UNIT 2 CLIMATE AND RESOURCES

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2.1 INTRODUCTION

In unit 1, you have read about the changing environment, from the natural to man-made, because of human intervention. The natural environment differs in various parts of the earth. But what determines whether a particular region would be a grassland or a desert or a lush green forest? The answer is—differences in the climate of these regions. Climate is a critical factor in soil formation, food production and energy demand of any geographical region. Climatic variations can have profound effects on the environment and thus on humankind. To assess the effects of these variations we must first have some understanding of the factors that constitute climate.

The earth is a mosaic of many types of climates and a variety of controls interact to shape the climate of any region. The controls that exert a regular and predictable influence on climate are latitude, altitude and proximity to large water bodies.

In addition, the climate is strongly influenced by circulation pattern of the atmosphere and ocean currents. Circulation determines the types of air masses that regularly develop over a region or move across it from other regions. This affects the rainfall, while ocean currents affect the climate of large land masses.

In this unit, you will learn about the global patterns of climate in general and about the climate in various regions of India which determine the patterns of agriculture. Agriculture and industry affect the distribution of population. Man needs food, clothes and shelter in addition to free natural air and water for his survival. People like to live at places where they can earn their livelihood easily. You will also briefly learn about the mineral resources of our country, that have made it possible for India to aquire a sophisticated industrial base. This will help you to realise that resources are finite and need to be used judiciously.

Objectives

After studying this unit you will be able to:

- define climate, list and describe the basic elements which constitute climate,
- describe the role of atmosphere and other factors in creating variation in climate including seasonal variation,
- explain why the Indian climate is known as 'monsoon climate',
- describe the agricultural patterns in India with relation to climate, and
- describe briefly the mineral resources of India.

2.2 GLOBAL PATTERNS OF CLIMATE

If we have a choice in deciding where we have to live, we often consider the climate as a major determining factor. Climate is defined as the weather conditions of an area which are averaged over a period of years, taking into account the weather extremes that are likely to occur.

All weather begins with four primary interacting elements:

1) The sun, which is a source of light and whose radiant energy ultimately determines the state of the atmosphere.
2) The earth itself, whose unique movements dictate the distinctive features of weather and climate.
3) The earth's atmosphere which modulates the passage of solar radiation to earth.
4) Natural landforms and geophysical features of the earth's surface—mountains, valleys, oceans, ice caps, deserts, lakes, rivers, etc., that alter the state of much of the atmosphere.

Let us first consider the unique features of the earth that contribute to the creation of weather. In addition to its annual movement around the sun, the earth rotates on its own axis from west to east at a speed of nearly 1690 km/hr. This west to east rotation in 24 hours gives us days and nights and determines the direction of winds and ocean currents both of which contribute to the formation of weather.

However, since the equatorial plane of the earth is inclined to the plane of its path around the sun at an angle of 23° 27', the length of days and nights varies except at the equator. For example we have longer days in summer, and shorter days in winter; the length of days and nights tends to become equal in spring and autumn. The earth completes one revolution round the sun in about a year or 365 1/4 days to be exact. The path of earth's revolution round the sun or its orbit is elliptical, with the sun situated at one focus of the ellipse. However, orbital **eccentricity** or departure from a circle is only slight. At **perihelion**, when it is nearest to the sun (January 3-4), it is only approximately 3.4 per cent closer to the sun than it is at **aphelion**, when it is at the farthest from the sun (July 3 or 4).

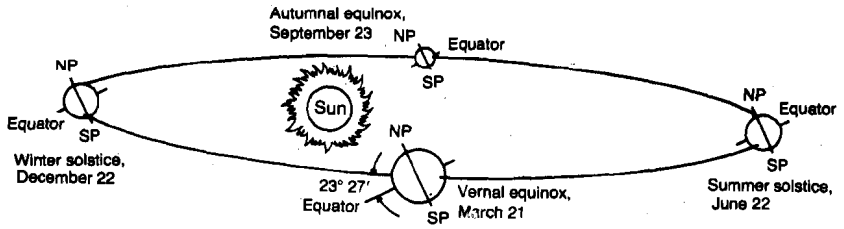


Fig. 2.1: The seasons occur because the earth's equatorial plane is inclined at 23° 27' to its orbital plane.

Because the intensity of solar radiation diminishes rapidly with distance from the sun, as the inverse square of the distance travelled to be exact, the intensity of solar radiation that reaches the earth's surface varies approximately 7 per cent about its mean value between perihelion (maximum) and aphelion (minimum). Seasons also result from the inclination of earth's equatorial plane to its orbital plane (see Fig. 2.1). Since the earth receives energy from the sun, the two factors, namely, motion of the earth and the sun's energy received by the earth, put combined effect on the air envelope which is present all around the earth. As a result we have different kinds of weather at different places. Different types of weather conditions on the earth create changes from day to day and some times from hour to hour. The nature of weather and climate is defined by some basic elements such as:

- temperature of the air,
- humidity of the air,
- type and amount of cloudiness,
- type and amount of precipitation. This means all types of water received on the earth from the atmosphere such as rain, snow, hail, etc.
- atmospheric pressure,
- speed and direction of the wind.

As we all know, temperature, humidity, precipitation, wind, etc., are never the same at different places. So, the climate of different areas of the earth is different.

The difference in climatic conditions at different places on the earth shows its direct effect on the ecosystems. For example, the plant and animal species present in one type of climatic area may not be present in another climatic area. In some climatic areas, there are very large trees while in others there may be only small plants and shrubs. Similarly, a particular type of animal found in one climatic zone may not survive in another. We will learn more about these when we discuss different types of ecosystems.

SAQ 1

Fill in the blanks with the appropriate words.

The ..... of the earth around the sun is slightly ....., ... is the point where earth is nearest to the Sun while ..... is the point when it is farthest from the sun. The seasons arise because the axis of the earth is ..... at 23° 27' to its .....

2.2.1 Mediatory Effects of the Atmosphere

As we have seen above, the earth's climate at different places is related to the energy received from the sun and the earth's motions. Let us see how the atmosphere plays an important role in creating climates of different types.

The atmosphere does not allow all incoming solar radiation to reach the surface of the earth. Nearly 16 per cent of the total energy received at the uppermost layer of the atmosphere is absorbed by oxygen, water vapour, ozone, and dust particles. This makes air warmer. On an average, 20% of the radiation is reflected back into the space by clouds while they absorb about 3%. Nearly 6% is back scattered by air molecules. The remaining 55% of the incoming radiation reaches the ground or ocean surface. Of this, 4% is reflected back and the rest is redistributed in the atmosphere both by conduction and convection (see Fig. 2.2).

