Social Science II

Standard IX

Part - 1

Govt.of Kerala
Department of Education

State Council of Educational Research and Training (SCERT), Kerala
2019

NT-459-1-SOC.SCI.-II-9-E-VOL.1

THE NATIONAL ANTHEM

Jana-gana-mana-adhinayaka, jaya he
Bharata-bhagya-vidhata.
Punjab-Sindh-Gujarat-Maratha
Dravida-Utkala-Banga
Vindhya-Himachala-Yamuna-Ganga
Uchchala-Jaladhi-taranga.
Tava shubha name jage,
Tava shubha asisa mage,
Gahe tava jaya gatha,
Jana-gana-mangala-dayaka jaya he
Bharata-bhagya-vidhata.
Jaya he, jaya he, jaya he,
Jaya jaya jaya, jaya he!

PLEDGE

India is my country. All Indians are my brothers and sisters. I love my country, and I am proud of its rich and varied heritage. I shall always strive to be worthy of it.

I shall give my parents, teachers and all elders respect, and treat everyone with courtesy.

To my country and my people, I pledge my devotion. In their well-being and prosperity alone lies my happiness.

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Dear students,

You might have got a colourful picture of the diversity of our earth as you went through the geography chapters from class five to eight. The chapters in class nine and ten are an enquiry into the reasons for such diversity. Such enquiries will lead you to more knowledge and the instinct to take an oath to "protect our earth". The knowledge of the relationship between economics and daily life will help you to live in the present day world. Different aspects of economics are incorporated in the textbook for this purpose. The learning activities relentless enquiries, and critical thinking will help you to open the window of knowledge.

The educational portal-Samagra and textbooks with QR code will make class room activities easy and interesting. The Textbook has been revised considering the National Skill Qualifications Frame work (NSQF), the disaster mitigation measures which is of contemporary relevance and ICT possibilities. Let this textbook be a pathfinder for you in becoming good citizens of the future.

With love and regards.

Dr. J. Prasad
Director, SCERT

CONSTITUTION OF INDIA

Part IV A

FUNDAMENTAL DUTIES OF CITIZENS

ARTICLE 51 A

Fundamental Duties- It shall be the duty of every citizen of India:

(a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;

(b) to cherish and follow the noble ideals which inspired our national struggle for freedom;

(c) to uphold and protect the sovereignty, unity and integrity of India;

(d) to defend the country and render national service when called upon to do so;

(e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;

(f) to value and preserve the rich heritage of our composite culture;

(g) to protect and improve the natural environment including forests, lakes, rivers, wild life and to have compassion for living creatures;

(h) to develop the scientific temper, humanism and the spirit of inquiry and reform;

(i) to safeguard public property and to abjure violence;

(j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievements;

(k) who is a parent or guardian to provide opportunities for education to his child or, as the case may be, ward between age of six and fourteen years.

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Certain icons are used in this textbook for convenience

For further reading (Need not be subjected to assessment)

Questions for assessing the progress

Learning activities

Let us assess

Extended activities

1

Sun : The Ultimate Source

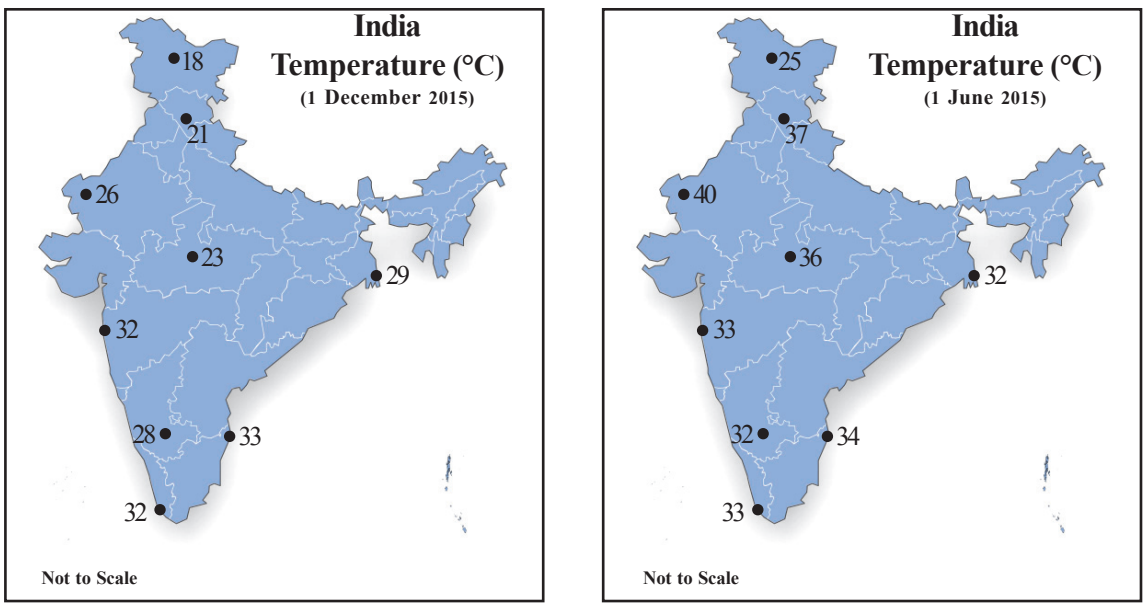


Fig. 1.1

Look at the above maps showing the atmospheric temperatures of a few cities in India (Fig 1.1)

- Is the temperature the same at different places on the same day?
- Is the temperature experienced at a particular place the same in all seasons?

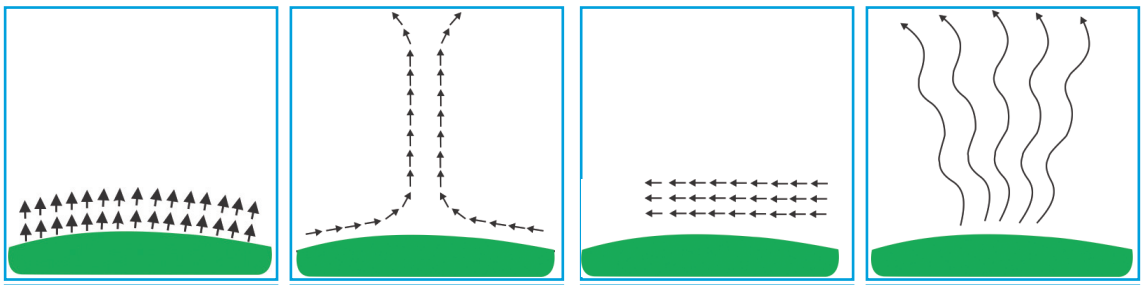
You might have understood that the temperature varies in accordance with place and time. Let us look at the causes and consequences of the varied distribution of atmospheric temperature.

You know that the sun is the sole source of energy for earth. Solar energy reaches earth in the form of short waves. This is called as Insolation.

The earth's surface facing the sun gets heated by this flow of energy, which begins with sunrise and lasts till sunset. The heat is then transferred to the atmosphere from the surface of the earth through various processes.

Processes of heat transfer in the atmosphere

The given diagrams (Fig 1.2) indicate the processes of heat transfer in the atmosphere.



Conduction	Convection	Advection	Terrestrial Radiation
Heat is transferred to that part of the atmosphere close to the hot surface of the earth.	Heated air expands and rises up.	Horizontal transfer of heat by wind.	Heat is transferred from the surface of the earth to the outer space in the form of long waves.

Fig. 1.2

Conduction, convection and advection are confined to the near atmosphere of the earth. The re-radiation of energy from the surface of the earth back to the outer space in the form of long waves is called terrestrial radiation. The atmosphere absorbs the terrestrial radiation.

You have studied in earlier classes that some gases present in the atmosphere can absorb terrestrial radiation.

Which are those gases? What is the consequence of such absorption?

Now you might have understood that the atmosphere is heated mainly by terrestrial radiation.

- Why does terrestrial radiation occur mostly at might?
- What is the difference between insolation and terrestrial radiation?

Heat budget

As you know, the term budget implies the balance between income and expenditure. Similarly, the balance between insolation and terrestrial radiation is called heat budget. Look at the picture (Fig 1.3).

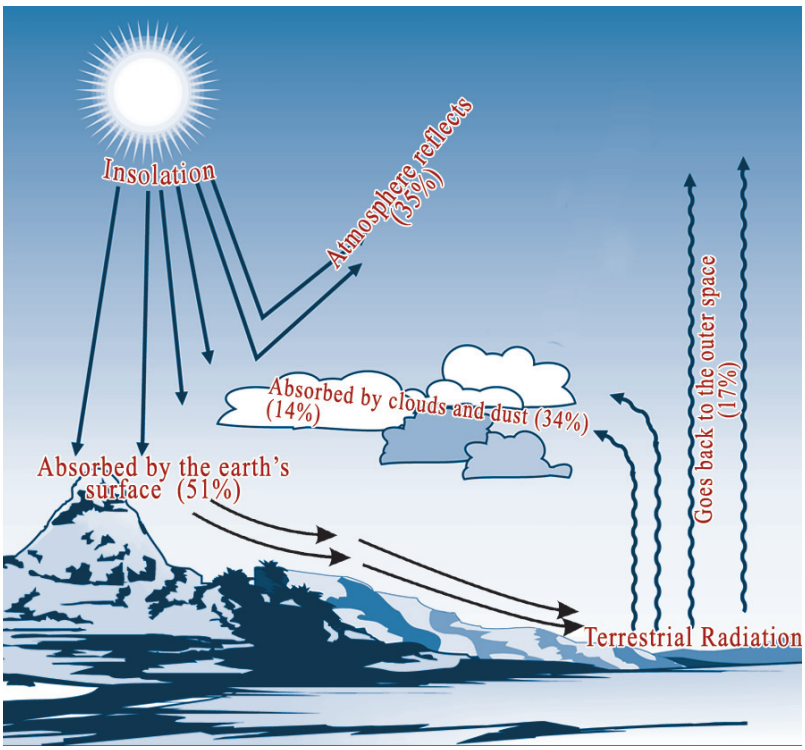


Fig. 1.3

If we consider the total amount of insolation reaching the outer surface of the atmosphere as 100 units, about 35 units of energy are reflected back by the atmosphere. Look at the following table to see how the remaining 65 units of energy are distributed.

Amount of energy reflected by the atmosphere and earth's surface	35 units	Direct terrestrial radiation	17 units
Energy reaching the earth's surface	51 units	Radiation from the atmosphere	48 units
Energy held by the atmosphere	14 units		
Total energy received by the atmosphere and surface of the earth	**65** units	**Total energy radiated back from the earth's surface and the atmosphere.**	**65 units**

Now you might have understood that the entire energy reaching the earth's surface is returned to the outer space through various means. Through this heat balancing process termed as heat budget, the surface temperature of the earth is kept balanced.

What would happen if there was no heat balancing process?

Temperature

You have learnt that the earth's surface as well as its near atmosphere is heated by insolation. Temperature is the degree of hotness of the atmosphere. It is from the weather condition at 2pm that the meteorologists measure the maximum temperature of a day. The minimum temperature is taken just before the sunrise.

Discuss why the maximum and minimum temperatures are being recorded at 2pm and just before sunrise respectively?

Which is the instrument used to measure temperature?

Measure the atmospheric temperature at a fixed time daily and display it in the school notice board or classroom.

Look at the weather information shown in Fig.1.4. The terms 'maximum' and 'minimum' temperatures are usages quite familiar to you since they frequently appear in the media.

The difference between the maximum and the minimum temperatures of a day is called diurnal range of temperature.

Diurnal range of temperature = maximum temperature of the day - minimum temperature of the day

The average temperature of a day is termed 'daily mean temperature'. It can be calculated as follows.

$$\text{Daily mean temperature} = \frac{\text{Maximum temperature of the day} + \text{Minimum temperature of the day}}{2}$$

Calculate diurnal range and daily mean temperature of the places shown in the weather report (Fig 1.4)

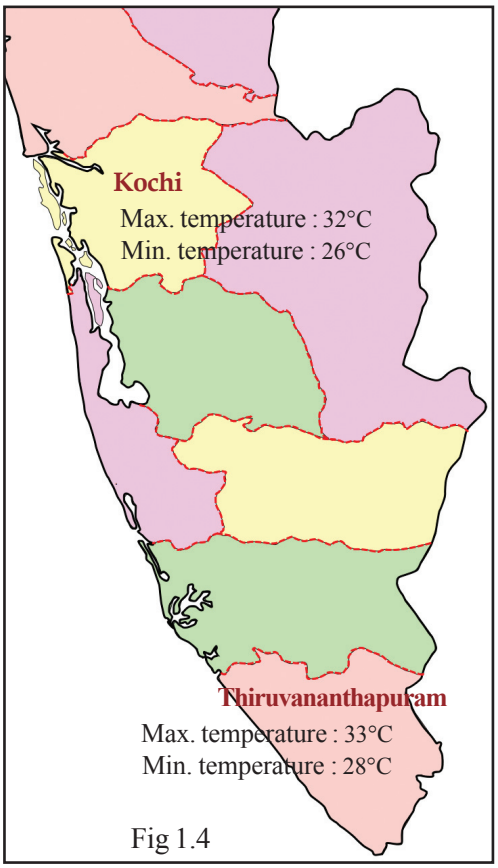
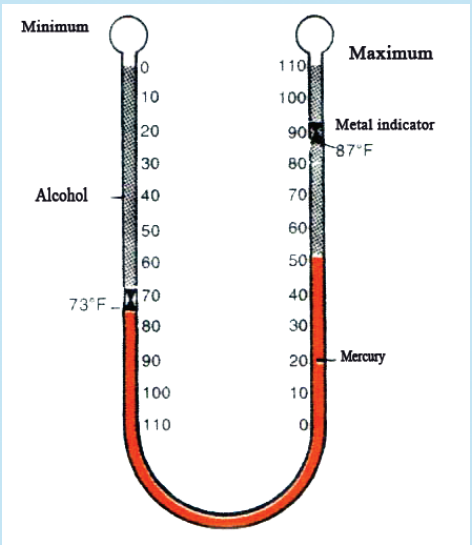
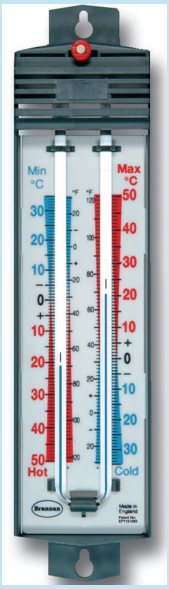


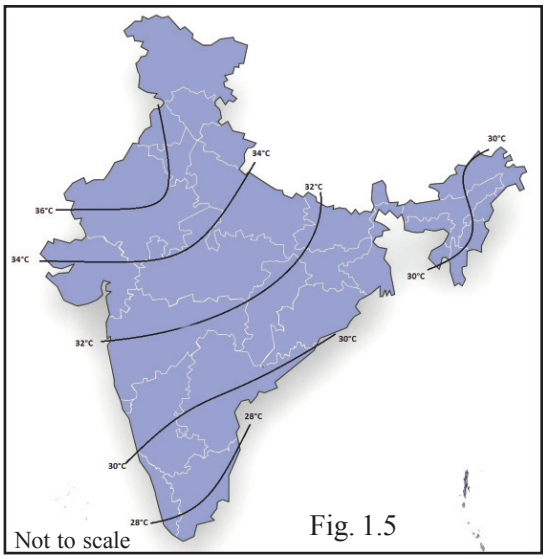
Fig 1.4

Maximum-minimum thermometer



This is the instrument for measuring the maximum and minimum temperature in a day. Here the two thermometers are connected using a U-shaped glass tube. The mercury filled in the maximum thermometer expands with rise in temperature and pushes up the metal indicator. The indicator remains at the position showing the maximum temperature of the day. Thus the maximum temperature can be read at any time during a day. The minimum thermometer has alcohol filled above the indicator. When the temperature falls, the indicator is pushed up as the alcohol contracts. The minimum temperature can be read from the position of the indicator at any time.





Not to scale

Fig. 1.5

The temperature distribution map can be prepared based on the temperature recorded at different places.

Look at the map (Fig. 1.5). You can see smooth curved lines connecting the places having equal temperature. This is the method used to represent the distribution of temperature in maps. The imaginary lines connecting places having equal atmospheric temperature are called isotherms.

