, near Jaisalmer (The approximate age of the wood-fossils is estimated to be 180 million years). Though the underlying rock structure of the desert is an extension of the Peninsular plateau, yet, due to extreme arid conditions, its surface



**Figure 2.6 : The Indian Desert**

Can you identify the type of sand dunes shown in this picture?

features have been carved by physical weathering and wind actions. Some of the well pronounced desert land features present here are mushroom rocks, shifting dunes and oasis (mostly in its southern part). On the basis of the orientation, the desert can be divided into two parts: the northern part is sloping towards Sindh and the southern towards the Rann of Kachchh. Most of the rivers in this region are ephemeral. The Luni river flowing in the southern part of the desert is of some significance. Low precipitation and high evaporation makes it a water deficit region. There are some streams which disappear after flowing for some distance and present a typical case of inland drainage by joining a lake or playa. The lakes and the playas have brackish water which is the main source of obtaining salt.

### The Coastal Plains

You have already read that India has a long coastline . On the basis of the location and active geomorphological processes, it can be broadly divided into two: (i) the western coastal plains; (ii) the eastern coastal plains.

The western coastal plains are an example of submerged coastal plain. It is believed that the city of Dwaraka which was once a part of the Indian mainland situated along the west coast is submerged under water. Because of this submergence it is a narrow belt and

provides natural conditions for the development of ports and harbours. Kandla, Mazagaon, JLN port Navha Sheva, Marmagao, Mangalore, Cochin, etc. are some of the important natural ports located along the west coast. Extending from the Gujarat coast in the north to the Kerala coast in the south, the western coast may be divided into following divisions – the Kachchh and Kathiawar coast in Gujarat, Konkan coast in Maharashtra, Goan coast and Malabar coast in Karnataka and Kerala respectively. The western coastal plains are narrow in the middle and get broader towards north and south. The rivers flowing through this coastal plain do not form any delta. The Malabar coast has got certain distinguishing features in the form of 'Kayals' (backwaters), which are used for fishing, inland navigation and also due to its special attraction for tourists. Every year the famous *Nehru Trophy Vallamkali* (boat race) is held in *Punnamada Kayal* in Kerala.

As compared to the western coastal plain, the eastern coastal plain is broader and is an example of an emergent coast. There are well-developed deltas here, formed by the rivers flowing eastward in to the Bay of Bengal. These include the deltas of the Mahanadi, the Godavari, the Krishna and the Kaveri. Because of its emergent nature, it has less number of ports and harbours. The continental shelf extends up to 500 km into the sea, which makes it difficult for the development of good ports and harbours. Name some ports on the eastern coast.



**Figure 2.7 : Coastal Plains**

On 26 December 2004, the Andaman and Nicobar Islands experienced one of the most devastating natural calamity. Can you name the calamity and identify some other areas which were adversely affected by the same calamity? What was its major consequence?

### The Islands

There are two major island groups in India – one in the Bay of Bengal and the other in the Arabian Sea. The Bay of Bengal island groups consist of about 572 islands/islets. These are situated roughly between 6° N-14° N and 92° E -94° E. The two principal groups of islets include the Ritchie's archipelago and the Labrynth island. The entire group of island is divided into two broad categories – the Andaman in the north and the Nicobar in the south. They are separated by a waterbody which is called the Ten degree channel. It is believed that these islands are an elevated portion of submarine mountains. However, some smaller islands are volcanic in origin. *Barren island*, the only active volcano in India is also situated in the Nicobar islands.

Some important mountain peaks in Andaman and Nicobar Islands are Saddle peak (North Andaman – 738 m), Mount Diavolo (Middle Andaman – 515 m), Mount Koyob (South Andaman – 460 m) and Mount Thuiller (Great Nicobar – 642 m).

The coastal line has some coral deposits, and beautiful beaches. These islands receive convectional rainfall and have an equatorial type of vegetation.

The islands of the Arabian sea include Lakshadweep and Minicoy. These are scattered between 8° N-12° N and 71° E -74° E longitude. These islands are located at a distance of 280 km-480 km off the Kerala coast. The entire island group is built of coral deposits. There are approximately 36 islands of which 11 are inhabited. Minicoy is the largest island with an area of 453 sq. km. The entire group of islands is broadly divided by the Ten degree channel, north of which is the Amini Island and to the south of the Canannore Island. The Islands of this archipelago have storm beaches consisting of unconsolidated pebbles, shingles, cobbles and boulders on the eastern seaboard.



Figure 2.8 : An Island

## **EXERCISES**



## Project/Activity

- (i) Make a list of major Himalayan peaks from the west to the east with the help of an atlas.
  - (ii) Identify the major landforms of your state and analyse the major economic activity practised by the people in each landform.