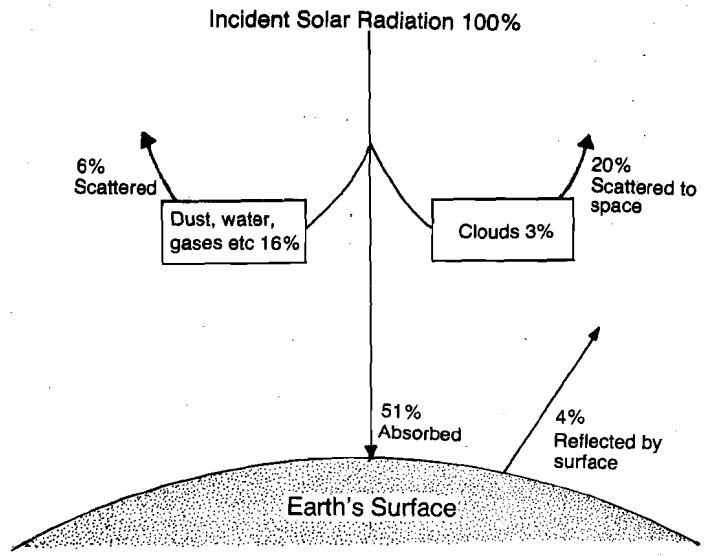


Fig. 2.2: Global disposition of solar radiation based on 100 units of incident solar radiation.

Without the envelope of atmosphere the sun's rays would scorch the earth's crust with temperatures as high as 82.2° C. by day at the equator and by night the same area would cool to −140° !

Another process which controls the sun's energy reaching the earth is the absorption of energy by the atmosphere. As said above, the gases present in the atmosphere absorb about 16% of the solar radiation entering the atmosphere. This absorbed energy heats the atmosphere directly. However, most of the heating of the atmosphere is indirect. First the earth's surface is heated and then it heats the air which comes in contact with it. Warm air rises up and cool air which takes its place gets heated in turn. Therefore, the temperature at lower altitudes, nearer the surface of the earth is always higher than the temperature at higher altitudes. So, on one hand, the atmosphere does not stop all energy coming from the sun, on the other it controls it.

The energy received from the sun is the basis of all life on the earth. This energy is converted into food by green plants by the process called photosynthesis. All types of ecosystems utilise directly or indirectly the food produced by photosynthesis. Depending on the quantity of energy received in an area, ecosystems of the area develop their special features, their flora and fauna. One important part of solar radiation absorbed by the atmosphere is the ultraviolet rays. These rays can cause damage to the living organisms. Ozone absorbs these rays and thus acts as a shield.

2.2.2 Air Currents

Air has different types of movements. It moves vertically as well as horizontally. The vertical movement of air is easy to understand. When a part of air becomes warm, its density becomes low, in other words it becomes lighter. The low density results in upward movement of the warm air. The warm moist air rising up forms clouds. The horizontal movement of air called wind is, not so easy to explain. In a very simple way we can say that wind is caused due to difference in air pressure at different places. Air always moves from areas of higher pressure to areas of lower pressure. One may ask how these differences in pressure are created. The answer is, due to an unequal heating of the earth's surface. As we have discussed above, earth's surface gets heated by the solar radiation reaching the earth. We have also learnt that the solar energy does not reach everywhere in a uniform way. Some areas receive more solar energy while others receive less, due to absorption, scattering and reflection of energy by the atmosphere. Where the energy has to travel longer distances, these factors become more effective and important. This is the reason why the areas of the earth which receive solar radiation at right angles with the sun right overhead, are heated more than those areas where radiation is at an inclination. Also, the sea surface and the land surface behave differently. The sea surface does not change its temperature quickly while land areas get heated or cooled quickly. This is the reason why during the day the air above the land gets heated and expands while the air above sea does not show much change. Therefore the air above the land moves towards the ocean at higher altitude. To compensate it there is a movement of air mass from sea towards land at the lower altitude. Thus, a kind of circulation is created. In the lower part air moves from sea to land and in the upper part from land to sea. This kind of circulation is of local nature and can be seen only in coastal areas. However, the unequal heating of different areas of earth plays a more important role. This leads to air circulation on a global scale.

To represent the global circulation of air, several models were proposed. Presently, the three cell circulation model for each hemisphere of the earth is considered to be very useful and explains most of the phenomena (see Fig. 2.3). There is one zone between the equator and about 30° latitude. This zone shows flow of air near the surface towards equator. In the upper part of the atmosphere flow of air in this zone is towards the poles. This is the zone where trade winds are created. The horse latitudes where not much wind flows, are located at the edge of this zone.

Horse latitudes are the regions at sea on 20° N and S latitudes. This name is given because sailing ships were often becalmed for long periods at these latitudes and horse transported as cargo often died of thirst and hunger.

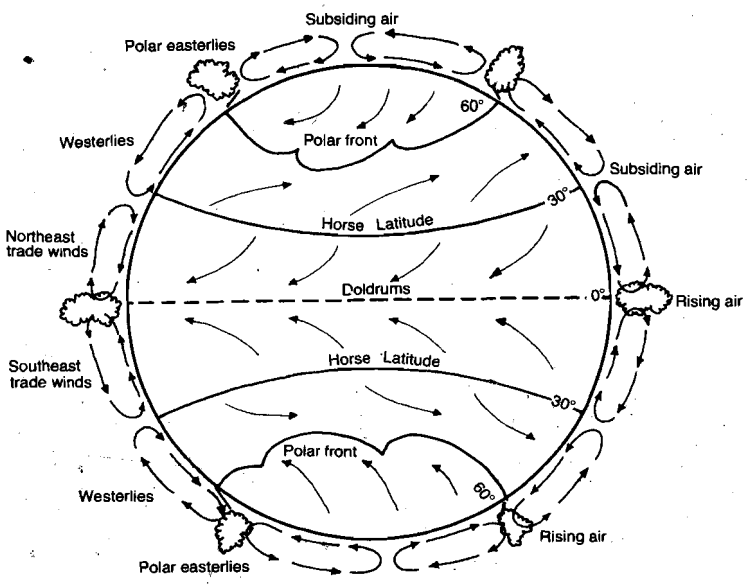


Fig. 2.3: Global circulation of air-proposed for the three-cell circulation model.

Next is the zone between 30° and 60° latitudes. In this zone the surface flow is poleward and the winds have a westerly component. The westerlies are important in maintaining the heat balance of the earth's surface. They carry the excess heat from the equatorial region towards the poles.

The third zone lies beyond 60° latitudes. In these areas there are surface flows of wind which move towards the equator. They form polar easterlies. These cold wind currents meet with the warm westerlies and often cause foggy conditions.