You know that temperature varies from place to place on the earth's surface. Let us find out the reason behind this.

Thermal equator

If isotherms are plotted by connecting the places having the highest temperature on earth, it will run almost parallel to the equator. Such an imaginary line is called thermal equator.

Factors influencing the distribution of temperature

Latitude

You have studied that the sunlight is most intense in the tropical region. The region receives more energy as the sun's rays are almost vertical.

How is sunlight distributed in temperate and frigid zones?

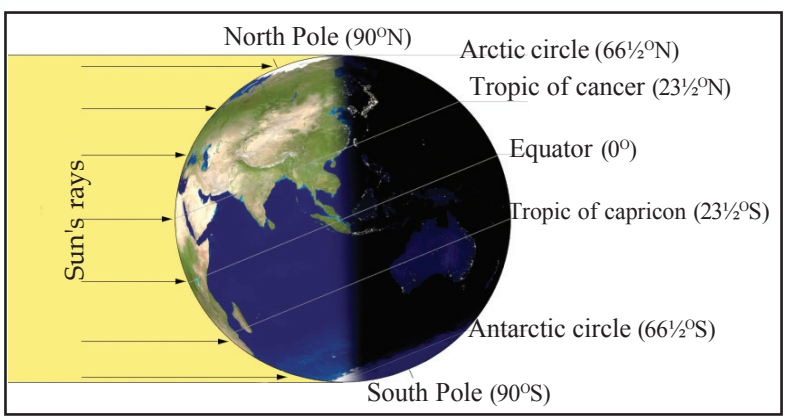


Fig. 1.6

The angle of incidence of the sun's rays becomes more inclined on approaching the poles. There occurs more energy loss as the sun's rays have to travel more through the atmosphere owing to the inclination.

Altitude

You have studied that the temperature in the troposphere decreases at the rate of 1° C per 165 m of altitude.

What is this process called?

The temperature is comparatively low at places situated much above the sea level.

Calculate the approximate temperature at the place marked A in the diagram (Fig. 1.7) assuming the sea level temperature as 30° C.

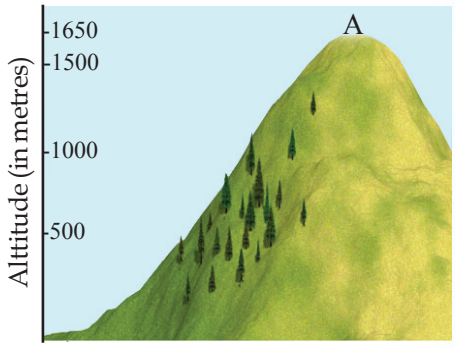


Fig. 1.7

The temperature experienced in places like Idukki and Wayanad is lower than that of the neighbouring districts Ernakulum and Kozhikode respectively. Why?

Nearness of ocean

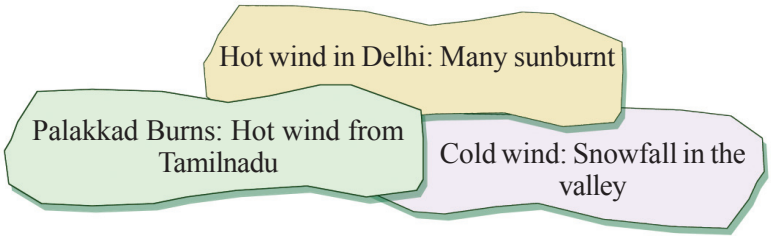
Examine the table showing the temperature related data of some cities in India.

City	Max. temperature	Min. temperature	Range of temperature
Thiruvananthapuram	33^{0}C	28^{0}C	5^{0}C
Bengaluru	35^{0}C	23^{0}C	12^{0}C
Delhi	38^{0}C	21^{0}C	17^{0}C
Goa	33^{0}C	27^{0}C	6^{0}C

Find the location of the given cities with the help of an atlas. The diurnal range of temperature is very high for Delhi and Bengaluru where as it is very low for Thiruvananthapuram and Goa, isn't it? It can be inferred that the range of temperature will be high at places away from the sea and vice versa. Temperature remains moderate at places close to the sea. This is because the heating of land causes wind to blow from sea to land and cooling of land causes wind to blow from land to sea.

Generally Kerala experiences moderate temperature. Why?

Winds



Observe the news headlines. The warm and the cold winds can respectively raise or lower the temperature of the places through which they pass.

Discuss in the class the influence of winds in regulating the temperature of a region and prepare notes.

The temperature of a place vary in accordance with its latitudinal location, altitude, nearness to sea, winds, etc.

Global distribution of temperature

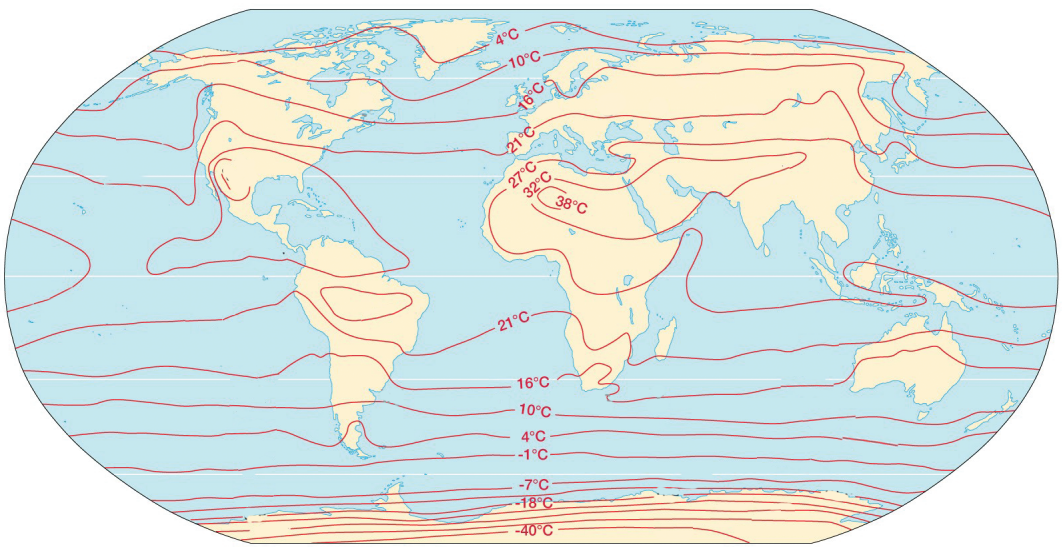


Fig. 1.8

Observe Fig.1.8. The smooth curved lines represent the temperature recorded at different places throughout the earth's surface.

What are these lines called?

Isotherms in the southern hemisphere are almost parallel to the Equator compared to those in the northern hemisphere. Why?

During summer, high temperature prevails over the land compared to the sea and during winter, the condition is reversed. The bending of isotherms is due to the differential heating of land and water.

In the weather maps for summer and winter seasons, the isotherms behave differently. Why?

It is the fluctuation in the atmospheric temperature that leads to the atmospheric phenomena like pressure variations, wind, cloud and precipitation.

Water content in the atmosphere significantly influences the atmospheric phenomena.

What is the role of temperature in bringing water content to the atmosphere?

Water in the atmosphere

Water content in the atmosphere is called humidity.

Is humidity uniform at all places?

List out the factors influencing the amount of moisture in the atmosphere.

- Temperature
-

Humidity varies not only with place, but also with time.

The actual amount of water present in the atmosphere is called absolute humidity. It is measured as the amount of water vapour present per cubic metre volume of air (g/m^3).

There is a limit to the amount of water vapour the atmosphere can hold at a certain temperature. The stage at which the atmosphere is fully saturated with water is termed as saturation level.

Wet and dry bulb thermometer

It consists of two thermometers. One records normal atmospheric temperature. The bulb of the second is kept wet by wrapping it in a wet muslin cloth. This is known as wet bulb thermometer. As the bulb is wet, this thermometer always shows lower temperature than normal. Relative humidity is calculated based on the difference in temperature between these two thermometers. Based on this difference at any particular temperature corresponding relative humidity can be found out from the chart given along with the instrument. Generally the relative humidity will be low when the difference in temperature is high and vice versa.

Relative Humidity (%)

Dry-Bulb Temperature (°C)	Difference Between Wet-Bulb and Dry-Bulb Temperatures (C°)														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	100	81	63	45	28	11										
2	100	83	67	51	36	20	6									
4	100	85	70	56	42	27	14									
6	100	86	72	59	46	35	22	10								
8	100	87	74	62	51	39	28	17	6							
10	100	88	76	65	54	43	33	24	13	4						
12	100	88	78	67	57	48	38	28	19	10	2					
14	100	89	79	69	60	50	41	33	25	16	8	1				
16	100	90	80	71	62	54	45	37	29	21	14	7	1			
18	100	91	81	72	64	56	48	40	33	26	19	12	6			
20	100	91	82	74	66	58	51	44	36	30	23	17	11	5		
22	100	92	83	75	68	60	53	46	40	33	27	21	15	10	4	
24	100	92	84	76	69	62	55	49	42	36	30	25	20	14	9	4
26	100	92	85	77	70	64	57	51	45	39	34	28	23	18	13	8
28	100	93	86	78	71	65	59	53	47	42	36	31	26	21	17	12
30	100	93	86	79	72	66	61	55	49	44	39	34	29	25	20	16

Sublimation

In some instances, due to rapid fall in atmospheric temperature, water vapour directly condenses to solid state (snowflakes). This is called sublimation.

When the atmosphere becomes saturated, condensation begins. You might remember what you have learnt about condensation in earlier classes.

Can you suggest a suitable experiment to demonstrate the condensation process?

The critical temperature at which condensation begins is called dew point.

The ratio between the amount of water vapour present in the atmosphere and the total water holding capacity of the atmosphere at a given termperature is called relative humidity. It is usually expressed in percentage.

For example, if the absolute humidity is half of the total water holding capacity at a particular temperature, then the relative humidity will be 50%. Let us see how it is calculated.

$$\text{Relative humidity} = \frac{\text{Absolute humidity}}{\text{Total water holding capacity of the atmosphere at that particular temperature}} \times 100$$

What will be the relative humidity at saturation level?

Relative humidity is measured using the instrument called wet and dry bulb thermometer.

Forms of condensation

Atmosphere should reach the saturation level for condensation to begin. With further addition of water vapour or due to a considerable fall in temperature, the water vapour in the atmosphere begins to condense.

Look at the different forms of condensation.

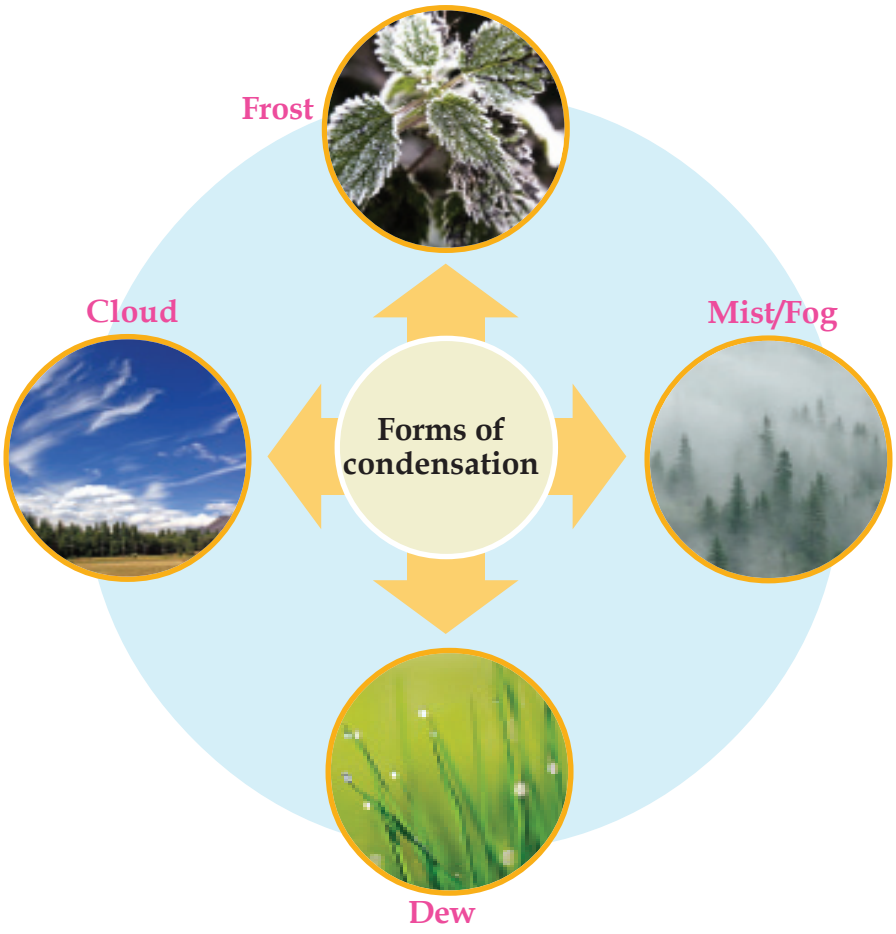


Fig.1.9

Dew

You might have noticed the water droplets clinging on to the blades of grass and leaves early in the morning. This is dew.

The surface of the earth gets cooled during the night and it cools the near atmosphere. This causes the water vapour to condense and the condensed droplets cling on to the cold surfaces on earth.

Dew
Fig 1.10

Dew disappears as the sun rises. Why?

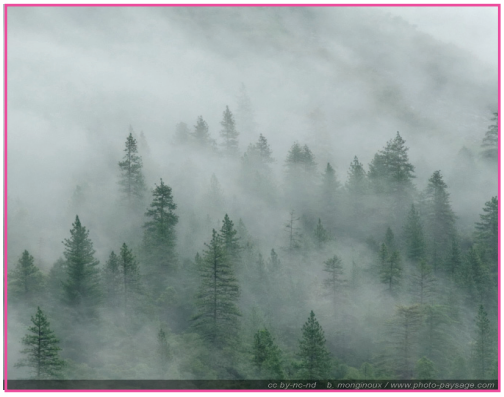
Frost
Fig.1.11

Frost

As you know there are places on the earth were the night temperature falls below 0° Celsius. Instead of dew, tiny ice crystals are formed in such places. This form of condensation is called frost.

Fog or Mist

See Fig 1.12. You might have experienced similar weather at least during winter seasons. This is called mist or fog. The condensed tiny droplets of water formed by the cooling of air remains suspended in the atmosphere itself. They can very well be described as clouds close to the earth's surface. Fog or mist is the result of condensation around the minute dust particles in the lower atmosphere. This may obstruct visibility. If the range of visibility is less than one kilometre, it is termed fog. If the range of visibility is more than one kilometre, it is called mist. The airports in North India get temporarily closed during winter due to dense fog.



Fog/Mist
Fig.1.12

Smog

In industrial regions, smoke and fog occur in combination to cause an atmospheric condition called Smog. This usually causes hindrance to traffic.

Clouds

You have learnt earlier that clouds are formed by the condensation of water vapour around the fine dust particles in the atmosphere. The water droplets so formed are less than 0.001 cm in dimension. That is why they remain suspended in the atmosphere. Haven't you seen different types of clouds in the sky? Clouds can be classified according to their form and height.

Based on form there are mainly 4 types of clouds.

Cirrus clouds : These are feather-like clouds in the upper atmosphere in clear weather conditions.

Stratus clouds : These appear in thick layers in the lower part of the sky.

Cumulus clouds : These clouds resemble huge cotton bundles and are formed due to strong convection currents. They have large vertical extent.

Nimbus clouds : These are dark rain clouds in the lower atmosphere. These clouds appear dark as it does not allow sunlight to pass through due to thick concentration of water droplets.

The clouds mentioned above do not generally occur independently. They are usually seen in combination. For example; the combination of cumulus and nimbus clouds is termed as cumulo-nimbus clouds.

Observe the sky and try to identify the different types of clouds.

The above discussed clouds usually occur at different altitudes. See the four different types of clouds based on altitude.

- High clouds (20000 to 40000 ft)
- Medium clouds (7000 to 20000 ft)
- Low clouds (< 7000 ft)
- Clouds with great vertical extent (2000 to 30000 ft)

You have learnt that clouds are formed by the condensation of water vapour. Let's see what happens to these water droplets thereafter.