## DRAINAGE SYSTEM



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You have observed water flowing through the rivers, *nalas* and even channels during rainy season which drain the excess water. Had these channels not been there, large-scale flooding would have occurred. Wherever channels are ill-defined or choked, flooding is a common phenomenon.

The flow of water through well-defined channels is known as 'drainage' and the network of such channels is called a 'drainage system'. The drainage pattern of an area is the outcome of the geological time period, nature and structure of rocks, topography, slope, amount of water flowing and the periodicity of the flow.

Do you have a river near your village or city? Have you ever been there for boating or bathing? Is it perennial (always with water) or ephemeral (water during rainy season, and dry, otherwise)? Do you know that rivers flow in the same direction? You have studied about slopes in the other two textbooks of geography (NCERT,

2006) in this class . Can you, then, explain the reason for water flowing from one direction to the other? Why do the rivers originating from the Himalayas in the northern India and the Western Ghats in the southern India flow towards the east and discharge their waters in the Bay of Bengal?



Figure 3.1 : A River in the Mountainous Region

A river drains the water collected from a specific area, which is called its 'catchment area'.

An area drained by a river and its tributaries is called a drainage basin. The boundary line

### Important Drainage Patterns

- (i) The drainage pattern resembling the branches of a tree is known as "dendritic" the examples of which are the rivers of northern plain.
- (ii) When the rivers originate from a hill and flow in all directions, the drainage pattern is known as 'radial'. The rivers originating from the Amarkantak range present a good example of it.
- (iii) When the primary tributaries of rivers flow parallel to each other and secondary tributaries join them at right angles, the pattern is known as 'trellis'.
- (iv) When the rivers discharge their waters from all directions in a lake or depression, the pattern is known as 'centripetal'.

Find out some of the patterns in the topo sheet given in Chapter 5 of *Practical Work in Geography- Part I (NCERT, 2006)*.