Due to these air currents all over the globe, heat is transferred from one area to another. Quantity of precipitation falling on different parts of the earth is also controlled by air currents. There is a close relationship between precipitation and distribution of earth's wind systems. We can easily identify zonal arrangement of precipitation from equator to poles. For example, the equatorial region has convergence of warm and moist air which results in heavy rainfall in the zone, while the areas where subtropical high winds dominate are generally dry.

Temperature also changes from place to place. Air currents and temperature are the two main factors which cause different types of climates in different zones of the earth. As said earlier, the climate is the deciding factor for ecosystem development in different zones of the earth. For example, the ecosystem that is found in the equatorial region is different from that which exists in the polar region or in the subtropical region.

2.2.3 Ocean Currents

Oceans have different types of water movement. Tide is the one which is known to everybody who has seen an ocean. Tides are regular movements of the waters caused by the pull of the moon and the sun. There is another movement of ocean water which is called ocean currents. These are like rivers of water flowing through the ocean and cause circulation of ocean waters. These are warmer or colder than the waters through which they pass. Patterns of circulation in the oceans are determined by major patterns of atmospheric circulation and are modified by the large land masses around and against which they must flow. Ocean currents have direct effect on the temperature of adjacent land areas. For example, there is a poleward movement of warm ocean currents, such as the North Atlantic Drift. This keeps winter temperatures in Britain and other parts of Western Europe warmer than they should be according to their geographical positions. Westerly winds in these areas carry the heat towards land.

'El Nino' meaning 'the child' is a warm ocean current which moves down the coast of Peru and Equador. It usually occurs during the christmas season. Sometimes it is strong enough to force the cold Humbolt current offshore taking with it the food supply of millions of birds. El nino advance causes the temperature of surface waters to increase by 5°C. Food producing algae die, common fishes of the area leave the region or die. The birds of the area leave due to scarcity of food. El nino occurs regularly between 2-10 years. It affects the global climatic pattern. The effect being felt as far as India in the years it is strong.

In the tropics and middle latitudes there are cold ocean currents during the summer. One such current is Benguela current which flows in the ocean near the western coast of Southern Africa. This current helps in reducing the temperature in the tropical region. So, the ocean currents have their own impact on climates of different parts of the world. You may have heard of 'El Nino'. It is also an ocean current of the Eastern Pacific. It is supposed to have played an important role in causing extreme weathers during 1982-83. When the climate is affected by such currents, the flora and fauna will also be affected, which ultimately affects the whole ecosystem.

2.2.4 Seasonal Variation in Climate

As we have seen earlier, weather is dependent on the heat and moisture present in the air as well as the movement of air or the ocean currents. The weather changes from year to year, season to season, day to day and even from hour to hour. Seasonal changes are due to the revolution of the earth around the sun. When the earth moves around the sun, its axis always points in the same direction. In the northern hemisphere, it always points towards the North Star or the Pole Star. This is the reason why for some part of the year, the North Pole tilts towards the sun leading to summer and for the other it is tilted away from the sun, leading to winter, in the northern hemisphere. Obviously converse will be the case in southern hemisphere, i.e., when we have summer in northern hemisphere, there will be winter in southern hemisphere. The main factor responsible for change in weather with the seasons is the angle of sun's rays reaching the earth. During winter the sun's rays are much more slanting than during summer. Slanting rays have to travel a longer distance through air. So the air will absorb, scatter and reflect more of the sun's rays (see Fig. 2.4).

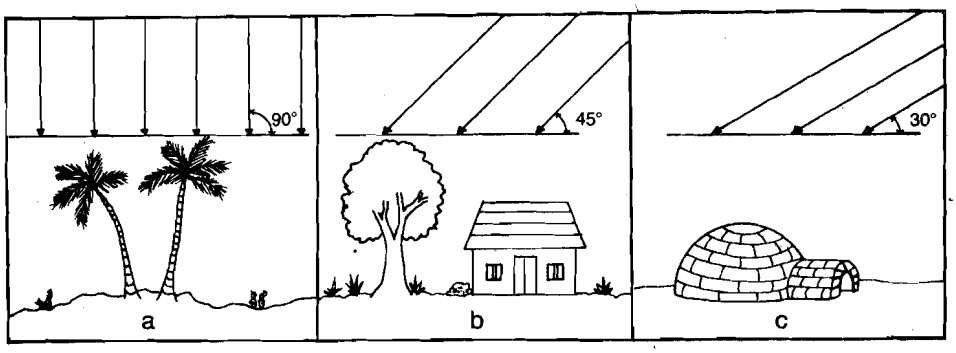


Fig. 2.4: Changes in the sun rays angle causes variation in the solar energy reaching the earth's surface. The higher the angle, the more intense the solar radiation received.

Also, when the sun is directly overhead, the solar rays are most concentrated. With lowering of the angle, sun rays spread over greater area, as a consequence the intensity of sun rays decreases. You may have experienced this while using a torch light. If the beam is directed straight on an object, the spot is small but intense. As you decrease the angle of the beam, the area illuminated becomes more but the intensity of illumination becomes less. This is because the same energy is being distributed over larger area. Change in energy with seasonal patterns has tremendous impact on plants and animals. There are certain plants which are found in a particular season. Similarly, animals also have adaptations in relation to the seasons, one such example is the hibernation by bears in winter. Productivity of organisms also varies with seasons. So, the ecosystems experience a direct impact of seasons. Not only different types of plants exist in different seasons but their productivity also changes with seasons. You must have noticed that different crops grow in different seasons, and in the case of perennial plants, the season when they flower or bear fruit are fixed.

2.2.5 Regional Climate

As described earlier there is a seasonal variation in climates and there is a global pattern of climatic variation. But this does not mean that during any season, the climate of a very large area generally remains the same. There are various regional factors which may affect local climate.

One of the factors is the presence of water bodies. We know that the air gets heated mostly due to heating of the earth's surface, therefore, any difference in the heating pattern of land and water will result in differences in heating of the air above. This does happen in the case of lakes and other water bodies which affect the local climate. There are differences associated with the type of land also. For example, a barren sandy area heats air much more than a forest. But the maximum difference exists between land and water. As land heats more rapidly and also cools more quickly than the sea, in the same climatic zone, land bound areas have climatic conditions different from those of areas near the sea. The latter will have a mild winter and a cool summer compared to some other place which is at the same latitude but does not receive wind from sea.

Altitude of a place also affects the climate of a place. Temperture drops by $5^{\circ} - 6.5^{\circ}$ C per kilometre height in the lower part of the atmosphere. So a place situated at an altitude of 2,000 metres should be cooler by about 13° C than a place at the same latitude at sea level.