Fig. 1.13 Cirrus clouds

Fig. 1.14 Stratus clouds

Fig. 1.15 Cumulus clouds

Fig. 1.16 Nimbus clouds

Precipitation

Continuous condensation causes the droplets in the clouds to grow in size. Being unable to resist the gravitational force of the earth, the water droplets get released from the clouds and fall on the earth in different forms. This process is called precipitation.

Look at the pictures.

Rainfall

Snowfall

Hailstones

These are the different forms of precipitation. The common manifestation of precipitation is in the form of water drops. This is the rainfall.

When the temperature falls below 0° Celsius, precipitation reaches the earth in the form of tiny crystals of ice. This is snowfall.

If the water droplets released from the clouds happen to pass through colder layers of the atmosphere, they may reach the earth in the form of ice pellets. This form of precipitation is called hailstones.

Which form of precipitation is most familiar to you?

Rain occurs differently

Let's see the different types of rainfall.

Look at the diagram (Fig. 1.20). The moisture-laden wind from the sea enters the land and moves upwards along the mountain slopes where it gets cooled and condensed to form clouds. When the windward sides of the mountain receive heavy rainfall, the leeward sides do not receive rainfall due to the descending dry air. This type of rainfall is known as orographic rainfall or relief rainfall. The places situated at the leeward side of the mountains that do not receive any rainfall are referred to as rain shadow regions.

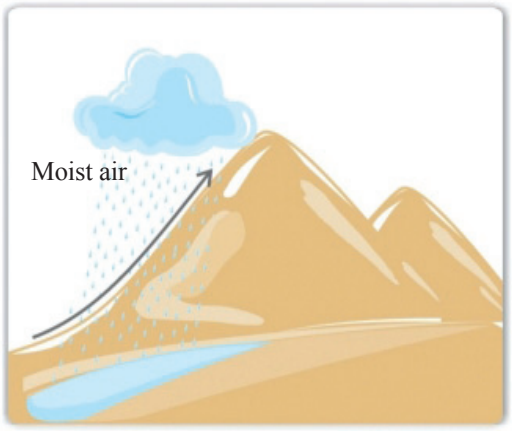


Fig.1.20 Orographic rain

When Kerala receives southwest monsoon rainfall, the western parts of Tamil Nadu remain dry. Why?

You have learnt the characteristics of equatorial climatic region. High temperature and daily afternoon rains are the peculiarities of these regions.

Due to high temperature, air gets heated and rises up.

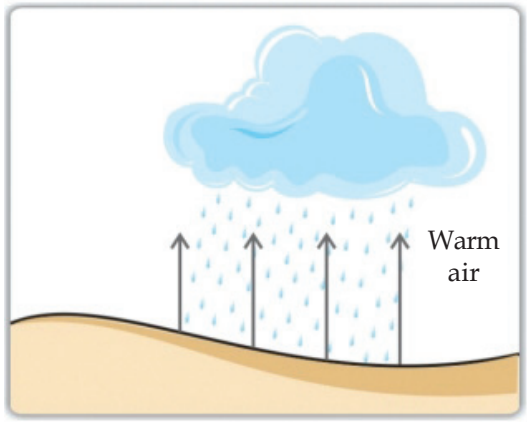


Fig. 1.21 Convectional rain

What is this process of heat transfer called?

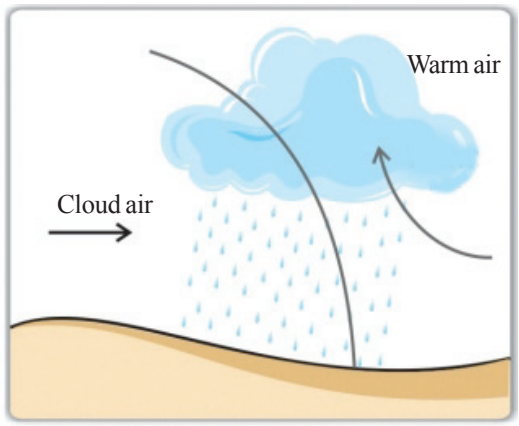


Fig 1.22 Border rain

Cumulus clouds are formed by the cooling and condensation of rising warm air. Rainfall occurs with thunder and lightning. This rain, mostly occurring in the afternoon, does not last long. This type of rainfall is called convectional rainfall. This is a common phenomenon in the tropical regions during summer.

There is always a difference in the atmospheric temperature over land and sea. If the air over the sea comes in contact with the air over the land in the coastal regions, the warm air will be pushed upwards causing cloud formation and rainfall. This type of rainfall is called border rain.

All the functions of our living planet, the earth, are regulated by the sun. The very existence of the biosphere is by direct or indirect dependence on the solar energy. Even the distribution of plants and animals on earth is in accordance with the availability of sunshine. The case of human beings also is not different. All the atmospheric phenomena inevitable for sustaining life on earth are controlled by solar energy. There is a natural mechanism to retain the required amount of energy obtained from the sun and to send back the surplus.

The average surface temperature of the earth will vary with even the slightest variation in the energy flows - insolation and terrestrial radiation. This in turn becomes a threat to the sustenance of life. You have learnt about the human activities that cause changes in the atmospheric temperature. Let 's control such unscientific practices and sustain our earth for the generations to come.

Let us assess

- Explain how latitudinal location influences distribution of temperature on earth.
- The isotherms in the northern hemisphere are more curved while those in the southern hemisphere are almost parallel to the Equator. Why?
- Suppose the relative humidity is 100%. Write your inferences regarding the atmospheric condition.
- Differentiate between
  - (a) Dew and frost
  - (b) Fog and mist

- Illustrate the concept of orographic rainfall with the help of a diagram.

Extended activities

- Illustrate heat budget on a chart paper and display it in the class.
- Mark the temperature of different cities in India on a map and draw isotherms by connecting the points suitably.
- Observe the functions of weather instruments by visiting a nearby weather station.
- Observe the sky and identify the clouds based on their forms.
- Prepare maximum number of objective questions based on this unit and conduct a quiz competition in the class.

2

The Signature of Time

The school social science club decided to conduct an exhibition on the topic 'Earth phenomena' in connection with the observance of the Earth Day. The followings are some of the pictures selected from those received for exhibition.

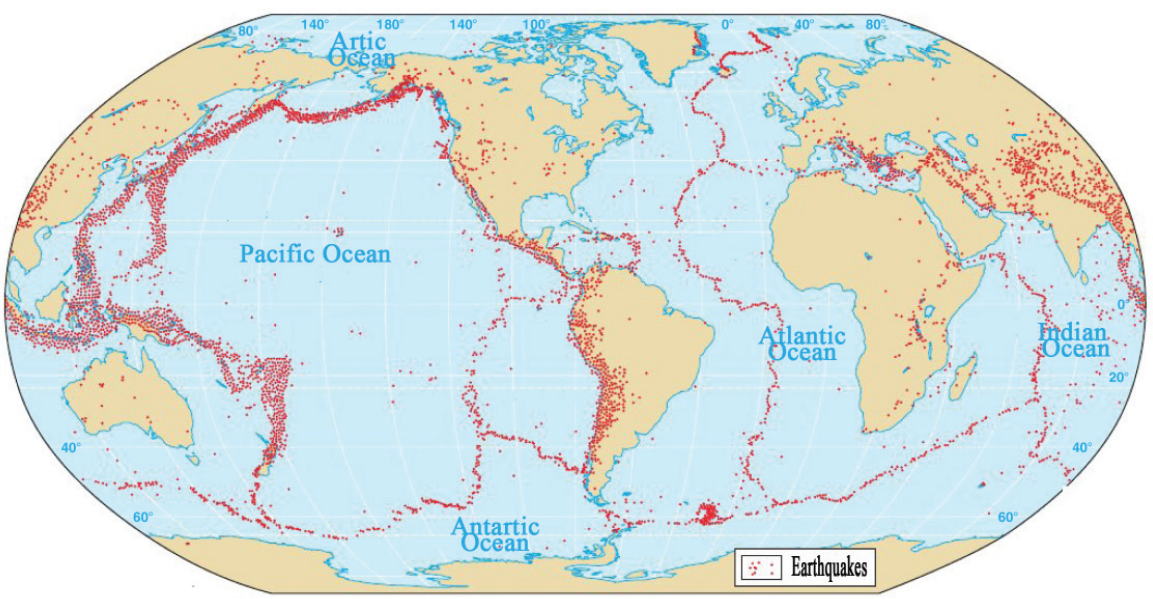


Fig. 2.1
Zones of severe earthquakes

Note: Red dots indicate earthquake zones

Fig 2.2 : Volcanic zones

Note: Red dots indicate volcanoes.

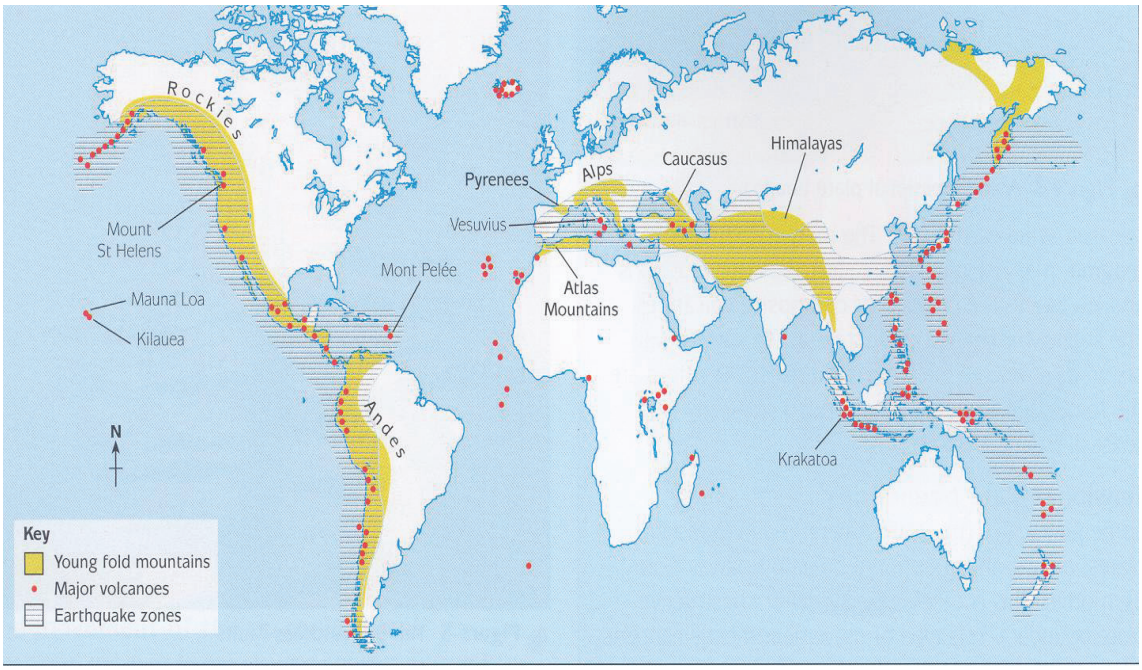


Fig. 2.3 : Major mountain ranges

Indicator: Yellow patches indicate major mountain ranges.

Can you mark the information in each of the above maps in a single map?

Don't forget to use different colours or symbols for each type of feature. You can use the following map(Fig.2.4) for this purpose.

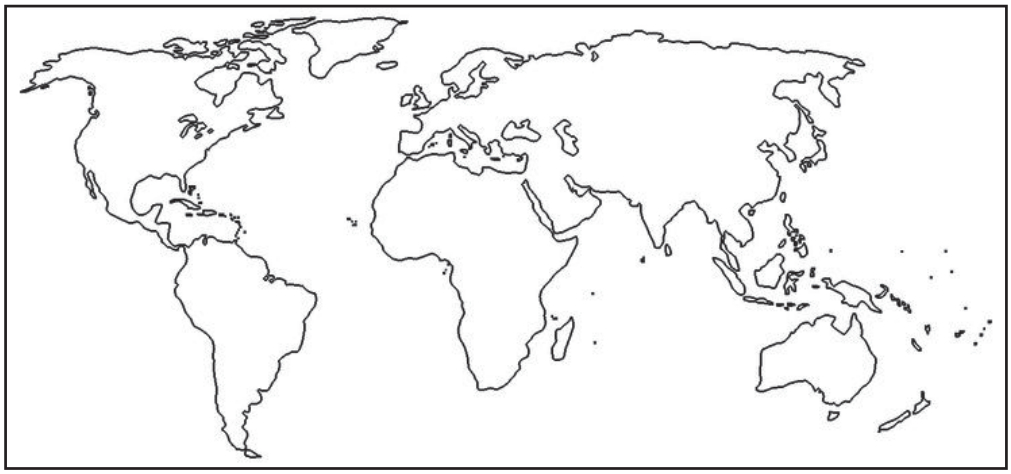


Fig 2.4

On completing this activity, haven't you reached the following conclusions?

Conclusions

- Earthquakes are frequent in certain parts of the earth.
- Volcanoes are more common in certain specific regions.
- There are some peculiarities in the distribution of mountains.
- Earthquake zones and distribution of mountains on the earth's surface more or less coincide.
-

The map you prepared will be somewhat like the following (Fig.2.5)

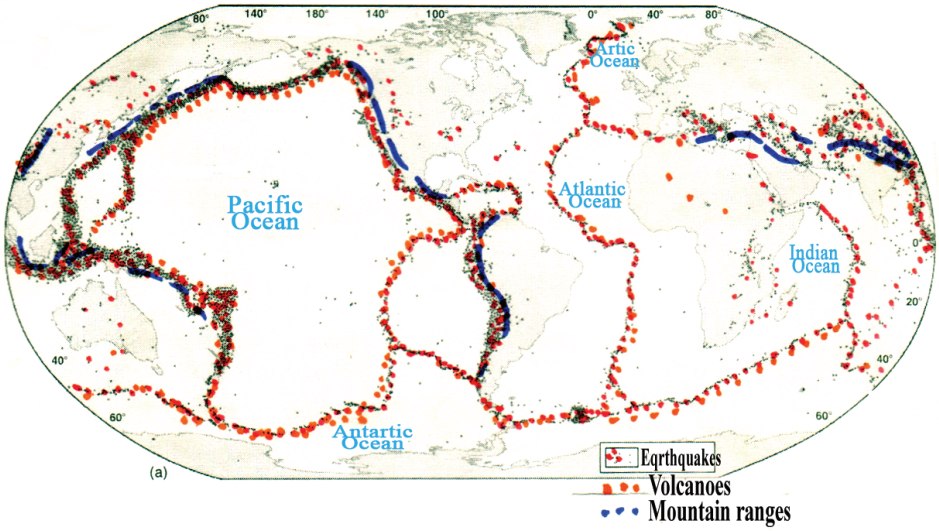


Fig.2.5 Major earthquake zones, volcanoes and mountain ranges.

You have recognized from the map that the earthquake zones, volcanoes, and mountain ranges overlap. Why is this so?

You know that the crust, which is the outermost layer of the earth, is solid. You have also learnt that the crust, together with the upper part of the mantle is known as the lithosphere. The lithosphere exists as several fragments just like the broken shell of an egg. Compared to the thickness of the portion from the crust to the inner core, the lithosphere is very thin. These portions of the lithosphere which are several thousand kilometres wide and roughly 100 kilometres thick are called lithospheric plates. Whether major or minor, each plate may exclusively contain either oceanic crust or continental crust or contain combinations of oceanic and continental crust.

While doing the map-based activity, didn't you notice some natural boundaries on the map? These are the boundaries of the lithospheric plates. Identify and list the different lithospheric plates from the following map.