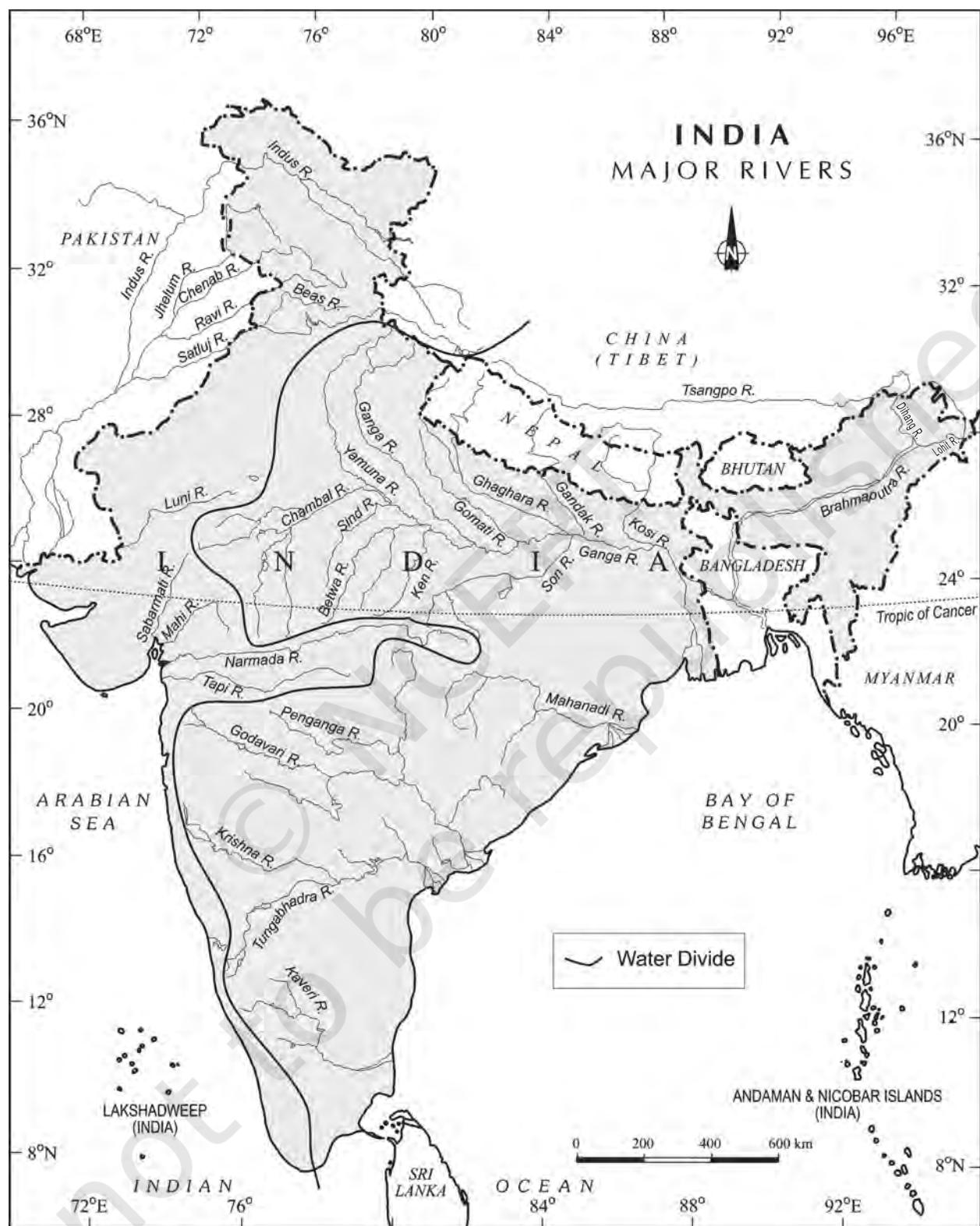


Figure 3.2 : Major Rivers of India

separating one drainage basin from the other is known as the watershed. The catchments of large rivers are called river basins while those of small rivulets and rills are often referred to as watersheds. There is, however, a slight difference between a river basin and a watershed. Watersheds are small in area while the basins cover larger areas.

River basins and watersheds are marked by unity. What happens in one part of the basin or watershed directly affects the other parts and the unit as a whole. That is why, they are accepted as the most appropriate micro, meso or macro planning regions.

Indian drainage system may be divided on various bases. On the basis of discharge of water (orientations to the sea), it may be grouped into: (i) the Arabian Sea drainage; and (ii) the Bay of Bengal drainage. They are separated from each other through the Delhi ridge, the Aravalis and the Sahyadris (water divide is shown by a line in Figure 3.1). Nearly 77 per cent of the drainage area consisting of the Ganga, the Brahmaputra, the Mahanadi, the Krishna, etc. is oriented towards the Bay of Bengal while 23 per cent comprising the Indus, the Narmada, the Tapi, the Mahi and the Periyar systems discharge their waters in the Arabian Sea.

On the basis of the size of the watershed, the drainage basins of India are grouped into three categories: (i) Major river basins with more than 20,000 sq. km of catchment area. It includes 14 drainage basins such as the Ganga, the Brahmaputra, the Krishna, the Tapi, the Narmada, the Mahi, the Pennar, the Sabarmati, the Barak, etc. (Appendix III). (ii) Medium river basins with catchment area between 2,000-20,000 sq. km incorporating 44 river basins such as the Kalindi, the Periyar, the Meghna, etc. (iii) Minor river basins with catchment area of less than 2,000 sq. km include fairly good number of rivers flowing in the area of low rainfall.

If you look at the Figure 3.1 you can see that many rivers have their sources in the Himalayas and discharge their waters either in the Bay of Bengal or in the Arabian Sea. Identify these rivers of North India. Large rivers flowing on the Peninsular plateau have their origin in the Western Ghats and discharge their waters

in the Bay of Bengal. Identify these rivers of the South India.

The Narmada and Tapi are two large rivers which are exceptions. They along with many small rivers discharge their waters in the Arabian Sea.

Name these rivers of the western coastal region from the Konkan to the Malabar coast.

On the basis of the mode of origin, nature and characteristics, the Indian drainage may also be classified into the Himalayan drainage and the Peninsular drainage. Although it has the problem of including the Chambal, the Betwa, the Son, etc. which are much older in age and origin than other rivers that have their origin in the Himalayas, it is the most accepted basis of classification. Hence, this scheme has been followed in this book.

### DRAINAGE SYSTEMS OF INDIA

Indian drainage system consists of a large number of small and big rivers. It is the outcome of the evolutionary process of the three major physiographic units and the nature and characteristics of precipitation.

### THE HIMALAYAN DRAINAGE

The Himalayan drainage system has evolved through a long geological history. It mainly includes the Ganga, the Indus and the Brahmaputra river basins. Since these are fed both by melting of snow and precipitation, rivers of this system are perennial. These rivers pass through the giant gorges carved out by the erosional activity carried on simultaneously with the uplift of the Himalayas. Besides deep gorges, these rivers also form V-shaped valleys, rapids and waterfalls in their mountainous



Figure 3.3 : Rapids

course. While entering the plains, they form depositional features like flat valleys, ox-bow lakes, flood plains, braided channels, and deltas near the river mouth. In the Himalayan reaches, the course of these rivers is highly tortuous, but over the plains they display a strong meandering tendency and shift their courses frequently. River Kosi, also known as the 'sorrow of Bihar', has been notorious for frequently changing its course. The Kosi brings huge quantity of sediments from its upper reaches and deposits it in the plains. The course gets blocked, and consequently, the river changes its course. Why does the Kosi river bring such huge quantity of sediments from the upper reaches? Do you think that the discharge of the water in the rivers in general and the Kosi in particular, remains the same, or does it fluctuate? When does the river course receive the maximum quantity of water? What are the positive and negative effects of flooding?