These regional differences in climate also affect living organisms. For example, as we climb a mountain, we see a gradual change in plants and animals, there may not be any plants and animals beyond a certain height. In the next section we will describe the physical features of India and its climate. But before that try to work out the following SAQ.

SAQ 2

Mark (√) for the correct statement and put (×) for incorrect statement in the given bracket.

a) Winds are formed due to difference in air pressure at different places [ ]
b) Sea surface changes its temperature easily and quickly while in the same area land gets heated or cooled slowly [ ]
c) Temperature and wind currents are the two main factors responsible for different types of climate [ ]
d) Climate alone decides the ecosystem development in different zones of the earth. [ ]

e) The cold oceanic current reduces the temperature in the tropical region. [ ]
f) A place situated at 6000 meter above sea level will have about an average temperature 39° C lower than a place at the same latitude at sea level. [ ]
g) At higher altitudes the atmosphere becomes thinner and density is low. [ ]

2.3 DESCRIPTION OF INDIA

India is situated in the southern part of the Asian continent between 5° and 35° N latitudes. Its length and width is almost equal. The physical features are marked by high mountains in the north and a plateau in the south. We can divide India into four physical regions, viz.

i) Northern chain of hills and mountains,

ii) Alluvial Gangetic plains extending from Punjab to Bengal,

iii) Deccan Plateau, and

iv) Coastal plains of the peninsular region.

In the north, the huge Himalayan mountains and the allied ranges stand in protection of the country against the cold dry winds blowing from the northern region of the Asian continent. They also check the summer monsoon and cause rainfall, otherwise the monsoon winds would have drifted away leaving India dry. Not only this, the Himalayan mountain range is the source of several big rivers which flow through the plains carrying enough water all round the year and for irrigating dry fields during hot and dry months. These rivers are replenished with water by the melting of snow on the mountain peaks. Water from these rivers is used for irrigation, industrial and drinking purposes. Several dams have been constructed to store water for producing electricity and for channelising the outgoing water in irrigation canals which is a great relief to farmers.

Keeping in view the physical features of the country, let us now discuss its climate.

2.3.1 Climate

India is a vast country having different types of climate in its different parts. These differences in the climate are determined by (i) location (ii) altitude (iii) distance from sea or the mountains and (iv) the general relief or topography. Yet its climate is labelled as 'Monsoon climate'. The south, due to its proximity to the equator always remains warm while some parts of the north due to high mountains experience cold with temperatures dipping below freezing point in winter. In most parts of India we experience four seasons, i.e., winter, spring, summer and the rainy season.

Let us see what causes winter in our country. When the sun shines in the southern hemisphere, due to tilting of the earth's axis, the angle of the sun rays becomes less in the northern hemisphere, i.e., the distance sun rays travel increases. As they have to traverse greater length of atmosphere, greater scattering of sun rays takes place and this keeps the weather cold. In northern India, winter is experienced more bitterly than in the southern part. Southern part of the country is peninsular plateau. It is surrounded by the Arabian sea in the west and by the Bay of Bengal in the east; the Indian ocean lies in the south. Due to sea breeze this part enjoys warmth, the minimum temperature remains about $20^\circ \pm 2^\circ$ C with very little variation in the daily minimum and maximum temperature, whereas in the north, temperature in the plains comes down to 10° C with wide variation in daily minimum and maximum temperature.

In the extreme north, hilly regions, due to their being at greater height from the sea, experience extreme cold with temperatures going below zero degree with huge variation in day and night temperatures. Cold wind blowing from the mountainous regions towards plains further brings down the temperature.

When the sun rays start falling on the northern hemisphere, more directly, the Indian sub-continent grows warmer and the spring season sets in. By May-June, sun shines very brightly and the summer is in full swing.

In the middle of June, monsoon sets in and rains start almost all over the country accompanied by heat and moisture. Most parts of the country have maximum rainfall in this period, only a small part of southern India, i.e., the eastern coastal part has winter rainfall. By the end of the rainy season winter sets in again.

As already stated most parts of India enjoy summer rainfall. Rains are caused when vapour-containing warm wind meets a cold front, this can happen when the wind rises and is blocked by the high mountains. On cooling, the water vapour precipitates as raindrops.

In the summer season when the northern part of the country becomes very hot, air pressure in the region becomes very low. At the same time the southwest region, because of the Arabian sea, and the southeast region, because of the Bay of Bengal, remain comparatively less hot and the air pressure there is high. Thus wind filled with vapour from sea, the high pressure area, blows towards land the low pressure area. These winds are checked by the Western Ghat mountains in the south and by the chain of hills and the Himalayan mountains in the north causing rainfall. For example, the wind which rises from the Arabian sea towards land is obstructed by the Western Ghat mountains causing heavy rainfall (300 - 400 cm) on the coastal region but when it rises above these hills and crosses to the other side, the wind contains very little moisture, resulting in very little rain (20 - 40 cm) behind Western Ghats on the southern plateau. Thus the dry southern peninsula is called the "rain shadow" area. The wind which blows towards Gujarat and Rajasthan blows unchecked upto the hills and does not cause rain during its onward journey. When these winds are checked by the hills, they cause much more rain near the mountains but, when pushed back contain less moisture causing little rain and leaving parts of Rajasthan and Gujarat dry (Fig. 2.5).