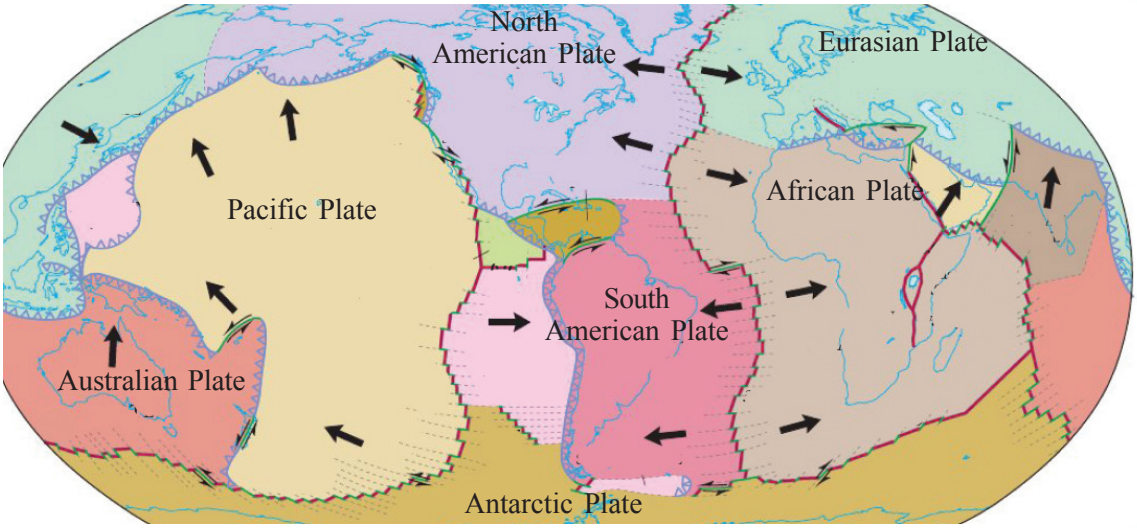


Fig. 2.6 : Lithospheric plates

- Pacific plate
-

Now you know the different lithospheric plates. These can be classified into major and minor plates based on size. Philippine, Cocos, Nasca, Caribbean, Scotia, Arabian etc. are minor plates. There are seven major plates. Of these the Pacific plate is the largest. Pacific plate involves oceanic parts alone.

Plates move

CHCLS8

The lithospheric plates are situated above the asthenosphere which is in a semi plastic state. Magma, which is a part of the mantle remain molten due to the high temperature at the earth's interior and undergoes continuous convection. This causes the movement of lithospheric plates (fig. 2.7).

The plates move at a speed of 2 centimetres to 12 centimetres a year. The speed of this movement has not always been uniform. Studies indicate that the speed of the plate movement was up to 30 centimetres a year about 580 million years ago.

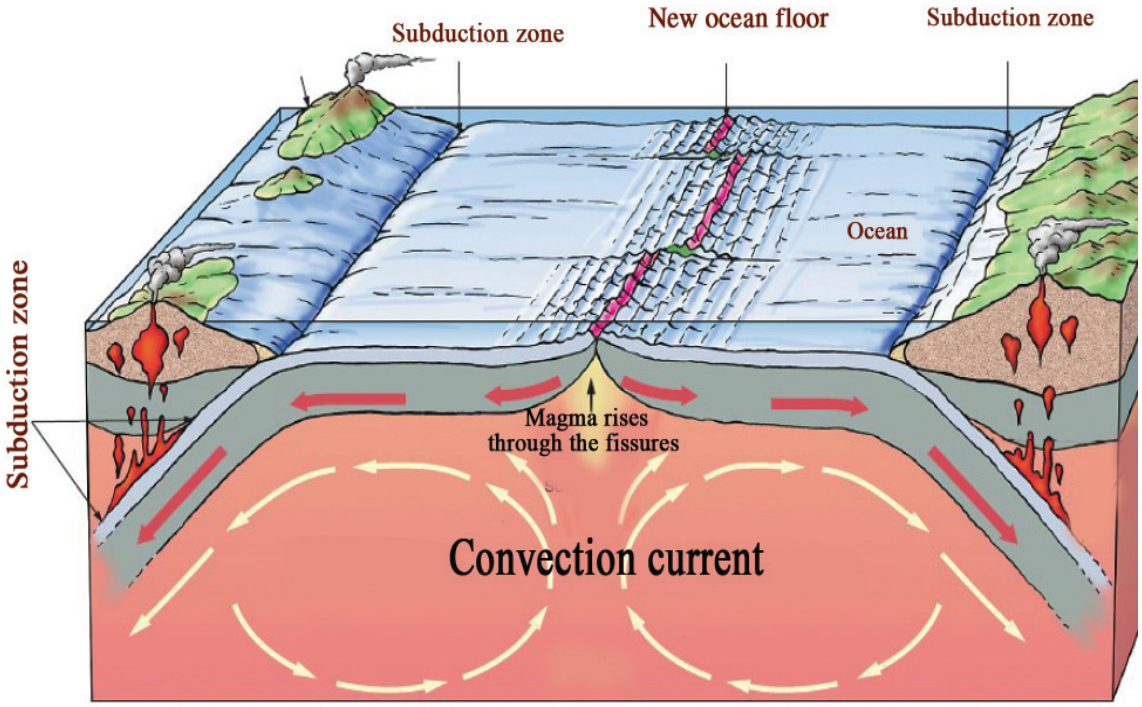


Fig. 2.7

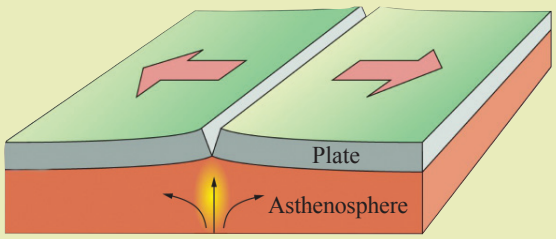
The Continental Drift Hypothesis

Alfred Wegener, a German meteorologist, put forward the idea of continental drift in 1912. He argued that millions of years ago, all the present day continents were a single unit forming supercontinent named Pangea which was encircled by an ocean called Panthalassa. Wegener believed that over millions of years, the continental portions drifted over the ocean floor forming the present continents.

With the help of your Social Science teacher, watch the animation video of plate movements shown in PhET.in the IT@School Edubuntu.

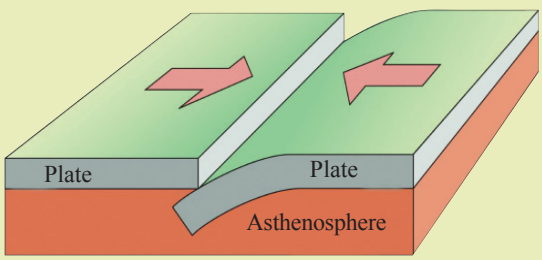
Look at the following diagrams (Fig.2.8 a, b, c) and find out the different types of plate margins created by the movements of the lithospheric plates.

a.



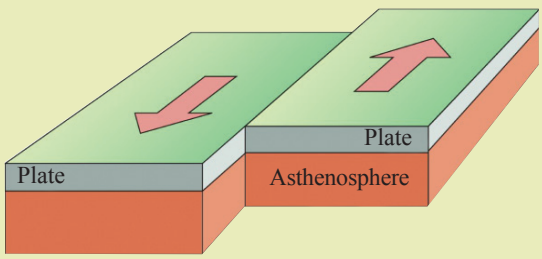
Plates move away from each other : Divergent margin

b.



Plates move towards each other : Convergent margin

c.



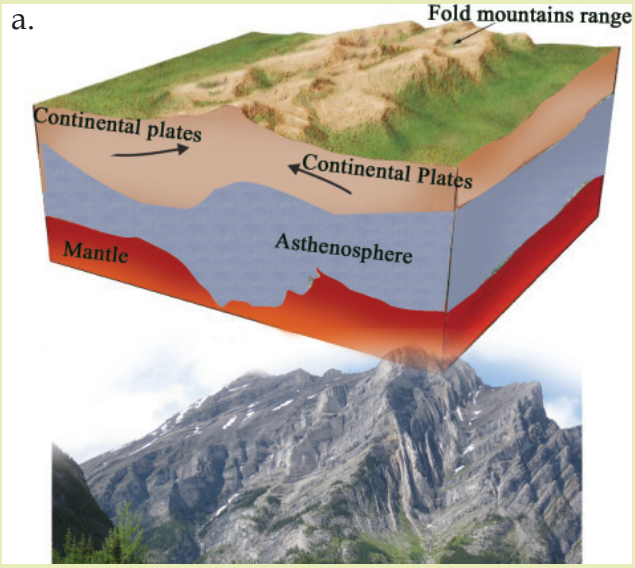
Plates slide past each other : Transform margins (Shear margins)

Fig. 2.8

Diverse landforms are created along the plate margins by the movements of plates.

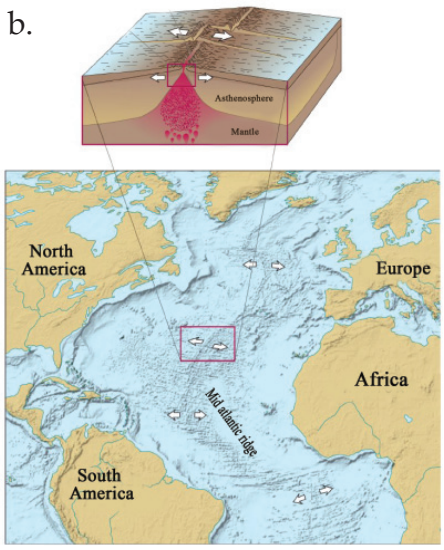
The following are the pictures of some landforms formed due to plate movements (Fig.2.9 a, b).

a.



•Convergent margin
Fig. 2.9 a

b.



•Divergent margin
Fig. 2.9 b

Convergent margins

Fold mountains

The rock layers may undergo folding due to the compression of lithospheric plates along convergent margins. Mountain ranges so formed are called fold mountains. The Himalayas, the Alps, the Andes, the Atlas, etc. are fold mountains.

Haven't you noticed the distribution of fold mountains in Fig.2.9a? Fold mountains are formed along the convergent margins. For example, the Himalaya is a fold mountain range formed between the Indian plate and the Eurasian plate.

Identify the plate margins where the world's major fold mountains are formed?

If there is any difference in density between the plates along a convergent margin, the denser plate will submerge under the lighter one. These zones are called subduction zones. Ocean trenches are developed in subduction zones. The Challenger Deep in the Pacific Ocean is an example. Identify the plates responsible for this.

Divergent margins

Observe the diagram (Fig.2.9b) and identify the type of plate margin between the African plate and the South American plate.

A 14000-km long north-south oriented mountain range has been formed in the Atlantic Ocean. This mountain range known as the Mid-Atlantic Ridge has been formed as a result of the divergence of the above mentioned plates. Magma comes out through the gap formed due to the divergence of plates and solidifies to form mountains. These types of mountains are known as Mid Oceanic ridges.

Sea floor spreading and the age of the rocks

New ocean floor is continuously being created as a result of magma that comes out through the divergent margins and solidification along the edges of the plates. This results in the phenomenon known as sea floor spreading. This is the reason that, rocks older than 200 million years are absent along the seafloor. But it has been discovered that most of the continents are older than 2000 million years.

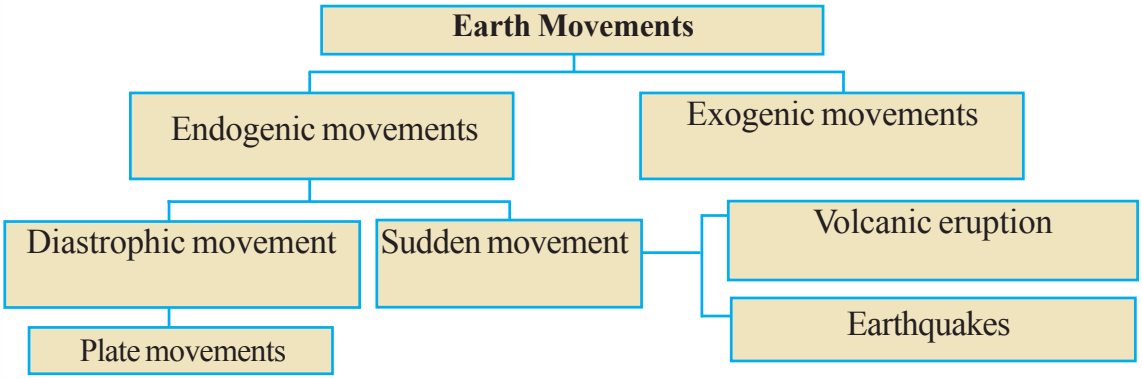
Transform margins

Landforms are not generally created along the margins where the plates slide past each other. But such margins are fault zones. The San Andreas Fault Zone in North America is an example (Fig.2.9 c).

As these plate margins are weaker than other areas, such margins are generally vulnerable to earthquakes, volcanoes, and faults.

The major relief features on the earth's surface such as the fold mountains, plateaus, and volcanoes are the result of plate movements. Let's see the other forces that bring about changes on the earth's surface.

Fig. 2.9 c



Most landforms on the earth's surface are the result of such earth movements. As a result of the earth movements, some regions on the earth's crust are either raised or lowered. Raising of the crustal portions are called uplift and lowering of the crust are called subsidence.

Earthquake

It was 25 April 2015. I was walking along the streets of Kathmandu with my friend. Suddenly the huge buildings in front of us began to collapse. The ground beneath us sank like a swing. It was difficult to escape from the shower of bricks and dust from the collapsing buildings. Trenches developed in the road making it impossible to run away. The hotel complex where we stayed previous day had turned into a heap of bricks. I realized that these are the rare moments between life and death.

My eyes were witnessing the unbelievable. Within a few moments the roads of the city have turned into trenches. Heaps of debris have formed in many parts of the city. The moment I thought I was going to faint, a stranger came through the dust and debris and held me in a tight embrace, smiled at me and walked away without uttering a word- the smile of suffering and survival.

What you have read is the earthquake experiences of Mr. Tshering Dorji, a traveller in Nepal.

You have understood that most of the earthquakes concentrate along plate margins.

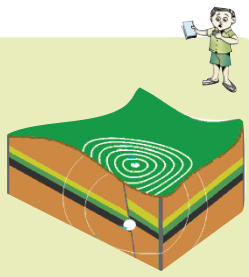
What is an earthquake?

Rocks in the deeper part of the earth undergo displacement and faults due to plate movements and other causes. Under such situations, severe pressure is exerted on the earth's lithosphere and seismic waves are generated just like waves in a pond spreading in all directions when a heavy object falls into it. These waves create tremors on the earth's surface. These tremors are experienced by us as earthquake.

Apart from plate movements and faulting, earthquakes occur due to other reasons as well. These are

- Collapse of the roofs of mines
- Pressure in reservoirs
- Volcanic eruptions

The deep points inside the earth where the earthquake occurs are known as focus and the point vertically above it on the earth's surface is known as epicentre.



- *Identify and mark the focus and the epicenter in the given diagram.*
- *Collect the details of earthquakes that have occurred since 2005 and mark their epicenters on a world map.*

Three types of waves are produced from the focus during an earthquake: primary waves, secondary waves and surface waves. The surface waves are the most destructive ones. The seismic waves are recorded by an instrument called seismograph.

The Richter scale measures the intensity of energy released at the time of an earthquake. The earthquake that occurred in Chile has been the most severe one. It recorded an intensity of 9.5 in the Richter scale.

Tsunami

Tremour waves originating due to earthquakes, volcanic eruptions, meteor impact. etc. in the ocean floor generates huge sea waves rising to several metres. Such waves are called Tsunamis. It is the

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Life Saved by Geography lessons

Hundreds of lives were saved by the 10 year old British girl named Tillysmith, who came with family to Phucat beach in Thailand for recreation.

Don't you want to know more?

The tourists in the beach eagerly crowded along the coast seeing the recession of sealevel. On seeing this phenomenon, Tillysmith thought about the giant Seismic sea-waves which she learnt from the geography class two weeks before. She immediately told her mother about this. She proclaimed that this is the phenomenon before the forthcoming Tsunami and that strong waves capable of washing out the coast would come soon. She warned the crowd to escape soon. As everybody ran away from there, it is the learning experience of Tillysmith helped in preventing a severe disaster.

coastal regions mainly affected by the disastrous effects of Tsunamis. The visible impact of Tsunami is the damage and destruction to life and property caused by it. Kerala coast was also affected by Tsunami on 26 December 2004. This Tsunami which havoced India and Srilanka was caused by the intense earthquake waves originated from Sumatra in Indian Ocean.

Tsunami surveillance and warning systems are widely in operation today. This system aims to identify the areas prone to Tsunami and also to extend warning to the coastal areas so as to prevent loss of life.