#### EVOLUTION OF THE HIMALAYAN DRAINAGE

There are differences of opinion about the evolution of the Himalayan rivers. However, geologists believe that a mighty river called Shiwalik or Indo-Brahma traversed the entire longitudinal extent of the Himalaya from Assam to Punjab and onwards to Sind, and finally discharged into the Gulf of Sind near lower Punjab during the Miocene period some 5-24 million years ago. The remarkable continuity of the Shiwalik and its lacustrine origin and alluvial deposits consisting of sands, silt, clay, boulders and conglomerates support this viewpoint.

It is opined that in due course of time Indo-Brahma river was dismembered into three main drainage systems: (i) the Indus and its five tributaries in the western part; (ii) the Ganga and its Himalayan tributaries in the central part; and (iii) the stretch of the Brahmaputra in Assam and its Himalayan tributaries in the eastern part. The dismemberment was probably due to the Pleistocene upheaval in the western Himalayas, including the uplift of the Potwar Plateau (Delhi Ridge), which acted

as the water divide between the Indus and Ganga drainage systems. Likewise, the down-thrusting of the Malda gap area between the Rajmahal hills and the Meghalaya plateau during the mid-pleistocene period, diverted the Ganga and the Brahmaputra systems to flow towards the Bay of Bengal.

#### THE RIVER SYSTEMS OF THE HIMALAYAN DRAINAGE

The Himalayan drainage consists of several river systems but the following are the major river systems:

##### The Indus System

It is one of the largest river basins of the world, covering an area of 11,65,000 sq. km (in India it is 321,289 sq. km and a total length of 2,880 km (in India 1,114 km). The Indus also known as the Sindhu, is the westernmost of the Himalayan rivers in India. It originates from a glacier near Bokhar Chu (31° 15' N latitude and 81° 40' E longitude) in the Tibetan region at an altitude of 4,164 m in the Kailash Mountain range. In Tibet, it is known as 'Singi Khamban'; or Lion's mouth. After flowing in the northwest direction between the Ladakh and Zaskar ranges, it passes through Ladakh and Baltistan. It cuts across the Ladakh range, forming a spectacular gorge near Gilgit in Jammu and Kashmir. It enters into Pakistan near Chilas in the Dardistan region. Find out the area known as Dardistan.

The Indus receives a number of Himalayan tributaries such as the Shyok, the Gilgit, the Zaskar, the Hunza, the Nubra, the Shigar, the Gasting and the Dras. It finally emerges out of the hills near Attock where it receives the Kabul river on its right bank. The other important tributaries joining the right bank of the Indus are the Khurram, the Tochi, the Gomal, the Viba and the Sangar. They all originate in the Sulaiman ranges. The river flows southward and receives 'Panjnad' a little above Mithankot. The Panjnad is the name given to the five rivers of Punjab, namely the Satluj, the Beas, the Ravi, the Chenab and the Jhelum. It finally

discharges into the Arabian Sea, east of Karachi. The Indus flows in India only through Jammu and Kashmir.

The Jhelum, an important tributary of the Indus, rises from a spring at Verinag situated at the foot of the Pir Panjal in the south-eastern part of the valley of Kashmir. It flows through Srinagar and the Wular lake before entering Pakistan through a deep narrow gorge. It joins the Chenab near Jhang in Pakistan.

The Chenab is the largest tributary of the Indus. It is formed by two streams, the Chandra and the Bhaga, which join at Tandi near Keylong in Himachal Pradesh. Hence, it is also known as Chandrabhaga. The river flows for 1,180 km before entering into Pakistan.

The Ravi is another important tributary of the Indus. It rises west of the Rohtang pass in the Kullu hills of Himachal Pradesh and flows through the Chamba valley of the state. Before entering Pakistan and joining the Chenab near Sarai Sidhu, it drains the area lying between the southeastern part of the Pir Panjal and the Dhauladhar ranges.

The Beas is another important tributary of the Indus, originating from the Beas Kund near the Rohtang Pass at an elevation of 4,000 m above the mean sea level. The river flows through the Kullu valley and forms gorges at Kati and Largi in the Dhauladhar range. It enters the Punjab plains where it meets the Satluj near Harike.