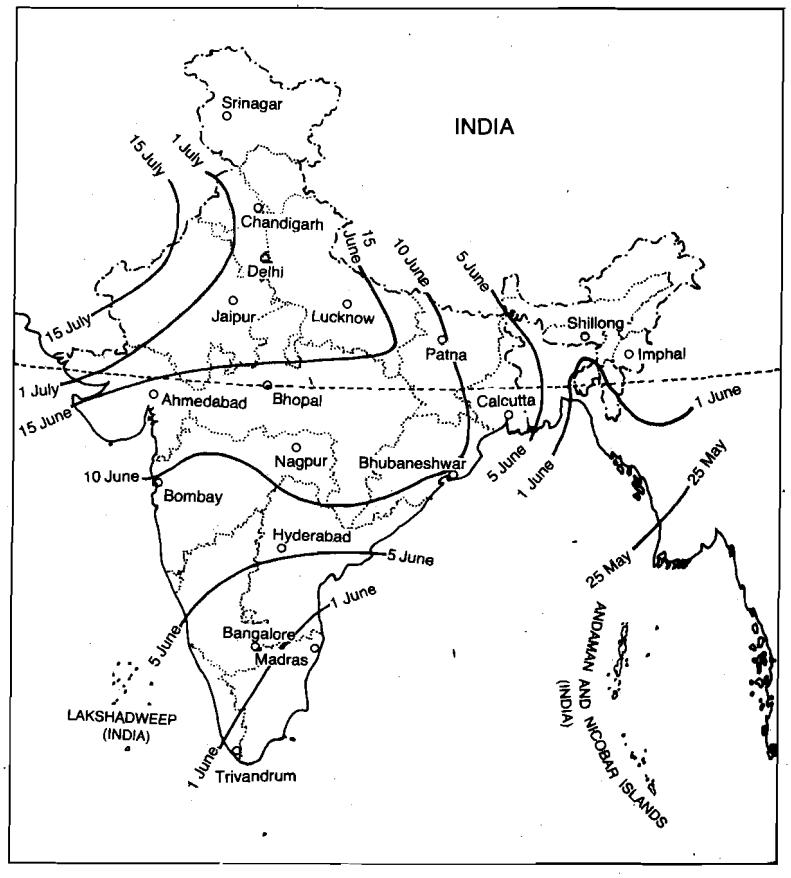


Fig. 2.5: Onset of monsoon in India.

Winds which rise from the Bay of Bengal are checked by the mountains in the east and cause heavy rainfall in Bengal and Assam. It is only due to these hills that this moisture-laden wind is checked at Cherapunji which at one time experienced the heaviest rainfall in the world. Figure 2.6 shows the seasonal rainfall in India from the month of June-September.

These winds change their direction and move towards the west covering plains of Bihar, Utter Pradesh and Punjab. They cause greater rainfall at the start of their journey which gradually decreases as these winds proceed towards west. So the quantum of rainfall decreases from east to west. These rains are known as Monsoons.

Though winter rains are generally scanty in India, the eastern coast of southern India enjoys winter rains. Let us see what causes winter rains. In winter the northern part of the country is cold and the air pressure there is high but southern India is warm due to Arabian sea and

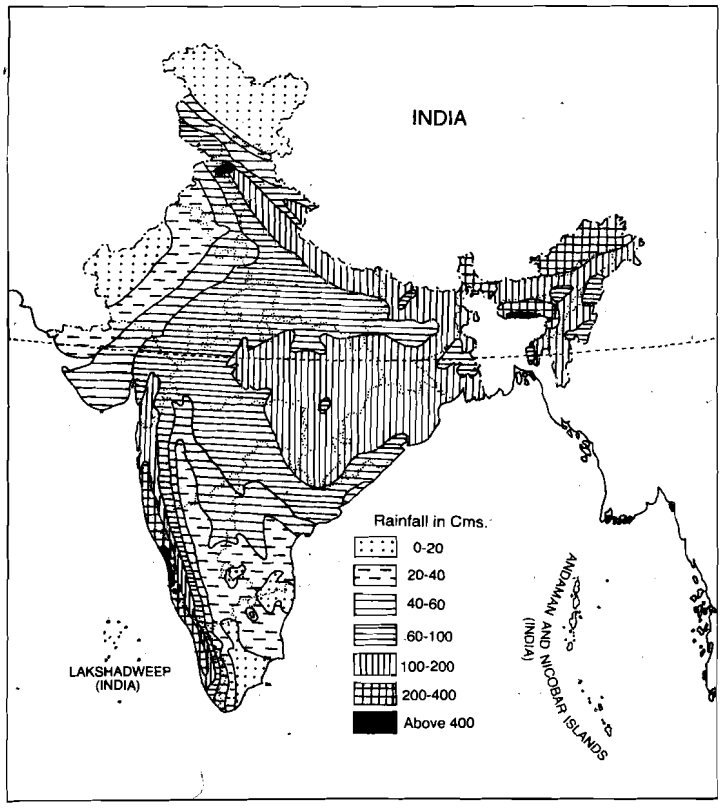


Fig. 2.6: Seasonal rainfall in India.

the Bay of Bengal and the pressure there is low. Hence wind blows from northern part of India towards the southern part. Since the wind originates from land it is dry and cold to begin with. However, it picks up moisture from the Bay of Bengal and moves towards the eastern coast. When checked by Eastern Ghats, rainfall occurs on the eastern coastal region, which therefore has good winter rainfall. Figure 2.7 shows the distribution of annual rainfall in our country.

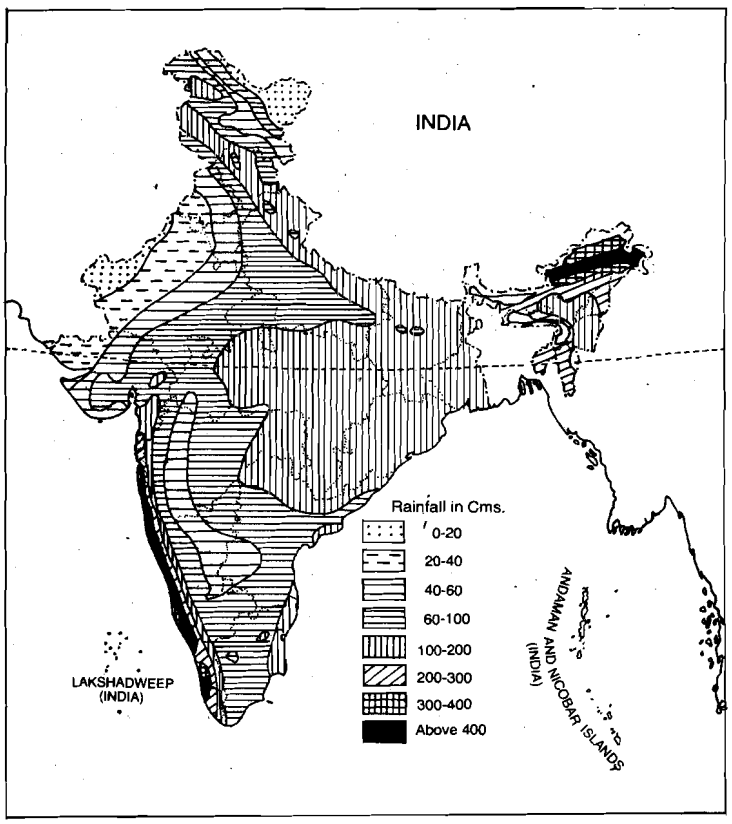


Fig. 2.7: Annual rainfall in India.

As much of the country has moderate to heavy monsoon rain in summer or winter, we will talk more about monsoon rains. One characteristic of monsoon rain is its uncertainty. The rain may start early and finish early or start late and finish early. It may sometimes start early and finish very late. In some years there may be heavy rains and in some years scanty, resulting in drought like conditions. Figure 2.8 shows the withdrawal of monsoon.