On behalf of the National Oceanic and Atmospheric Administration (NOAA), a real time Tsunami monitoring system named Dart (Deep ocean Assesment and Reporting of Tsunami) has been established at various locations. Satellite communication systems are being utilised for the purpose.

What are the measures we can take to mitigate the impact of Tsunamis?

- Recession in sea level may be an indicator of Tsunami. If so, move on to safer locations.
- Take official warnings seriously.
- Don’t arrive at self conclusion that the dangerous situation is over, wait for official declaration.
- Once trapped by Tsunami waves try to escape holding any floating materials firmly.

NCC, Red corss and other voluntary organisations has important role in disaster management activities in Tsunami affected regions. You can also participate in such disaster management operations.

Volcanoes

You have learnt that the plate margins are active with volcanoes. Look at the picture (Fig.2.12).

Haven't you noticed the hot molten rock that comes out through the fissures on the crust? Volcanoes are formed by such molten rock material coming out through the fissures along the plate margins.

Nearly 80% of the world's volcanoes are situated around the Pacific Ocean. This zone containing more than 452 volcanoes is known as 'the Pacific Ring of Fire'.

You know that volcanoes pose serious threats to life. But they are also useful in many ways.

Don't you want to know how they are useful to man?

- The soil formed by the weathering of lava rocks is fertile. Example : the black soil of the Deccan plateau.
- Volcanic ash is a good manure.
- Geysers are formed in many volcanic regions. Such regions are being developed as tourist centers. Example: the Old Faithful Geyser, Yellow Stone National Park - North America.

Is there any chance of Volcanic eruptions in Kerala?

Refer the publications and websites of Disaster Management authorities for the precautions to be taken during volcanic eruptions.

Let us assess

- Identify the different plate margins. Which are the associated landforms?
- Answer the following questions based on earthquakes.
  - How do earthquakes occur?
  - Which are the different types of seismic waves?

- Which one of the seismic waves cause maximum destruction on the earth's surface?
- Which is the scale used to measure the intensity of earthquakes?

- What do you mean by 'the Pacific Ring of Fire?
- How are volcanoes useful to mankind?

Extended activities

- Collect from Internet the maps showing the movements of lithospheric plates and include them in the digital album.
- Prepare a map of the 'Pacific Ring of Fire' and include it in the digital album.
- Collect information on the most destructive volcanic eruptions and earthquakes on the earth.

3

National Income

Given above are some news headlines related to national income. National income indicates the economic condition of a country. A higher national income implies economic progress of a country. Let us analyse in detail the important concepts related to national income and how it is calculated in India.

National income

In the previous classes we have learnt about the income of individuals and families as well as the source of their income. The amount of income earned by the members of a family through different sources during a year is the annual income of that family. Likewise, the total income received by a country in one year is its national income. It is the amount earned from the production of goods and services in a country during a year. This is received mainly from three sectors:

- Agriculture sector
- Industrial sector
- Service sector

Adding up the income from these three sectors, we get National Income. When we calculate the money value of goods and services produced in a country during a particular year, we get the National Income of the country for that year.

Why do we calculate national income?

National income is helpful in calculating the economic growth of a country and to compare the economic growth of different countries.

Country	National Income (in billion dollars)		
	2010	2013	2014
USA	16663.20	17348.10	17968.20
China	9490.80	10356.50	11384.80
Japan	4919.60	4602.40	4116.20
Germany	3746.50	3874.40	3371.00
United Kingdom	2678.40	2950.00	2864.90
France	2811.10	2833.70	2422.60
India	1875.20	2051.20	2182.60
Italy	2137.60	2147.70	1819.00
Brazil	2391.00	2346.60	1799.60

(Source : IMF world Economic Outlook, October 2015)

The above table shows the national incomes of a few countries during three years.

- *Find out the countries which have the highest and the lowest national income in 2014.*
- *Compared to 2013, which countries have achieved economic growth in 2014?*
- *Compared to 2013, which countries have failed in achieving economic growth in 2014?*

From this table, it is clear that compared to 2013, India has achieved better economic growth in 2014.

What are the other objectives of calculating national income?

- To assess the contribution of different sectors in the economy
- To study the problems faced by the economy
- To help the government in planning and implementing different projects.
- To find out the limitations and advantages of economic activities like production, consumption, and distribution.
-

Some important concepts of national income

We have discussed what national income is and the need for calculating it. Now, let us see a few concepts related to national income.

Gross National Product - GNP

Gross National Product is an important concept of national income. It is calculated on the basis of the final goods and services produced in a country. The products that are available for consumption are called the final product. For example, we manufacture shirts using raw materials such as cloth, thread, and buttons. Here, the shirt is the final product for consumption. The money value of final products is taken into account for calculating the Gross National Product. While calculating the money value of the shirt, the value of raw materials such as buttons and clothes are included. Thus, the money value of final goods and services produced is the gross national product. The GNP of a country is calculated for a particular financial year. In India, a financial year is from 1 April to 31 March.

Gross National Product considers only the final product. Find out more examples.

Gross Domestic Product - GDP

Gross Domestic Product is the most suitable concept of national income to analyse the contribution of sectors in an economy. The GDP of a country is the total money value of the final goods and services produced within the domestic territory during a financial year. The income of people working abroad and the profit of institutions and firms operating abroad will not be included while calculating the Gross Domestic Product. For example, suppose an Indian firm operates in America. The profit of that institution will be included in the Gross Domestic Product of America but in the Gross National Product of India. That is to say, while calculating the GDP of India, such income will be excluded.

Net National Product - NNP

If you purchase a computer and sell it the next year, will you get the same amount that you spent while purchasing it? Why? Similarly, with time, machinery and other things suffer from wear and tear. The cost incurred to remedy this wear and tear is termed as depreciation charges. The depreciation charges are taken into consideration while calculating the national income. When we deduct depreciation charges from the Gross National Product we get the Net National Product. Technically, the Net National Product is considered as national income.

Net National Product =
Gross National Product - Depreciation charges

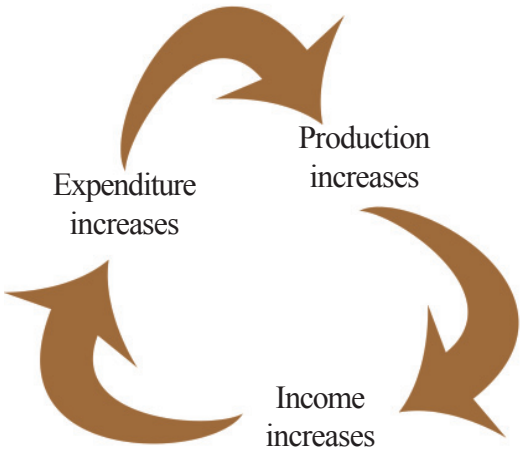
Per capita income

When we divide the national income by population, we get per capita income. It helps to know the economic position of a country and to compare it with other countries.

$$\text{Per capita income} = \frac{\text{National income}}{\text{Total population}}$$

How to calculate the national income.

The economic condition of a country is calculated on the basis of national income. It is necessary to increase production for economic prosperity. When production increases, the rewards of factors for production like land, labour, capital, and organisation also increases. The increase in rewards such as rent, wages, interest, and profit results in increased consumption and investment.



Production, income, and expenditure are interrelated. There are three methods for estimating national income:

- Product method
- Income method
- Expenditure method

Product method

Under the product method, the national income is calculated by adding up the money value of goods and services produced by the primary, secondary, and tertiary sectors. It is useful for assessing the contribution of each of these sectors towards the national income. It is also used to analyse which sector contributes the most to national income.

Income method

You know that income is the reward received for the factors of production. In income method, national income is calculated based on rent, wages, interest, and profit, which are the rewards for factors of production. This method is helpful in analysing the contribution of each factor of production to the national income.

Expenditure method

The expenditure method is used to estimate the national income by calculating the expenditure incurred by individuals, firms and government in a particular year. In Economics, just like consumption expenditure, investment is also considered as an expenditure. The summation of consumption expenditure, investment expenditure and government expenditure, gives the total expenditure.

Estimation of national income using any of the above three methods will give the same results.

Difficulties in calculating national income of India

The Central Statistical Office (CSO) is the official agency that estimates the national income of India. The estimation is done mainly for the purpose of planning and development activities of the government. It also helps to understand the nature of the employment sectors and the types of employment the people are engaged in. In India, we make use of the product, income, and expenditure methods to estimate the national income.

The assessment of national income is a tough job that is challenged by practical and ideational issues. Let us examine a few of them.

- Lack of reliable statistical data creates difficulty in estimating national income
- There is a chance of calculating the money value of goods and services more than once (double counting) while they pass through different stages of production.
- Services of housewives is not included in national income.
- The production of goods for self consumption is not included in the estimation of national income. Example - vegetable garden at home
- Ignorance and illiteracy of the people create problems in collecting statistical data.
- The practical difficulty in assessing the money value of services impede the correct estimation of national income

- Consumers seldom maintain records of expenditure incurred by them.

Attempts are being made to overcome these difficulties so that national income can be calculated more accurately.

Sectoral contribution to India's national income

The sum of income received from the primary, secondary, and tertiary sectors constitutes the national income of a country. The table below provides information about the share of these sectors to the Gross Domestic Product of India.

Share of different sectors in India's GDP (in %)			
Sector	**2015-16**	**2016-17**	**2017-18 (PE)**
Primary Sector	20.10	20.35	19.56
Secondary Sector	27.42	26.88	26.59
Teritiary Sector	52.48	52.77	53.85
Total	**100**	**100**	**100**

(Source : Central Statistical Office)

Answer the following questions based on the above table.

- *Which sector has made the highest contribution to India's GDP in 2015- 2016? What is the contribution of the same sector in 2017 - 18?*
- *Which sector has contributed the least to national income in 2016-2017 and 2017-18?*
- *What is the position of the industrial sector in 2015-16, 2016-17, and 2017-18?*

What other information can be drawn from the table?

The recent trends in the contribution of various sectors to the national income of India show an increase in the growth of the service sector. The secondary and teritary sectors have come to contribute more to the national income than the primary sector.

It is clear from the above table how much growth has taken place in the tertiary sector when compared to the other two sectors. As

a part of development, the rise in the establishment of educational institutions and hospitals along with the advancement in banking, insurance, and telecommunication have helped the growth of the teritary sector. With economic growth, people are more willing to partake in transport and tourism. Development of knowledge based industries has also helped in the growth of the tertiary sector.

Growth of knowledge sector

The knowledge sector is the sector which efficiently uses knowledge and technology to attain economic growth. Today, modern technology and information & communication possibilities have grown and developed into knowledge economy. Education, innovation, and Information & Communication Technology (ICT) form the basis of knowledge economy. In knowledge economy, production and consumption of intellectual capital take place.

Intellectual capital is an invisible asset. It is the collective knowledge of all the people in an enterprise or a society.

Today, as a part of the tertiary sector, growth of services based on knowledge is happening on a large scale. People giving expert advice on shares and taxes, software experts, etc. are a part of this sector. Top business executives, researchers, scientists, expert policy makers, economic experts, etc. strengthen to this sector. The government also gives priority to the development of the knowledge sector. Initiatives of Govt. of Kerala like the Infopark and Technopark are examples.

India has achieved immerse progress in information and communiction technology, so much so that today we are a global service provider in the field of software technology. As a result of this 'knowledge boom', India can enhance the welfare of the people through an increase in economic growth.

Some favourable factors which can help India grow further in this sector are:

- Human resource including technical experts who are well versed in the English language.
- Wide domestic market
- Strong private sector
- Development of science and technology

If all these possibilities are made use of, India can develop knowledge economy and thereby increase its national income.

Let us assess

- Which among the following is not an important objective in estimating national income?
  a. To study the economic problems
  b. To help in formulating government plans
  c. To calculate the population of a country
  d. To analyse the contribution of different sectors
- Which among the following concepts of national income considers the domestic territory of a country?
  a. GNP b. GDP c. Per capita income d. NNP
- Write short notes on the following
  1. Main concepts of national income
  2. CSO
  3. Knowledge economy and India
- Explain the main methods of estimating national income
- Write four limitations in estimating the national income of India.

Extended activities

- With the help of reading materials and the Internet, find out the different institutions in India that contribute to the knowledge economy. Analyse how they helped in increasing India's national income.
- Prepare a report on the growth of national income of world nations with the help of the Economic Survey 2014-15.

4

By the Hands of the Nature

Fig. 4.1

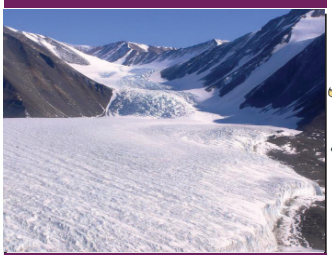
Observe the pictures (Fig 4.1). Sky-scraping mountains, extensive plains, uninterrupted waterfalls, scorching deserts, extensive plateaus

with hard rock terrain, various big and small valleys...how diverse the earth's surface is! The mountains, valleys, plains, plateaus, waterfalls, etc. forms the various landforms on earth. Most of them have evolved through millions of years. Let us examine the various landforms, the forces behind their formation, and their characteristics in detail.

Landforms

You might remember the mention in the previous chapter that internal forces and external forces can make changes on the earth's surface.


River


Glacier


Seawave


Wind

The processes that help in the formation of landforms are called geomorphic processes. Varied landforms are created by the continuous processes carried out by external agencies like running water, wind, glaciers, sea waves, etc. Hence these agencies are often called geomorphic agents.

Glaciers

Thick masses of ice slowly move downhill in snow -clad regions. Such slow moving masses of ice are called glaciers.

Geomorphology

Geomorphology is the branch of geography which deals with the study of origin and evolution of landforms.

Observe the diagram (Fig 4.2).

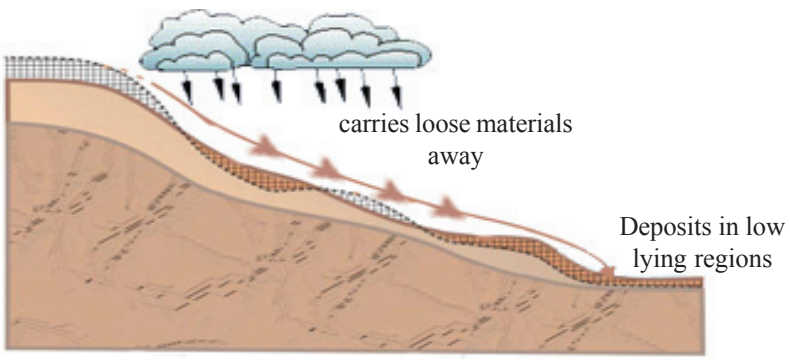


Fig. 4.2

Haven't you seen how rainwater carries away the loose rock particles from elevated regions and deposits elsewhere? (Fig 4.2)

What changes take place on the surface of the earth as a result of both the processes mentioned above?

You have learnt about the weathering processes causing the weakening of surface rocks on earth.

What are the different processes of weathering?

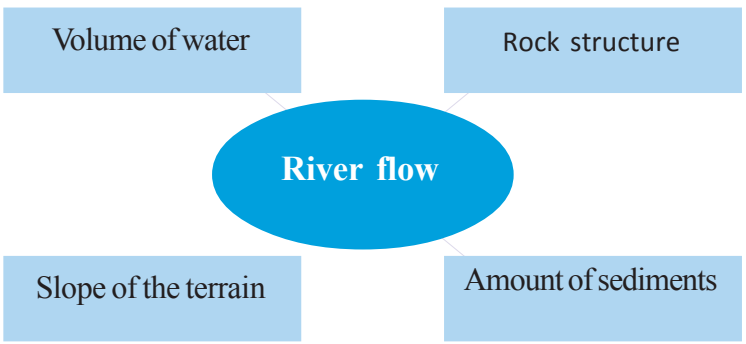
The transfer of rock particles formed by physical, chemical or biological weathering processes from one place to another by external agencies such as running water, wind, glaciers, sea waves etc. is called erosion. These materials will be deposited in low lying regions and this process is called deposition. Now you might have realised that external forces cause both erosion and deposition.

The erosion as well as deposition carried out by external agencies create varied landforms. Let us go through the various landforms created by such processes.

Along the river banks...