The Satluj originates in the 'Raksatal' near Mansarovar at an altitude of 4,555 m in Tibet where it is known as Langchen Khambab. It flows almost parallel to the Indus for about 400 km before entering India, and comes out of a gorge at Rupar. It passes through the Shipki La on the Himalayan ranges and enters the Punjab plains. It is an antecedent river. It is a very important tributary as it feeds the canal system of the Bhakra Nangal project.

### The Ganga System

The Ganga is the most important river of India both from the point of view of its basin and cultural significance. It rises in the

Gangotri glacier near Gaumukh (3,900 m) in the Uttarkashi district of Uttarakhand. Here, it is known as the Bhagirathi. It cuts through the Central and the Lesser Himalayas in narrow gorges. At Devprayag, the Bhagirathi meets the Alaknanda; hereafter, it is known as the Ganga. The Alaknanda has its source in the Satopanth glacier above Badrinath. The Alaknanda consists of the Dhauli and the Vishnu Ganga which meet at Joshimath or Vishnu Prayag. The other tributaries of Alaknanda such as the Pindar joins it at Karna Prayag while Mandakini or Kali Ganga meets it at Rudra Prayag. The Ganga enters the plains at Haridwar. From here, it flows first to the south, then to the south-east and east before splitting into two distributaries, namely the Bhagirathi and the Padma. The river has a length of 2,525 km. It is shared by Uttarakhand (110 km) and Uttar Pradesh (1,450 km), Bihar (445 km) and West Bengal (520 km). The Ganga basin covers about 8.6 lakh sq. km area in India alone. The Ganga

#### Do you Know?

'Namami Gange Programme', is an Integrated Conservation Mission, approved as "Flagship Programme" by the Union Government in June 2014 with the twin objectives of effective abatement of pollution, conservation and rejuvenation of the National River Ganga.

Main pillars of the Namami Gange Programme are:

- Sewerage Treatment Infrastructure
- River-Front Development
- River-Surface Cleaning
- Bio-Diversity
- Afforestation
- Public Awareness
- Industrial Effluent Monitoring
- Ganga Gram

You may explore about this project at  
<http://nmcg.nic.in/NamamiGanga.aspx#>

river system is the largest in India having a number of perennial and non-perennial rivers originating in the Himalayas in the north and the Peninsula in the south, respectively. **The Son is its major right bank tributary.** The important left bank tributaries are the Ramganga, the Gomati, the Ghaghara, the Gandak, the Kosi and the Mahananda. The river finally discharges itself into the Bay of Bengal near the Sagar Island.

The Yamuna, the western most and the longest tributary of the Ganga, has its source in the Yamunotri glacier on the western slopes of Banderpunch range (6,316 m). It joins the Ganga at Prayag (Allahabad). It is joined by the Chambal, the Sind, the Betwa and the Ken on its right bank which originates from the Peninsular plateau while the Hindan, the Rind, the Sengar, the Varuna, etc. join it on its left bank. Much of its water feeds the western and eastern Yamuna and the Agra canals for irrigation purposes.

Name the states which are drained by the river Yamuna.

The Chambal rises near Mhow in the Malwa plateau of Madhya Pradesh and flows northwards through a gorge up wards of Kota in Rajasthan, where the Gandhisagar dam has been constructed. From Kota, it traverses down to Bundi, Sawai Madhopur and Dholpur, and finally joins the Yamuna. **The Chambal is famous for its badland topography called the Chambal ravines.**

The Gandak comprises two streams, namely Kaligandak and Trishulganga. It rises in the Nepal Himalayas between the Dhaulagiri and Mount Everest and drains the central part of Nepal. It enters the Ganga plain in Champaran district of Bihar and joins the Ganga at Sonpur near Patna.

The Ghaghara originates in the glaciers of Mapchachungo. After collecting the waters of its tributaries – Tila, Seti and Beri, it comes out of the mountain, cutting a deep gorge at Shishapani. The river Sarda (Kali or Kali Ganga) joins it in the plain before it finally meets the Ganga at Chhapra.

**The Kosi is an antecedent river with its source to the north of Mount Everest in Tibet, where its main stream Arun rises. After crossing the Central Himalayas in Nepal, it is joined by the Son Kosi from the West and the Tamur Kosi from the east. It forms Sapt Kosi after uniting with the river Arun.**

The Ramganga is comparatively a small river rising in the Garhwal hills near Gairsain. It changes its course to the southwest direction after crossing the Shiwalik and enters into the plains of Uttar Pradesh near Najibabad. Finally, it joins the Ganga near Kannauj.

The Damodar occupies the eastern margins of the Chotanagpur Plateau where it flows through a rift valley and finally joins the Hugli. The Barakar is its main tributary. Once known as the 'sorrow of Bengal', the Damodar has been now tamed by the Damodar Valley corporation, a multipurpose project.