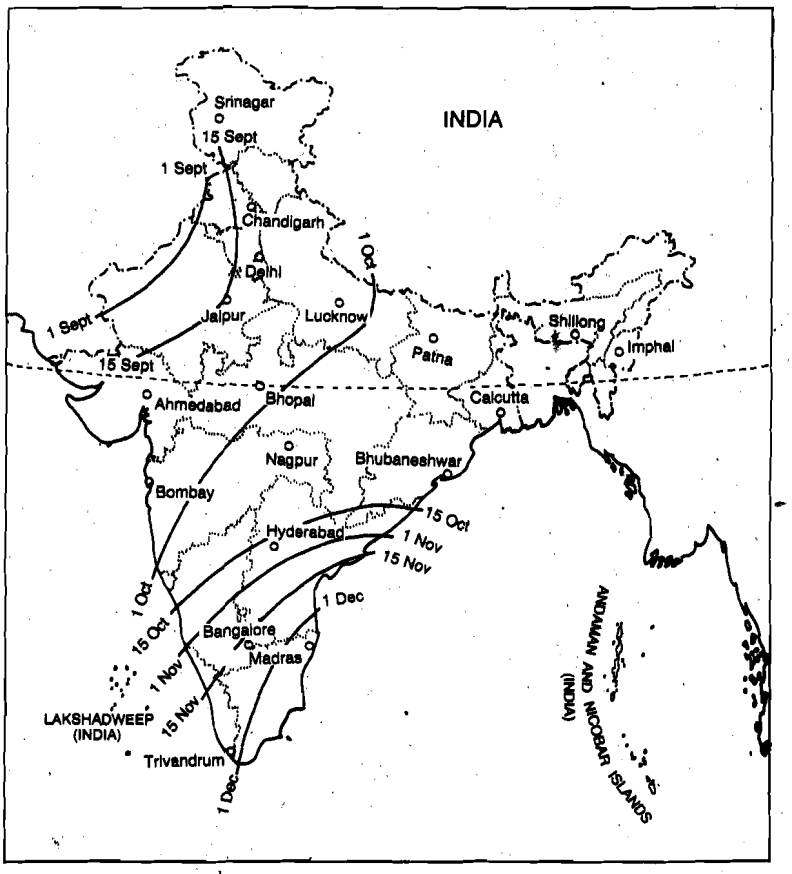


Fig 2.8: Withdrawal of monsoon.

The rainfall also varies from one part of the country to the other. You may have often heard that there is flood in some parts while at the same time, in some other parts, there is drought. Rain water is an important contributor to our economy as our agriculture is largely based on rain water. Pumping-up ground water for all agriculture would be too expensive. It can also lead to salinity due to its high salt content. Farmers, in large parts of the country, have to depend mostly on monsoon rains. Apart from its indispensible role in irrigation, water is an important factor in our daily life. It is considered as one of the parameters of the quality of life in a country. India has one of the lowest municipal water consumption levels in the world, with acute scarcity of drinking water in many areas. Drought and flood create several environment problems apart from disrupting lives of several thousand people every year.

There is an illusion in our country that water is abundant and unlimited. This is because we never pay for the actual cost of water that we use in fields, industry or at home. Few years ago we had acute water shortage in Tamil Nadu and Gujarat. Perhaps it was an early warning that there is an urgent need to start thinking very seriously about the conservation and management of water of agricultural, industrial and urban sectors. There is also a lot of water pollution due to the dumping of toxic or hazardous chemicals in rivers and other water bodies. We urgently need to evolve environmentally sound and economically efficient water conservation and management policies.

SAQ 3

Fill in the blanks with the appropriate word given below :

Indian climate is labelled as ..... climate. The ..... part of country experiences bitter cold whereas ..... part of country is warmer in winter.

When the winds with ..... moisture cross the Western ghat it causes ..... rain on the .... behind the Western ghat. It is called .... area.

We will now briefly describe the resources of India, its agricultural produce and mineral resources.

2.3.2 Agriculture

A large sector of our population is dependent on agriculture for their livelihood. Let us first talk about crops. In most parts of the country two crops are produced in a year though in certain places even three crops are produced. Rabi and Kharif are the two most important crops of India. Rabi crops are sown in October-November and harvested in March-April except certain crops like sugarcane, which are sown and harvested in other months.

Rabi crops include wheat, barley, peas, grains, pulses like arhar; cotton and oilseeds except groundnut. Kharif crops include maize, millets, pulses like urad and moong, hemp and paddy which are sown in July and harvested in the end of September or beginning of October.