Rivers originate from the springs at high altitudes. Rills formed by rainwater may join together to form streams. A river develops through the merging of numerous such streams. The place of origin of a river is called its source and the place at which it discharges into the sea or to a water body is called the river mouth.

Let us see some factors determining the flow of a river.



The course of a river can generally be divided into three stages based on the difference in slope from its source to mouth.

- Upper course
- Middle course
- Lower course

Upper course is that part of the river where it rapidly flows down along steep slopes from the place of origin. The intensity of erosion is severe in this course.

Middle course is that stage of the river where it flows through gently sloping foothills. As the velocity of the flow decreases, the intensity of erosion declines and deposition begins.

Lower course is the stage where the river flows through the plains. The rate of deposition will be higher due to the slow pace of the river and the increase in the amount of sediments during this stage.

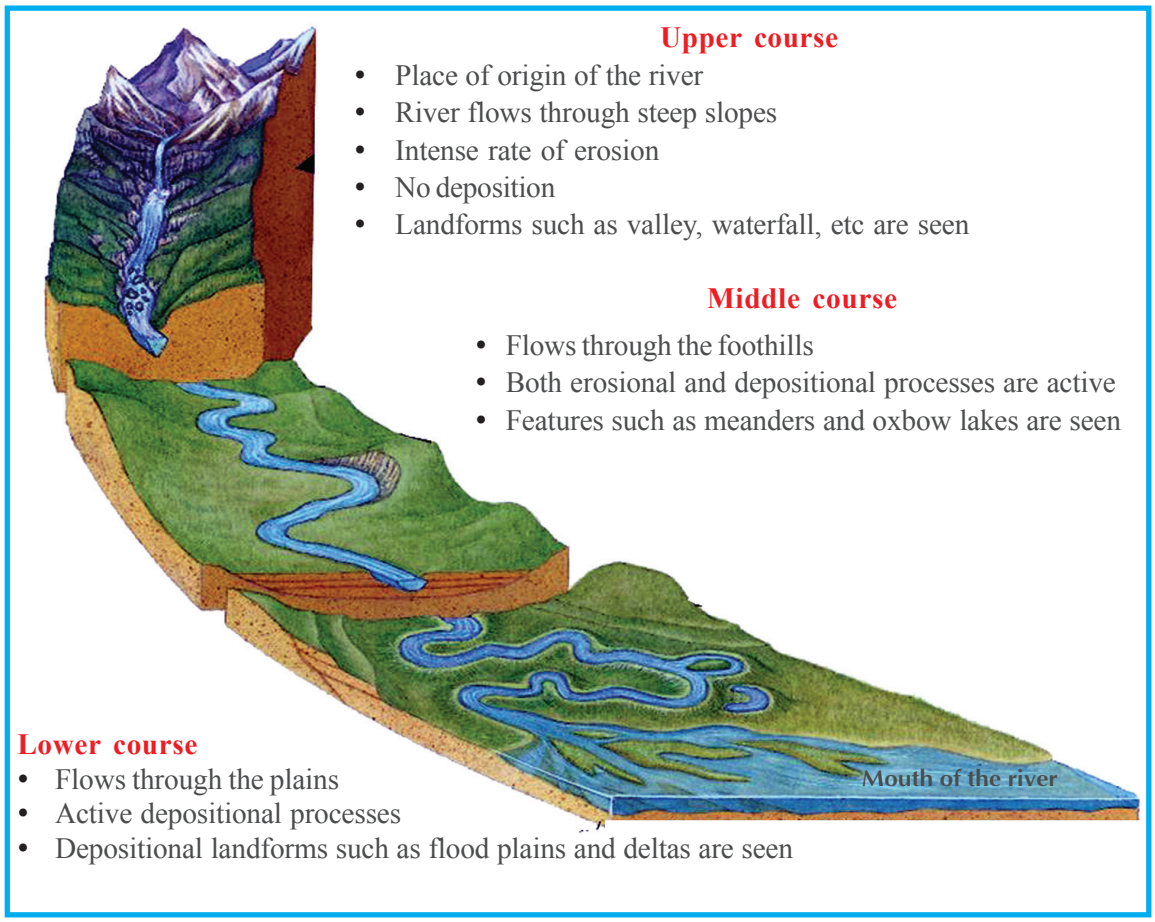


Fig. 4.3

Varied features are seen in the river course at every stage. Observe the diagram (Fig 4.3) and answer the following questions by analysing the features of these three courses.

- *In which stage is the intensity of erosion more?*
- *Which process results the landforms developed in the lower course?*

You have learnt the characteristics of a river right from the source to the mouth. The landforms created at different courses of a river are different in nature. Let us familiarise with a few erosional and depositional processes and the resultant landforms.

River erosion

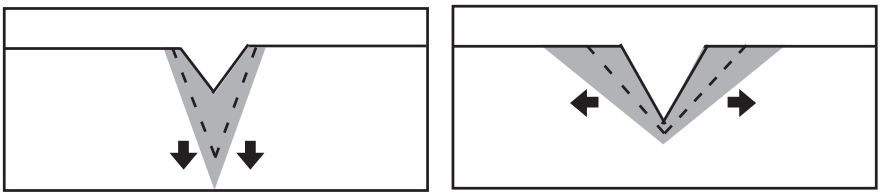
Velocities of water flow, slope of the terrain, and rock structure are the factors affecting the intensity of river erosion.

The rock particles like gravel, sand, pebbles, etc. carried by the river rub against the rocks along the bed and both the sides of the river. This results in the wearing down of rocks. Such erosion is known as abrasion or corrasion. Through these processes the river can polish even the hard rocks along its course.

You might have seen the pebbles as shown in the picture (Fig 4.4) along river courses. What could be the reason behind their round shape and polished surface?

Fig. 4.4

Fig. 4.5 indicates how the erosion alters the bed and valleys of the river



Erosion along the bed Erosion along the valleys

Fig. 4.5

River bed erosion is more prevalent in the upper course of the river.

To the landforms created by river...

See the picture (Fig 4.6). It is a deep gully formed as a result of erosion caused by running water.

Fig. 4.6

Why are such gullies formed along steep slopes?

Deepening of rivers occurs through intense erosion resulting from an increase in the velocity of water flow. The valleys take a distinct shape as a result of the intensity of erosion along the river bed. Look at the shape of a valley formed in this manner (Fig 4.7). Such valleys are called V-shaped valleys.

Fig. 4.7

Landforms created by the erosion and depositional activities of rivers are called fluvial landforms.

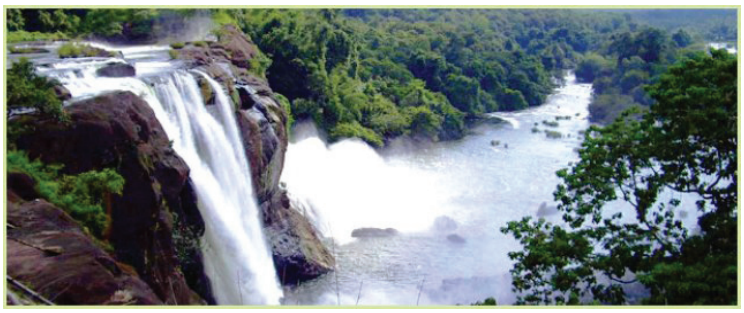


Fig. 4.8

Look at the given picture (Fig 4.8) of a waterfall. Waterfalls are generally formed at the upper course of rivers as a result of erosion. Soft rocks are easily eroded in the valleys where soft and hard rocks are found intermingled. This results in the formation of waterfalls.

The rate of erosion along the river bed decreases as the river leaves the upper course. However, lateral erosion dominates. The river flowing through comparatively gentle slopes takes deviation when the sediments or rockforms create obstruction to the flow. Such bending course of a river is shown in the picture (Fig 4.9). The sinuous curves formed along the river course are called meanders. Meanders are usually formed in the middle and lower courses of wide rivers.

Fig. 4.9

Observe the transformation happening to the meanders through further erosion and deposition (Fig. 4.10). Meanders may further curve through continuous erosion and deposition. Finally the river takes a straight course. Due to deposition the curves may get detached from the main river form isolated water bodies. Such water bodies are called oxbow lakes (Fig.4.11)

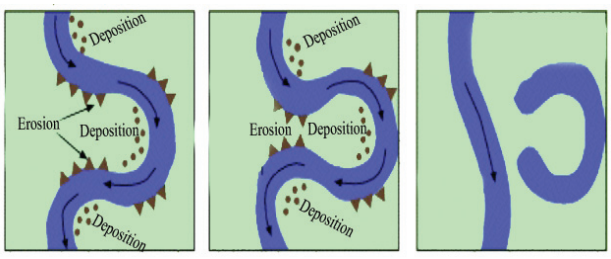


Fig. 4.10

Fig. 4.11

Fig. 4.12

Observe the pictures (Fig 4.10 and 4.11) to understand how oxbow lakes take birth from meanders.

Are flood plains a boon?

You might have seen the rivers overflowing their banks during rainy seasons. Flood water may cover extensive areas on both sides of the river. The deposition of alluvium along both the flooded banks may cause the formation of plains. Such plains are called flood plains (Fig 4.12).

Many of the famous civilizations have taken birth along such flood plains.

Flood plains are very significant as they are suitable for agriculture.

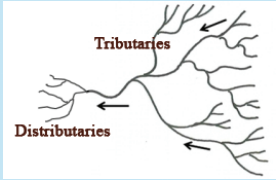
Prepare notes by discussing the agricultural importance of flood plains.
Hints: Soil, water availability, physiography

Alluvial plains of North India

The North Indian plains, known as the back bone of Indian agriculture, is one among the extensive alluvial plains of the world. The Ganga plain is the most extensive portion of this plain which occupies three main divisions- the Indus plain, the Ganga plain, and the Brahmaputra plain. Crops such as wheat, maize, pulses, sugar cane, jute, etc are cultivated here. This region, inhabited by a significant proportion of the total population of India, is the depositional plain formed by the North Indian rivers.

Tributaries and Distributaries

The streams and rivulets flowing into the main river are called its tributaries.



Absence of slope and large amount of sediments close to the river mouth cause the river to bifurcate into various branches. These branches are called distributaries.

You have learnt that the velocity of the river decreases when it nears the river mouth. Most rivers branch out to distributaries at this stage where the volume of both water and sediments is high. The sediments brought by the river are deposited between these distributaries forming almost triangular shaped landforms called deltas (Fig 4.13). These features are called deltas as they resemble the Greek alphabet Δ (Delta).

Fig. 4.13

Sundaris in the Sundarbans

The Sundarbans in West Bengal is the largest delta in the world. This delta region is formed by the deposition by the rivers Ganga and Brahmaputra. This delta is known as Sundarbans after the mangrove vegetation type 'Sundari' found over here. This region covered with mangrove forests is a major biodiversity hotspot in India.

Complete the table based on what you have learnt about the landforms created by rivers.

Landforms	Course of formation	Erosional/Depositional
• Waterfall	• Upper course	• Erosional
•	•	•
•	•	•

What you have seen till now is the erosional and depositional landforms created by running water on the surface of the earth. You know that a portion of the surface runoff gets percolated down the soil to form underground water.

Why is water called as universal solvent?

Most of the minerals present in the rocks get dissolved as water pass through them. This process is called solution. Erosion by underground water and the subsequent formation of landforms are the result of solution. Let us see how this takes place.

Landforms created by underground water

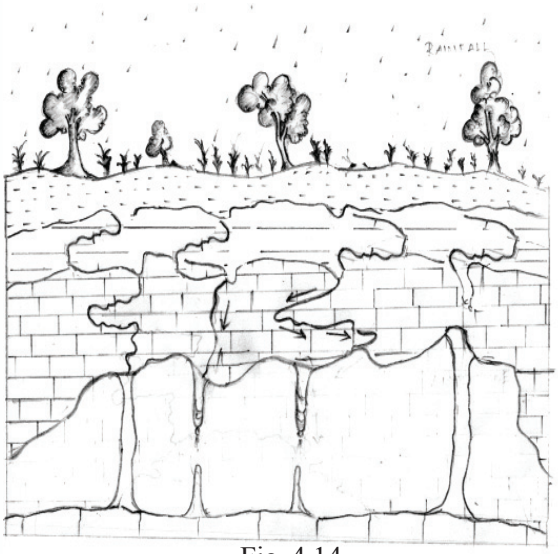


Fig. 4.14

Rocks like limestone easily dissolve in rainwater which percolates to form underground water. Hence the erosional and depositional landforms of underground water are mainly confined to limestone regions. Such landform features are generally called Karst topography. Let us look at a few landforms created by underground water.

Given diagram (Fig 4.14) is the sketch of a cave formed by the solution of limestone in underground water. The water with dissolved limestone in it drips from the roof of such caves. A portion of this mixture remains on the roof of the caves itself. This deposit of lime grows upside down due to this long continued process. They are called stalactites.

The deposit of lime on the floor of the cave also grows upward as a result of the deposition from above. These are called stalagmites. Stalactites and stalagmites do merge together with to form pillars.

Identify the landform created by the merging of stalactites and stalagmites from the picture (Fig 4.15).

Now you might have understood that the limestone caves are formed by erosion, whereas stalactites, stalagmites, and limestone pillars are formed by deposition.

The picture given (Fig 4.15) is the interior of a limestone cave. Collect more pictures of this kind with the help of the Internet.

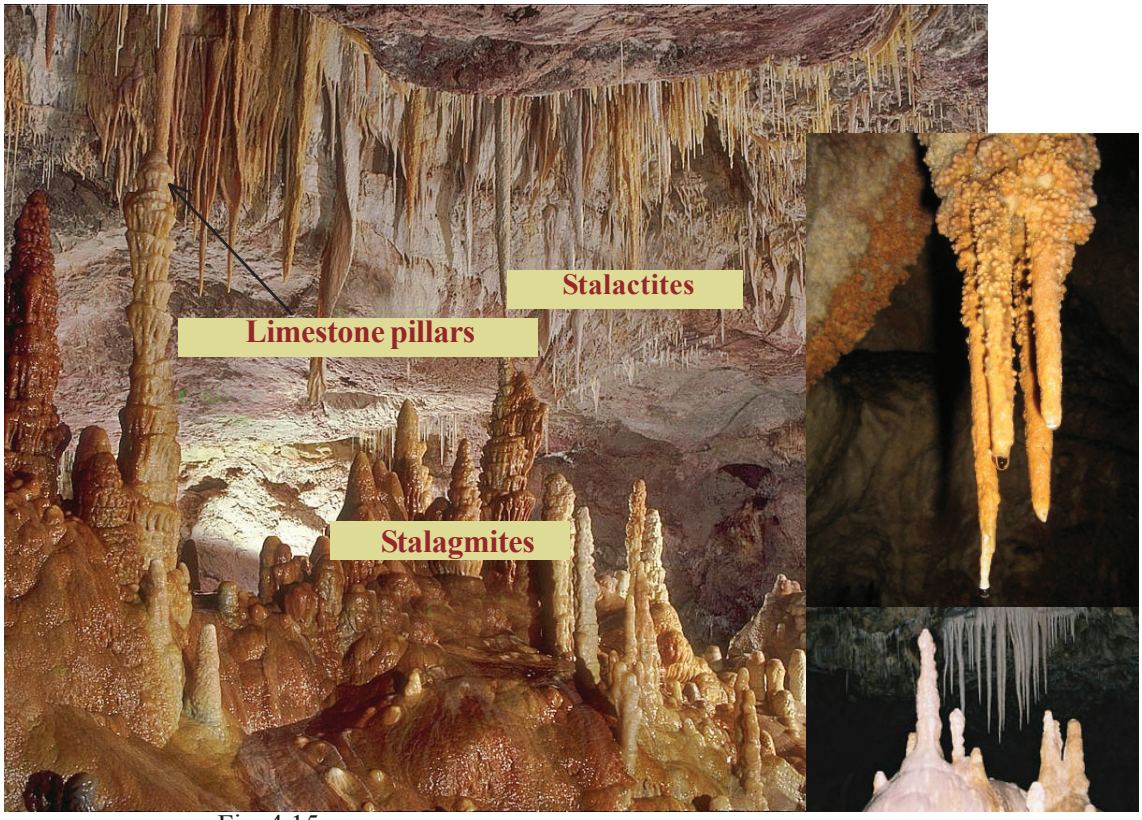


Fig. 4.15

The Borra caves near Vishakapatanam in Andhra Pradesh is an example for lime stone caves (Fig 4.16). The wonderful landforms have made the caves a tourist hotpot.