The Sarda or Saryu river rises in the Milam glacier in the Nepal Himalayas where it is known as the Goriganga. Along the Indo-Nepal border, it is called Kali or Chauk, where it joins the Ghaghara.

The Mahananda is another important tributary of the Ganga rising in the Darjiling hills. It joins the Ganga as its last left bank tributary in West Bengal.

**The Son is a large south bank tributary of the Ganga, originating in the Amarkantak plateau.** After forming a series of waterfalls at the edge of the plateau, it reaches Arrah, west of Patna, to join the Ganga.

### The Brahmaputra System

The Brahmaputra, one of the largest rivers of the world, has its origin in the Chemayungdung glacier of the Kailash range near the Mansarovar lake. From here, it traverses eastward longitudinally for a distance of nearly 1,200 km in a dry and flat region of southern Tibet, where it is known as the Tsangpo, which means 'the purifier.' The Rango Tsangpo is the major right bank tributary of this river in Tibet. It emerges as a turbulent and dynamic river after carving out a deep gorge in the Central

Himalayas near Namcha Barwa (7,755 m). The river emerges from the foothills under the name of Siang or Dihang. It enters India west of Sadiya town in Arunachal Pradesh. Flowing southwest, it receives its main left bank tributaries, viz., Dibang or Sikang and Lohit; thereafter, it is known as the Brahmaputra.

The Brahmaputra receives numerous tributaries in its 750 km long journey through the Assam valley. Its major left bank tributaries are the Burhi Dihing and Dhansari (South) whereas the important right bank tributaries are the Subansiri, Kameng, Manas and Sankosh. The Subansiri which has its origin in Tibet, is an antecedent river. The Brahmaputra enters into Bangladesh near Dhubri and flows southward. In Bangladesh, the Tista joins it on its right bank from where the river is known as the Jamuna. It finally merges with the river Padma, which falls in the Bay of Bengal. The Brahmaputra is well-known for floods, channel shifting and bank erosion. This is due to the fact that most of its tributaries are large, and bring large quantity of sediments owing to heavy rainfall in its catchment area.

### THE PENINSULAR DRAINAGE SYSTEM

The Peninsular drainage system is older than the Himalayan one. This is evident from the broad, largely-graded shallow valleys, and the maturity of the rivers. The Western Ghats running close to the western coast act as the water divide between the major Peninsular rivers, discharging their water in the Bay of Bengal and as small rivulets joining the Arabian Sea. Most of the major Peninsular rivers except Narmada and Tapi flow from west to east. The Chambal, the Sind, the Betwa, the Ken, the Son, originating in the northern part of the Peninsula belong to the Ganga river system. The other major river systems of the Peninsular drainage are – the Mahanadi the Godavari, the Krishna and the Kaveri. Peninsular rivers are characterised by fixed course, absence of meanders and non-perennial flow of water. The Narmada and the Tapi which flow through the rift valley are, however, exceptions.

### The Evolution of Peninsular Drainage System

Three major geological events in the distant past have shaped the present drainage systems of Peninsular India: (i) Subsidence of the western flank of the Peninsula leading to its submergence below the sea during the early tertiary period. Generally, it has disturbed the symmetrical plan of the river on either side of the original watershed. (ii) Upheaval of the Himalayas when the northern flank of the Peninsular block was subjected to subsidence and the consequent trough faulting. The Narmada and The Tapi flow in trough faults and fill the original cracks with their detritus materials. Hence, there is a lack of alluvial and deltaic deposits in these rivers. (iii) Slight tilting of the Peninsular block from northwest to the southeastern direction gave orientation to the entire drainage system towards the Bay of Bengal during the same period.

### River Systems of the Peninsular Drainage

There are a large number of river systems in the Peninsular drainage. A brief account of the major Peninsular river systems is given below:

The Mahanadi rises near Sihawa in Raipur district of Chhattisgarh and runs through Odisha to discharge its water into the Bay of Bengal. It is 851 km long and its catchment area spreads over 1.42 lakh sq. km. Some navigation is carried on in the lower course of this river. Fifty three per cent of the drainage basin of this river lies in Madhya Pradesh and Chhattisgarh, while 47 per cent lies in Odisha.

The Godavari is the largest Peninsular river system. It is also called the Dakshin Ganga. It rises in the Nasik district of Maharashtra and discharges its water into the Bay of Bengal. Its tributaries run through the states of Maharashtra, Madhya Pradesh, Chhattisgarh, Odisha and Andhra Pradesh. It is 1,465 km long with a catchment area spreading over 3.13 lakh sq. km 49 per cent of this, lies in Maharashtra, 20 per cent in Madhya Pradesh and Chhattisgarh, and the rest in Andhra Pradesh. The Penganga, the Indravati, the

Pranhita, and the Manjra are its principal tributaries. The Godavari is subjected to heavy floods in its lower reaches to the south of Polavararam, where it forms a picturesque gorge. It is navigable only in the deltaic stretch. The river after Rajamundri splits into several branches forming a large delta.