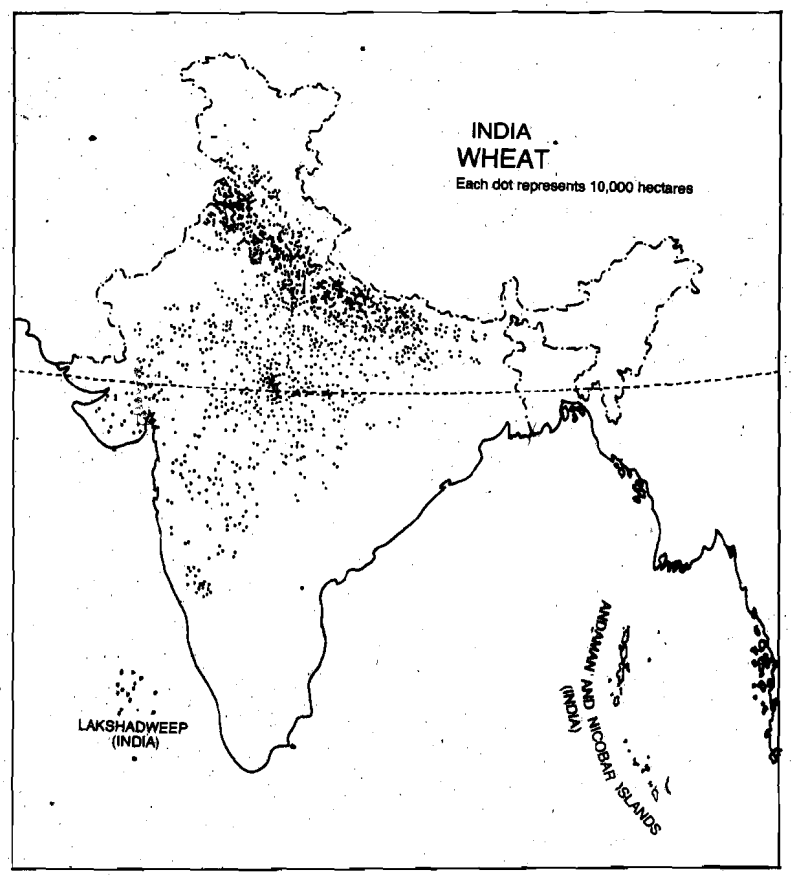
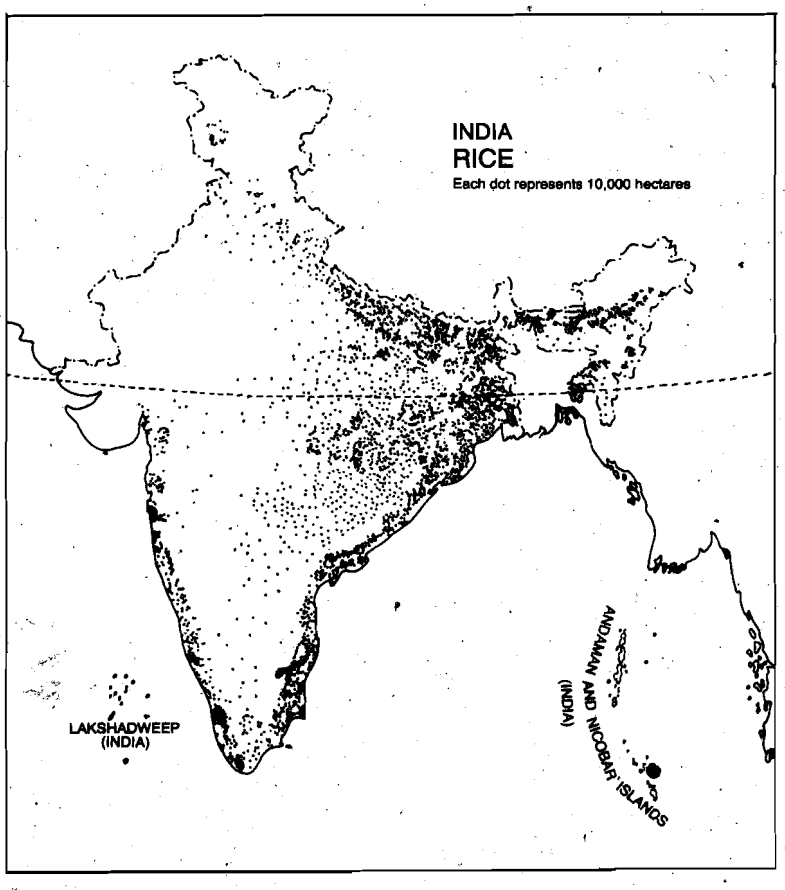


Fig. 2.9: Wheat production in India.

The variety of crops and their yield depends upon various factors like soil, rainfall, temperature, availability of irrigation facilities etc. In the plains of northern India, alluvial soil is found. In Punjab and western half of Uttar Pradesh, production of wheat is more favoured and good yield is procured because of fertile soil, favourable temperature and adequate rainfall. Figure 2.9 shows the areas where wheat is produced. In the eastern half of Uttar Pradesh, Bihar and West Bengal where soil is fertile, temperature is nearly the same as Punjab and Western Uttar Pradesh but rainfall is more than these areas, paddy is produced easily (Fig. 2.10). In West Bengal and Tamil Nadu heavy rains help raise three crops of paddy during a year. Among the non-food grain crops, the most important is oilseed, sugarcane, raw cotton, jute, tea, coffee, rubber and tobacco. Cotton production is abundant in the Southern Peninsular Plateau except in the coastal plains. Cotton requires black soil, less quantity of rains and a comparatively dry climate. Besides these agricultural products, different kinds of fruits and various spices are produced in our country. These are exported to

a large extent. In the Southern Peninsula valuable spices are grown on the hills. Cardamom hills are know only for production of cardamom.



2.10: Rice production in India.

Indian agriculture is still largely traditional; it is dependent on the vagaries of weather, and the land under cultivation is extremely unevenly distributed. A very large percentage of farmers is concentrated on a very small percentage of total area of cultivation; agriculture suffers from lack of water, and credit and lack of incentives.

Though agriculture is necessary for the country, it contributes to several environmental problems. More and more agricultural land is needed for the growing population, for which forests are cleared. Thus indirectly agriculture contributes to soil erosion, depletion and various other problems. The western model of high-input agriculture has indeed paid dividends but has brought in its wake problems of topsoil loss or depletion. The crop-land itself is under stress on account of urbanisation and industrialisation. We have to evolve some new system of crop production in which high inputs are reduced.

About half of India's land is cultivated and about one-fifth is forested, while the rest is uncultivated. The quality of soil is generally poor and soil erosion is common in many parts of the country. About three-fourths of the total land area under forests is 'reserved' or protected. The remaining is unclassified and generally not well managed. Only the Himalayan belt and a few mountainous areas have thick forests. Because most of the plains are bereft of any worthwhile forest cover there has been a desiccation in the climate and vegetation. Moisture has been removed from the soil and this in turn has led to adverse effects on rainfall from the monsoon clouds.

Among the important species of trees present are teak, sal, bamboo and the coniferous group and many medicinal plants. Forest cover is important in maintaining the ecological balance. For a long time, these forests have been destroyed for petty needs and greed of timber merchants. But now their importance has been realised and efforts are being made at all levels not only to preserve the existing forests but to increase the forest area by planting new trees. These forests also check soil erosion. Aforestation is necessary in dry desert areas to check further erosion; therefore, plants suited to this climate must be planted in large numbers.

Although India has the largest livestock populations in the world, milk yeilds are extremely low. The main milk producers are the buffalos and cows. Only about 5 percent is produced

by goats, sheep and camels. The low yeild of milk is due to the poor quality stock, inadequate fodder resources, limited grassland areas, and old-fashioned methods of livestock management. The present fodder resources are sufficient for only two-thirds of the total livestock strength.

2.3.3 Mineral Resources

India is also endowed with rich natural mineral resources which are being utilized for various developmental programmes. Many of these programmes were taken up in the post independence era.

Coal and iron which are basic minerals for industrial growth of a country are found in abundance. In addition other minerals like copper, gypsum, gold, etc., are also found. Figure 2.11 shows the mineral deposits in India. Reserves of non-ferrous metals with the exception of aluminium are not enough to meet domestic needs.