Fig. 4.16

Some coastal scenarios

Coastal landforms are created by the erosional and depositional processes carried out by waves.

Let us take a look at some landforms along coastlines.

The steep hillocks facing the sea are called sea cliffs. These steep structures are formed by the crumbling of the sea-facing slopes

Fig. 4.17

due to wave erosion. Picture (Fig 4.17) given is that of a sea cliff at the Varkala beach in Thiruvananthapuram district.

The strong blast of sea waves on the rocky coasts causes the wearing down of rocks. As a result of such abrasion by waves, isolated rock pillars are formed from coastal rocks. Such pillar like rocks standing upright along the coastline are called stacks. Picture (Fig. 4.18) given is that of stacks found along the coast of Thalassery in Kannur district.

Fig. 4.18

How do these stacks withstand the strong wave erosion?

Beaches are formed as a result of the deposition by waves. Beaches are depositional landforms along the coastlines formed with sand, gravel, etc. (Fig 4.19).

Fig. 4.19

You might be aware of the tourism prospects of a few prominent beaches in Kerala like Kovalam, Sanghumugham, Varkala, Cherai, Kozhikode, Muzhappi-langad etc.

Locate the districts in which the beaches of tourism importance found in Kerala. Collect pictures of the same from the Internet and include them in your geography picture collection.

Try to get first hand experience of the diversified coastal landforms along the extensive coastline of Kerala during your study tour.

Along the sandy stretches...

Look at the picture (Fig 4.20). List the features that distinguish deserts from other places.

Fig. 4.20

- High temperature
-
-

Which is the major geomorphic agent creating landforms in deserts?

Landforms created by wind are mostly seen in deserts.

Observe the picture (Fig 4.21). You can see the removal of sand particles by strong winds. The strong whirl winds carry away the dry desert sands from one place to another. This process of wind erosion is called deflation.

Fig. 4.21

As a result of the continued erosion caused by sand and other rock particles carried by strong winds, rocks in deserts get worn down. This process of wind erosion is called abrasion. Fig. 4.22 shows here is of a rock formed in this manner. Such

Fig. 4.22

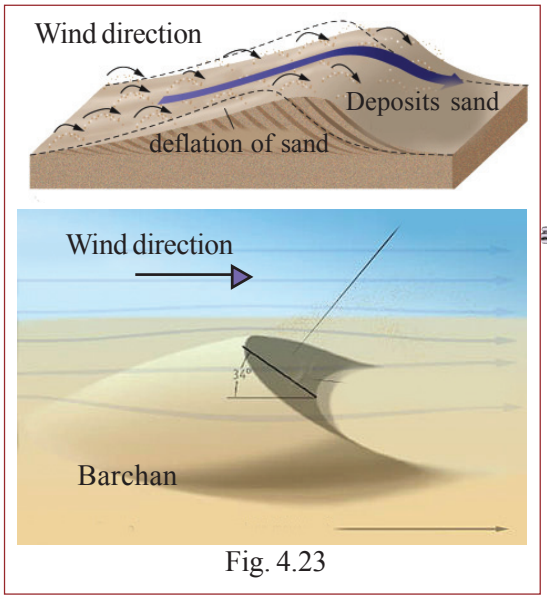


Fig. 4.23

rocks seen in deserts resembling mushrooms are called mushroom rocks.

What could be the reason for the increased erosion at the bottom of the rocks as shown in Fig. 4.22?

The sand dunes formed in the deserts are a result of the deposition by wind. The sand dunes commonly formed in crescent shapes are called barchans (Fig 4.23).

Illustrate the change in orientation of the barchans if the wind blows from the opposite direction.

Think and find out...

Find out from the Internet the only continent where the deserts are absent.

The above mentioned landforms are not seen in our state, even though we get regular winds. Why?

On the snow - clad mountains...

An extensive snow field is shown in the picture (Fig 4.24) Such snow fields are formed by continuous snowfall extending over years. The snow-covered mountains extend over vast areas and have kilometre-thick massive ice sheets. These slowly crawl down from the regions of their formation. Such slow


Fig. 4.24

moving mass of ice is called a glacier. Sand and other rock particles are also carried down by these moving masses of ice. The rock particles spiked to the bottom of these glaciers rub against and polish the surfaces over which they move. This causes the formation of various glacial erosional landforms.

Glacial landforms are generally confined to the high mountain ranges and the poles.

The movement of a glacier along the mountain slope is depicted in the given picture (Fig 4.25). Observe the changes occuring to the valley at different stages. Different types of valleys as shown in the pictures are formed by glacial erosion (Fig 4.26 and Fig 4.27). Arm chair like valleys so formed are called cirques (Fig 4.26).

The erosion caused by the continuous movement of glaciers along the valleys carves out steep sided and flat bottomed U-shaped valleys (Fig 4.27).

The sediments carried down by the glaciers will be deposited in various parts of the valley. These depositional features by glaciers are called moraines.

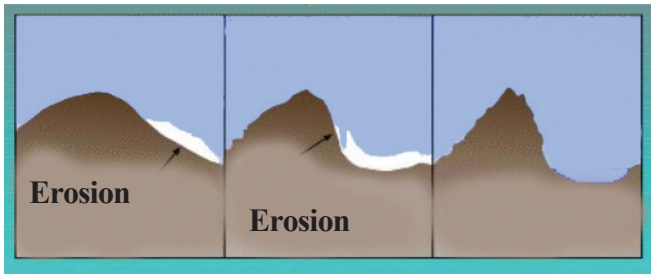


Fig. 4.25

Fig. 4.26

Fig. 4.27

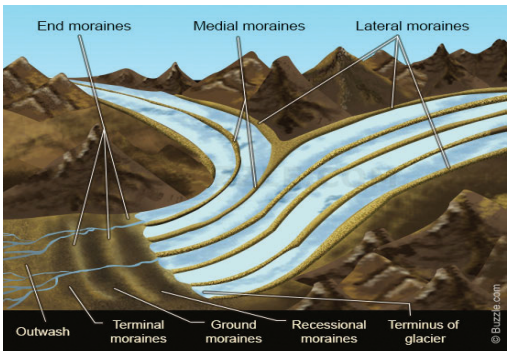
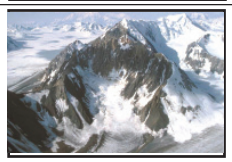
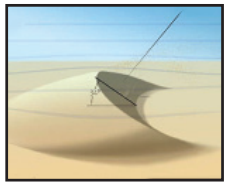


Fig. 4.28

Observe the diagram (Fig 4.28) and identify the various portions of the valley in which moraines are formed.

- Along the sides of the valley
-
-

Complete the given worksheet in the light of the information gathered from this chapter.

Pictures	Name of landform	Geomorphic agent	Process of formation (erosional/ depositional)
			
			
			
			
			
			

The landforms you have familiarised are those created by erosional or depositional work by external forces. There are a number of other landforms as well on the earth's surface.

Fig. 4.29

The elevated regions are levelled down by erosion and low lying regions are filled by deposition. These processes are called degradation and aggradation respectively. The processes together are generally called gradation as both level the surface of the earth.

The surface of the earth is subjected to continued changes due to various external forces. Some of these changes occur rapidly while some occur slowly. The results of slow movements can be perceived only through observations over a long period of time.

Look at the pictures (Fig 4.29). You might be familiar with such activities. These pictures indicate the role of human activities in bringing changes to the earth's surface. List such activities.

- Reclamation of agricultural fields
-
-

Are these natural gradation processes?

Conduct a seminar on the topic 'The role of human activities in changing the surface of the earth.'

Points to be included are:

- Unscientific construction practices
- Consequences
- Local examples

You have learnt from the unit that the surface of the earth is subjected to continuous changes. The role of human beings in

Let us conserve our surroundings for future

Hills and mountains are sources of fresh water - Protect them

bringing about changes on the earth's surface is significant. The impact of man on environment is ever increasing with the improvement in technology. Let us retain the harmony of nature that encompasses the soil, humans, trees and all for the future generations as well.

Let us assess

- Describe the characteristics of different stages in course of a river.
- Compare the V-shaped valleys with U-shaped valleys based on processes of formation.
- List out the agricultural and environmental significance of deltas and flood plains with examples.
- Illustrate the formation of mushroom rocks with the help of a diagram.
- Explain the formation of any two erosional landforms created by glaciers (with the help of diagrams)
- Prepare a table showing the erosional and depositional landforms created by any three external forces.
- 

A

B

Identify the landforms shown in the pictures and explain how they are formed.

Extended activities

- Identify the various fluvial and coastal landforms during the study tour and include it in your tour report.
- Prepare a geographical picture album by including the pictures of various landforms, geomorphic agents, artificial gradation processes, etc. from the field or from the Internet.
- Draw diagrams of various landforms on chart papers and display them in the classroom, along with explanatory notes on each of them.

5

Ocean and Man

What you see are a few glimpses of human life. There is hardly anyone who does not depend on the oceans in one way or the other.

When viewed from the space, the earth looks like a vast expanse of water. The continents appear as landmasses projected in between. Nearly 71% of the earth's surface area is covered with water. Land is confined

to the remaining 29%. Oceans occur between the land masses. The major oceans are the Pacific, the Atlantic, the Arctic, the Antarctic and the Indian Ocean.

Each of the above oceans contain bays, straits and several seas. The portion of the sea surrounded by land on three sides is called a bay. The narrow stretch of sea between two landmasses is kown as strait. Sea is the portion of an ocean close to the land. The Arabian Sea is a part of the Indian Ocean.

Fig. 5.1

Oceans at a glance

Ocean	Basic information
The Pacific Ocean	• Total area: 165.2 lakh sq.km. • Average depth: 4280 m. • Challenger Deep is the deepest point in the Pacific Ocean (11034m).
The Atlantic Ocean	• Total area: 82.4 lakh sq.km. • Average depth: 3700 m. • Deepest point: Puerto Rico trench (8618 m) • A 14000 km long mountain range known as the Mid Atlantic ridge exists along the middle of this ocean.
The Indian Ocean	• Total area: 73.4 lakh sq.km. • Average depth: 3960m. • Deepest point: 7725 m (Warton trench)
The Arctic Ocean	• The smallest ocean • Total area: 14.09 lakh sq.km. • Deepest point: 5180 m
The Antarctic Ocean	• The ocean surface is frozen • Also known as the 'southern ocean' • Total area: 32 lakh sq.km.

Identify the location of each ocean from the world map.

List the straits, bays, and the seas of each ocean with the help of an atlas.

Islands and peninsula

Islands are land surrounded by sea on all sides. The landmasses surrounded by sea on three sides are called peninsula.

The following table contains the names of some major islands and peninsulas in the world. With the help of an atlas find out the names of the oceans to which they belong.

Islands	Peninsula
Sri Lanka, Japan, Philippines,	Indian Peninsula
Madagascar, Maldives, Victorian Islands,	Arabian Peninsula
British isles, Greenland, Iceland,	Alaska Peninsula
Sumatra, Newfoundland, New Guinea,	Labrador Peninsula
Baffin, Cocos	Scandinavian Peninsula

Temperature, salinity, and density are the important characteristics of sea water. These are not uniform in all oceans. Let us find out the reasons for this.

Distribution of ocean temperature

Temperature varies in accordance with latitude. The highest temperature is recorded between 10° latitudes on either side of the equator. The average temperature here is about 27°C. As you move away from the Equator, temperature decreases considerably. The temperature falls to about 10°C in the mid latitudes and up to -2°C in the polar regions. What is the reason for the variation in temperature over different latitudinal zones?

Variation in the amount of insolation received on the earth is the major reason for this. The ocean currents and winds also influence the temperature of sea water. Analyze the variation in temperature

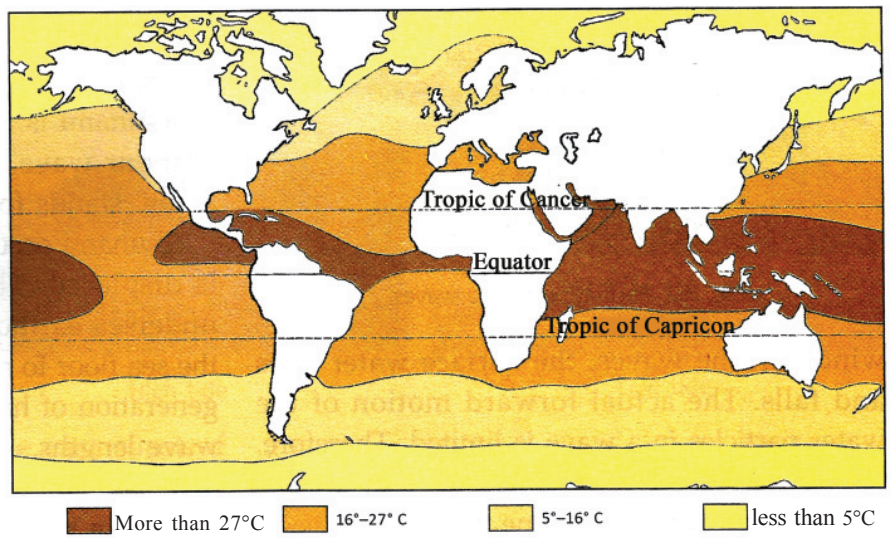


Fig. 5.2

along different latitudes from the Fig. 5.2.

Salinity of sea water

Sea water is salty. The average amount of saltiness of sea water is 3.5%. This water can be purified by separating the salt from it.

The concentration of salt content in sea water is known as salinity. It is expressed as the grams of salt present in 1000 grams of water. The average salinity of sea water is 35 parts per thousand and is recorded as $35\,^{0}/_{00}$. This means that 35 grams of salt is present in 1000 grams of sea water. Salinity is not uniform across oceans.

Chemistry of sea water

Major portion of the saline water contains sodium chloride (common salt). It also contains magnesium chloride, mangnesium sulphate, calcium sulphate, potassium sulphate, calcium carbonate etc. Most of them can be commercially extracted. But some of these occur in only rare quantities and hence their cost of extraction is expensive.

The conditions leading to variation in salinity are given below:

- Salinity will be more in land-locked seas.
- Salinity increases in areas of high evaporation.
- Salinity decreases in areas where snow melt water reaches in large quantity.
- Salinity decreases at river mouths.
- Heavy rainfall leads to reduction in salinity.

Salinity varies from ocean to ocean and at different depths.

The equatorial regions record high salinity as compared to the polar regions. Why?

Why does salinity increase in land - locked seas?

Why is salinity less at river mouths?

Density of sea water

The density of sea water is not uniform everywhere. This is due to the variations in salinity and temperature of sea water. Density decreases as temperature increases; and it increases as salinity increases. You have understood that the temperature, salinity and the density of sea water are not uniform everywhere. These variations lead to movements of sea water. Let us look into the movements of sea water and the reasons thereof.

Movements of sea water

Waves, tides, and ocean currents are the movements of sea water.

Waves

Look at Fig. 5.3. The up and down motion of the water along the surface of the sea is called sea waves.

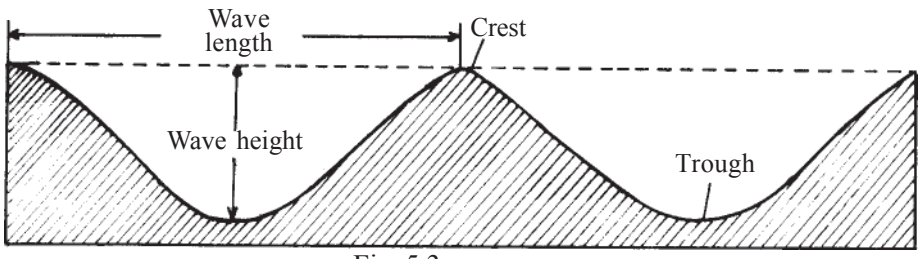


Fig. 5.3

The summit of the wave is known as wave crest and the bottom part is known as wave trough. The distance between two adjacent crests is the wave length and the vertical distance between the crest and the trough is the wave height.