The Krishna is the second largest east-flowing Peninsular river which rises near Mahabaleshwar in Sahyadri. Its total length is 1,401 km. The Koyna, the Tungbhadra and the Bhima are its major tributaries. Of the total catchment area of the Krishna, 27 per cent lies in Maharashtra, 44 per cent in Karnataka and 29 per cent in Andhra Pradesh and Telangana.

The Kaveri rises in Brahmagiri hills (1,341m) of Kogadu district in Karnataka. Its length is 800 km and it drains an area of 81,155 sq. km. Since the upper catchment area receives rainfall during the southwest monsoon season (summer) and the lower part during the northeast monsoon season (winter), the river carries water throughout the year with comparatively less fluctuation than the other Peninsular rivers. About 3 per cent of the Kaveri basin falls in Kerala, 41 per cent in Karnataka and 56 per cent in Tamil Nadu. Its important tributaries are the Kabini, the Bhavani and the Amravati.

The Narmada originates on the western flank of the Amarkantak plateau at a height of about 1,057 m. Flowing in a rift valley between the Satpura in the south and the Vindhyan range in the north, it forms a picturesque gorge in marble rocks and Dhuandhar waterfall near Jabalpur. After flowing a distance of about 1,312 km, it meets the Arabian sea south of Bharuch, forming a broad 27 km long estuary. Its catchment area is about 98,796 sq. km. The Sardar Sarovar Project has been constructed on this river.

Collect information about Narmada river conservation mission named "Namami Devi Narmade" and discuss with your peers.

The Tapi is the other important westward flowing river. It originates from Multai in the Betul district of Madhya Pradesh. It is 724 km long and drains an area of 65,145 sq. km. Nearly 79 per cent of its basin lies in Maharashtra, 15 per cent in Madhya Pradesh and the remaining 6 per cent in Gujarat.

Luni is the largest river system of Rajasthan, west of Aravali. It originates near Pushkar in two branches, i.e. the Saraswati and the Sabarmati, which join with each other at Govindgarh. From here, the river comes out of Aravali and is known as Luni. It flows towards the west till Telwara and then takes a southwest direction to join the Rann of Kuchchh. The entire river system is ephemeral.

#### EXTENT OF USABILITY OF RIVER WATER

The rivers of India carry huge volumes of water per year but it is unevenly distributed both in time and space. There are perennial rivers carrying water throughout the year while the non-perennial rivers have very little water during the dry season. During the rainy season, much of the water is wasted in floods and flows down to the sea. Similarly, when there is a flood in one part of the country, the other area suffers from drought. Why does this happen? Is it the problem of availability of water resource or that of its management? Can you suggest some measures to mitigate the problems of floods and droughts simultaneously occurring in different parts of the country? (See Chapter 6 of the book).

Can these problems be solved or minimised by transferring the surplus water from one basin to the water deficit basins? Do we have some schemes of inter-basin linkage?

**Teachers may explain the following examples**

- Periyar Diversion Scheme
- Indira Gandhi Canal Project
- Kurnool-Cuddapah Canal
- Beas-Satluj Link Canal
- Ganga-Kaveri Link Canal

Have you read in the newspapers about the linking of rivers? Do you think that digging a canal is enough to transfer water from the Ganga basin to the Peninsular river? What is the major problem? Consult Chapter 2 of this book and find out the difficulties posed by the unevenness of the terrain. How can the water be lifted from the plain area to the plateau area? Is there sufficient surplus water in the north Indian rivers which can be transferred on a regular basis? Organise a debate on the whole issue and prepare a write up. How do you rank the following problems in using river water?

- (i) No availability in sufficient quantity
- (ii) River water pollution
- (iii) Load of silt in the river water
- (iv) Uneven seasonal flow of water

- (v) River water disputes between states
- (vi) Shrinking of channels due to the extension of settlements towards the thalweg.

Why are the rivers polluted? Have you seen the dirty waters of cities entering into the rivers? Where do the industrial effluents and wastes get disposed of? Most of the cremation grounds are on the banks of rivers and the dead bodies are sometimes thrown in the rivers. On the occasion of some festivals, the flowers and statues are immersed in the rivers. Large scale bathing and washing of clothes also pollute river waters. How can the rivers be made pollution free? Have you read about Ganga Action Plan, or about a campaign for cleaning the Yamuna at Delhi? Collect materials on schemes for making rivers pollution free and organise the materials in a write up.