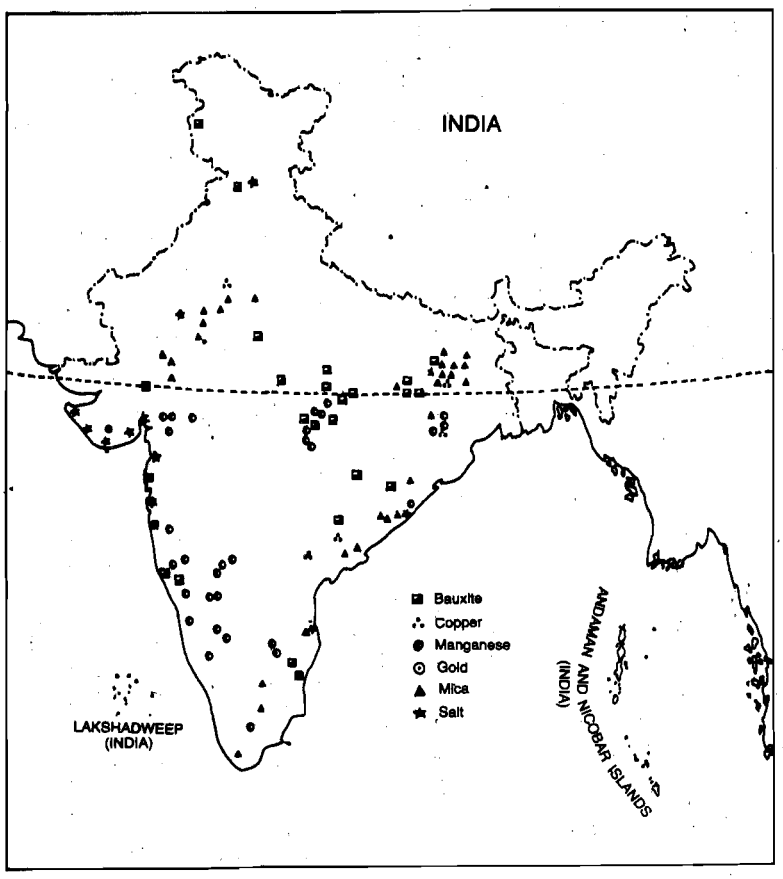


Fig 2.11: Important mineral resources of India.

It is clear that coal will be the country's primary fuel for years. There are enough deposits of noncoking coal to meet its requirements unless the initial rate of exploitation increases substantially, or the growth rate of the economy becomes very rapid. The coal reserves are not evenly distributed, the workable coalmines are concentrated in Bihar, West Bengal, Madhya Pradesh and Andhra Pradesh.

Apart from coal, India has lignite reserves in Tamil Nadu, Rajasthan and Gujarat. The Tamil Nadu reserves are being systematically exploited by means of an industrial complex that produces power, fertilisers and briquettes.

India is one of the worlds leading iron ore exporters. The most extensive deposits are found in Bihar, Orissa, Madhya Pradesh, Karnataka, Goa, Andhra Pradesh, and Tamil Nadu. There are also considerable amounts of chromite and titanium reserves. However, it is now being realised that these minerals can get exhausted if they are not used prudently and thriftly.

Petroleum and natural gas have been found not only on land but in estuaries and off-shore regions as well. But in view of the finite nature of these resources and the pollution resulting from their excessive use, search for renewable energy sources is continuing.

SAQ 4

Put (√) against the correct statement and (×) against the incorrect statement.

a) Sugarcane is Rabi crop but it is not sown with other Rabi crops. [ ]

b) Rabi crops include all the oilseeds. [ ]

c) Alluvial soil is found in northern part of the country. [ ]

d) Cotton cultivation needs only dry climate and less rain. [ ]

e) Three crops of paddy can be produced in those parts of the country where the rains are heavy. [ ]

f) Himalayas are responsible for heavy monsoon rains. [ ]

g) Petroleum and natural gas are also found in estuaries and off-shore regions. [ ]

2.4 SUMMARY

In this unit you have studied that:

- Climate is the aggregate of weather conditions over an extended period including the extreme in weather conditions. It is the principal factor that controls the geographic distribution of various plants and animals.
- The climate of a region is shaped by its latitude, altitude, atmospheric circulation and proximity to large bodies of water.
- The earth's annual orbit around the sun and its daily rotation on its own axis are both important in determining the world climate. The seasons result from the inclination of the earth's equatorial plane to its orbital plane at a fixed angle of 23° 27'.
- The atmosphere controls the sun's energy reaching the earth and the unequal heating of the earth's surface is responsible for air circulation patterns which control precipitation, and drive the ocean currents.
- The Indian climate is labelled monsoon climate, even though there is wide variation in temperature and rainfall throughout the country. Most parts of the country have summer rains. Only the eastern coast experiences substantial winter rains.
- India is an agricultural country with two main crops—Rabi and Kharif. Main crops of Rabi are wheat, peas, gram, oilseeds, etc. Main crops of Kharif are paddy, maize, millet, moong, urad, groundnut, etc. The agricultural patterns are traditional and dependent mostly on the monsoon.
- India is rich in minerals like coal, iron, aluminium, etc. The other natural resources are forests and livestock. It must be appreciated, however, that mineral and natural resources are limited and there is a need for careful and prudent use of these resources.

2.5 TERMINAL QUESTIONS

1) List the basic elements of weather and climate.

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2) Why does the eastern coast receive winter rather than summer rains ?

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3) Explain why the area behind the Western Ghats receives scanty rainfall ?

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4) Mount Everest is 8,848 m high therefore, it is so much closer to the sun as compared to the Gangatic plain. Yet it is perpetually covered with snow. Can you explain why ?

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5) Draw up a list of Rabi and Kharif crops grown in the area where you live in.

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2.6 ANSWERS

Self Assessment Questions

1) Orbit, elliptical, perihelion, aphelion, inclined, orbital plane.

2) a) √ b) × c) √ d) × e) √ f) √

3) monsoon, northern, southern, less, little, southern plateau, rain shadow.

4) a) √ b) × c) √ d) × e) √ f) √ g) √

Terminal Questions

1) i) Temperature of air

ii) Humidity of air

iii) Type and amount of precipitation

iv) Atmospheric pressure

v) Atmospheric circulation

vi) Ocean currents

2) In winter the northern part of India is cold and air pressure is high there. The southern part, however, is warm due to proximity to Arabian sea and Bay of Bengal. The air pressure is low. Wind blows from areas of high pressure to areas of low pressure. It picks up moisture from Bay of Bengal and moves towards the eastern coast where it is checked by the Eastern Ghats causing rainfall.

3) The area behind the Western Ghat is a 'rain shadow' area. The moisture filled air rises against the Western Ghat mountains and as the wind cools it rains heavily there but after crossing the Ghats when it descends there is hardly any moisture in the warm wind.

4) Temperature drops with elevation at the rate of 6.5° C per km.