### EXERCISES

1. Choose the right answer from the four alternatives given below.
  - (i) Which one of the following rivers was known as the 'Sorrow of Bengal'?
 

(a) The Gandak	(c) The Kosi
(b) The Son	(d) The Damodar
  - (ii) Which one of the following rivers has the largest river basin in India?
 

(a) The Indus	(c) The Ganga
(b) The Brahmaputra	(d) The Krishna
  - (iii) Which one of the following rivers is not included in 'Panchnadi'?
 

(a) The Ravi	(c) The Indus
(b) The Chenab	(d) The Jhelum
  - (iv) Which one of the following rivers flows in a rift valley?
 

(a) The Son	(c) The Yamuna
(b) The Narmada	(d) The Luni
  - (v) Which one of the following is the place of confluence of the Alaknanda and the Bhagirathi?
 

(a) Vishnu Prayag	(c) Karan Prayag
(b) Rudra Prayag	(d) Deva Prayag
2. State the differences between the following.
  - (i) River Basin and Watershed
  - (ii) Dendritic and Trellis drainage pattern
  - (iii) Radial and Centripetal drainage pattern
  - (iv) Delta and Estuary
3. Answer the following questions in about 30 words.
  - (i) What are the socio-economic advantages of inter-linking of rivers in India?

- (ii) Write three characteristics of the Peninsular river.
4. Answer the following questions in not more than 125 words.
- What are the important characteristic features of north Indian rivers? How are these different from Peninsular rivers?
  - Suppose you are travelling from Haridwar to Siliguri along the foothills of the Himalayas. Name the important rivers you will come across. Describe the characteristics of any one of them.

**Project/Activity**

Study the Appendix III and answer the following questions.

- Which river has the largest proportion of catchment area in the country?
- Make a comparative bar diagram on a graph paper to show the length of the courses of the rivers.



## **UNIT III**

### ***CLIMATE AND VEGETATION***

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*This unit deals with*

- *Weather and climate – spatial and temporal distribution of temperature, pressure, winds and rainfall; Indian monsoons: mechanism, onset and variability – spatial and temporal; climatic types*
- *Natural vegetation – forest types and distribution; wild life conservation; biosphere reserves*

# CLIMATE

CHAPTER

4



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We drink more water during summers. Your uniform during the summer is different from the winters. Why do you wear lighter clothes during summers and heavy woollen clothes during winters in north India? In southern India, woollen clothes are not required. In northeastern states, winters are mild except in the hills. There are variations in weather conditions during different seasons. These changes occur due to the changes in the elements of weather (temperature, pressure, wind direction and velocity, humidity and precipitation, etc.).

Weather is the momentary state of the atmosphere while climate refers to the average of the weather conditions over a longer period of time. Weather changes quickly, may be within a day or week but climate changes imperceptively and may be noted after 50 years or even more.

You have already studied about the monsoon in your earlier classes. You are also aware of the meaning of the word, "monsoon". Monsoon connotes the climate associated with seasonal reversal in the direction of winds. India has hot monsoonal climate which is the prevalent climate in south and southeast Asia.

## UNITY AND DIVERSITY IN THE MONSOON CLIMATE

The monsoon regime emphasises the unity of India with the rest of southeast Asian region. This view of broad unity of the monsoon type of climate should not, however, lead one to ignore its regional variations which differentiate

the weather and climate of different regions of India. For example, the climate of Kerala and Tamil Nadu in the south are so different from that of Uttar Pradesh and Bihar in the north, and yet all of these have a monsoon type of climate. The climate of India has many regional variations expressed in the pattern of winds, temperature and rainfall, rhythm of seasons and the degree of wetness or dryness. These regional diversities may be described as sub-types of monsoon climate. Let us take a closer look at these regional variations in temperature, winds and rainfall.

While in the summer the mercury occasionally touches 55° C in the western Rajasthan, it drops down to as low as minus 45° C in winter around Leh. Churu in Rajasthan may record a temperature of 50° C or more on a June day while the mercury hardly touches 19° C in Tawang (Arunachal Pradesh) on the same day. On a December night, temperature in Drass (Ladakh) may drop down to minus 45° C while Thiruvananthapuram or Chennai on the same night records 20° C or 22° C. These examples confirm that there are seasonal variations in temperature from place to place and from region to region in India. Not only this, if we take only a single place and record the temperature for just one day, variations are no less striking. In Kerala and in the Andaman Islands, the difference between day and night temperatures may be hardly seven or eight degree Celsius. But in the Thar desert, if the day temperature is around 50° C, at night, it may drop down considerably upto 15° -20° C.