The friction exerted by winds on the ocean surface is the reason for waves. As the speed of the wind increases, the strength of the waves also increases. Strong waves generated as a result of severe winds such as cyclones cause shelving of shores. You might have read the news in dailies regarding the sea surges during the south west monsoon season. These sea surges cause severe damage along the shores. Some measures are taken to prevent damage and to protect the lives of people living in the coastal areas.

- Depositing boulders along the seashore.
- Construction of interlocking concrete structures (*Pulimuttu*)
- Planting of mangroves.

The sand moved back and forth by the waves is deposited as sand bars due to the particles being blocked by each other. This is the solution by nature to protect the shores from sea surges. You have heard of the tsunami

waves that hit the Kerala coast in 2004. The earthquakes and volcanoes on the ocean floor generate monstrous waves that are disastrous. Such sea waves are known as seismic sea waves or tsunami waves. These waves move at a speed of up to 800 km per hour.

Mud bank (*Chakara*)

Mud bank is a phenomenon that develops in the Arabian Sea during the onset or at the end of the monsoon season. Planktons grow luxuriantly in the turbulent muddy water along the seashore during the monsoon rains. Schools of fish such as shrimp, sardine, and mackerel arrive to feed on the planktons and the mud, giving fishermen a good catch. This phenomenon is known as mud bank.

Tides

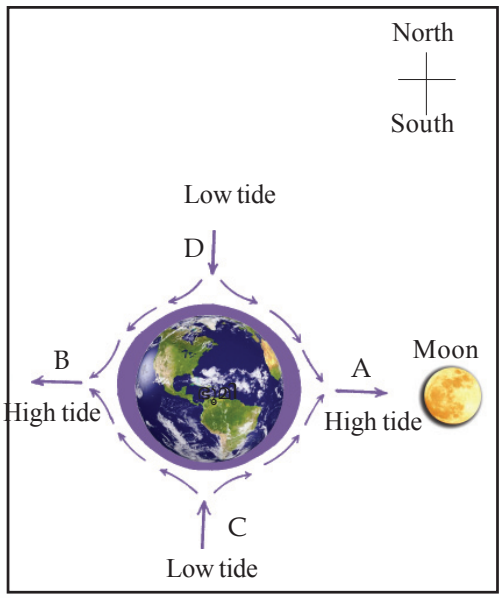


Fig 5.4 **Tides**

Tides are the periodic rise and fall of water level in the ocean. The rise in the level of ocean water is the high tide and the lowering of the water level is known as the low tide.

Let us look into the reasons for tides. Tides are formed as a result of the gravitational pull exerted by the moon and the sun along with the centrifugal force due to the earth's rotation.

Look at Fig.5.4. The water level on the part of the earth facing the moon rises. The rise in water level due to the gravitational pull exerted by the moon leads to high tide. You might have noticed that the water level at the opposite side also has risen. The centrifugal force due to the earth's rotation is the reason for the rise in water level here. It can be seen that the water level goes down at places located 90° away from the places of tidal influence. This is due to the draining of water towards the tidal regions. The phenomenon of fall of water level is known as low tide.

In addition to the gravitational pull of the moon, the gravitational pull exerted by the sun also causes tides. Though the moon is smaller than the sun, its attraction is more powerful than that of the sun, since it is closer to the earth.

Spring tides and neap tides

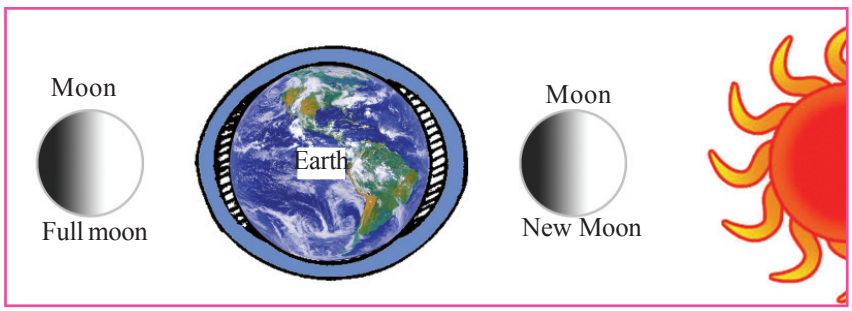


Fig. 5.5

Look Fig.5.5. The sun, moon, and earth come in a straight line on full moon and new moon days. The tidal force will be intense due to the combined influence of sun and moon. As a result the tides formed on these days will be stronger. These are known as spring tides. The moon and the sun will be at an angular distance of 90° from the earth after seven days from the full moon and new moon days. As the sun and the moon attract the earth from an angular distance of 90° the tides caused are weak. Such weak tides are known as neap tides. Note the positions of the earth, moon, and sun in the given diagram (Fig.5.6).

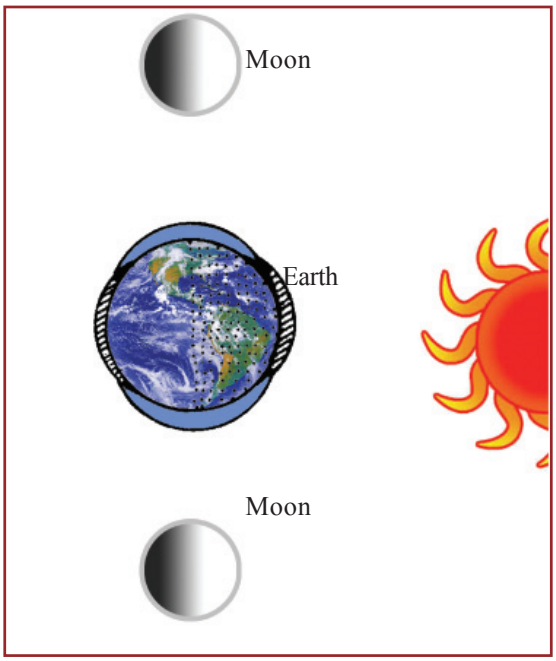


Fig. 5.6

Effects of tides

High tides and low tides have many effects. Let's have a look at them.

- The debris dumped along the sea shores and ports are washed off to the deep sea.
- The formation of deltas is disrupted due to strong tides.
- Brackish water can be collected in salt pans during high tides.
- The fishermen make use of the tides for going and returning from the sea in catamarans.
- Tidal energy can be used for power generation.
- Ships can be brought to shallow harbours during high tides.

Ocean currents

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Ocean currents are the continuous flow of sea water from one direction to another. They can be classified as warm currents and cold currents. Warm currents are the currents that flow from the tropical or subtropical regions towards the polar or sub polar regions. Similarly cold currents are the currents that flow in from the polar or the sub polar regions towards the tropical or sub tropical regions.

The temperature and salinity of sea water varies from ocean to ocean. This difference leads to density differences in sea water. The difference in density is one of the factors that cause ocean currents.

Currents of the Pacific Ocean

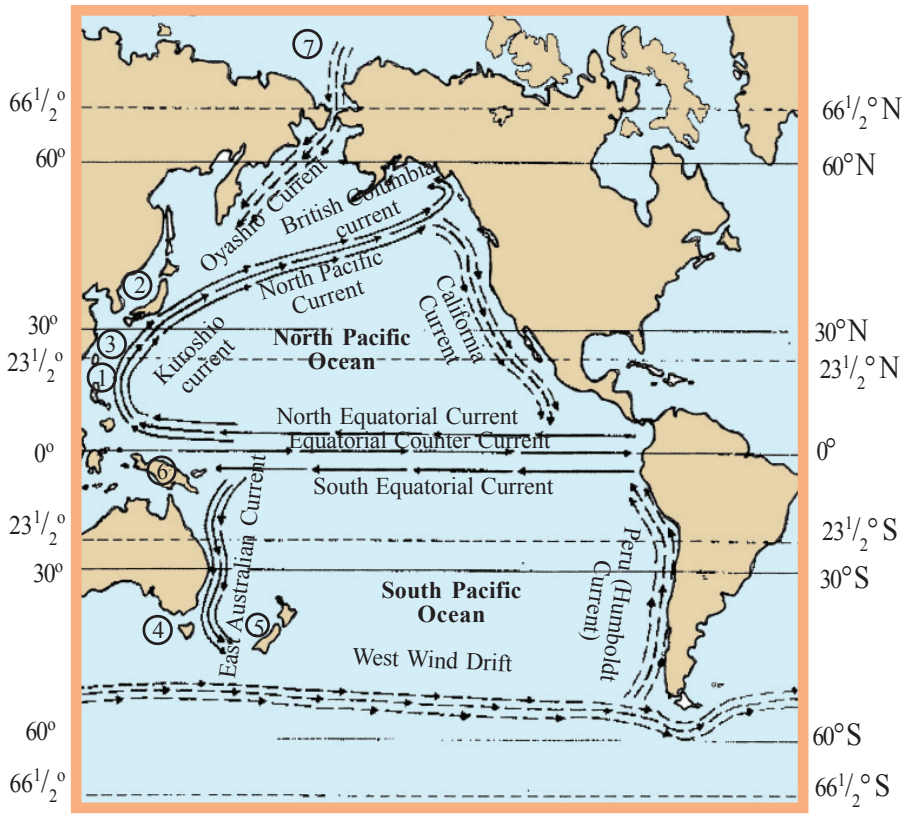


Fig. 5.7

Warm Current

Cold Current

1. Philippine Islands
2. Japanese Islands
3. Taiwan Island
4. Tasmania
5. New Zealand
6. New Gunea Island
7. Bering Strait

Complete the table using Fig. 5.7

Warm currents	***Cold currents***
• *North equatorial current*	• *California Current*
•	•
•	•
•	•

Currents of Atlantic Ocean

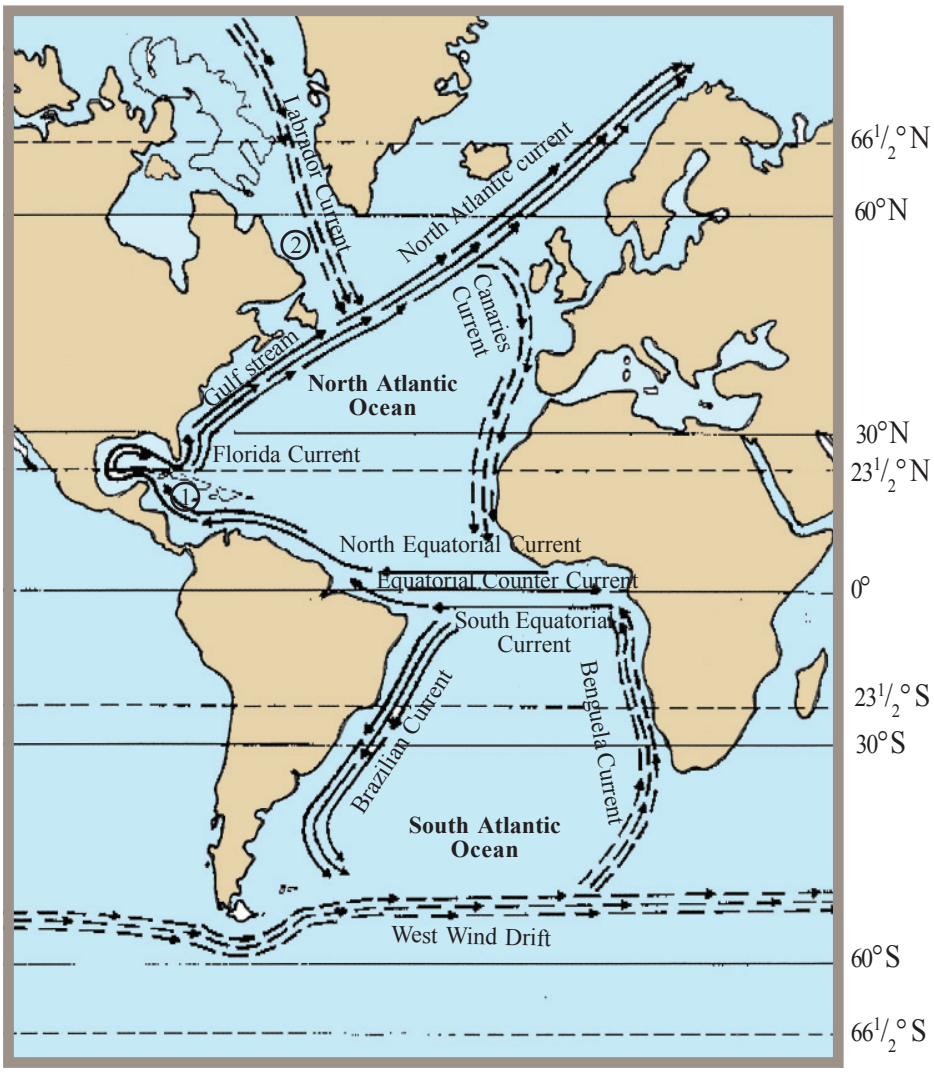


Fig. 5.8

Warm Current

Cold Current

1. West Indies
2. Newfoundland Island

List the warm and cold currents of the Atlantic Ocean.
Identify the continents near which they flow and prepare notes.

Currents of the Indian ocean

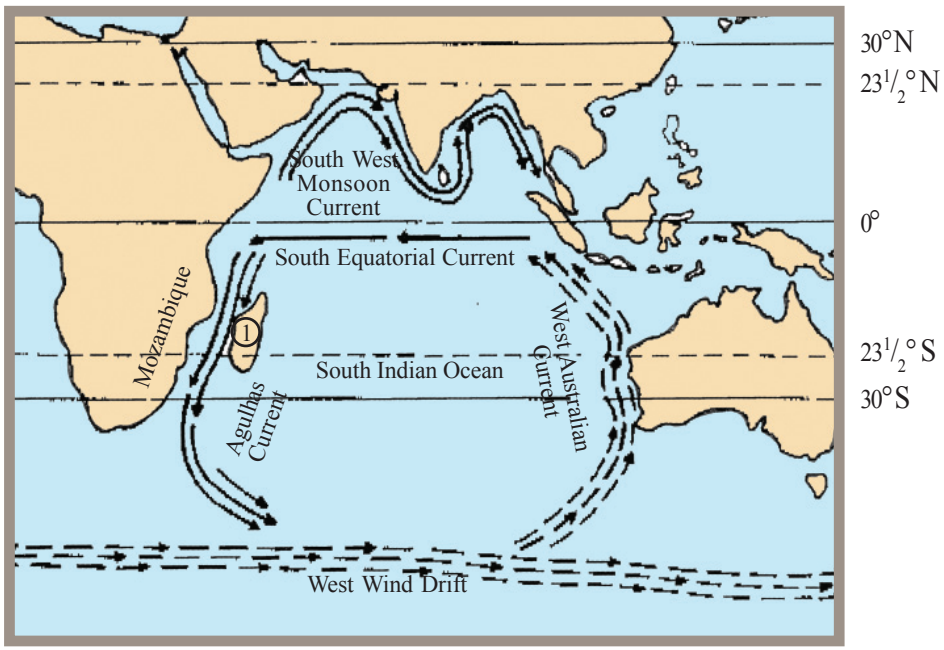


Fig.5.9

Warm Current
Cold Current

1. Madagascar

Complete the following table based on the currents of the Indian ocean.

Currents	*Warm/cold*	*Direction*
• *South equatorial current*	• *Warm*	• *From east to west*
•	•	•
•	•	•

Effects of ocean currents

- Influence the climate of coastal regions.
- Fog develops in the regions where warm and cold currents meet.
- The regions where the warm and cold currents meet provide favourable conditions for the growth of fish.

Grand banks

The Grand Banks are among the major fishing grounds in the world. It is situated on the shores of Newfoundland to the east of North America. As it is the meeting place of the warm Gulf Stream current and the cold Labrador current, it provides suitable conditions for the growth of planktons which in turn attracts fishes of many kinds.

Hope you are convinced of the importance of sea water movements in human life. Oceans are useful to man in different ways. Let us look at them.

Climate

Oceans have a decisive role in controlling the climate along the coastal regions. The sea breeze during the day and the land breeze in the night regulate the temperature over the coasts. Oceans play a part in the formation of weather phenomena like rain, wind, and cyclones. Generally the coastal regions have moderate climate, whereas severe summer and winter prevail in regions away from the sea.

Mineral deposits

Most of the minerals found on land are also found in the oceans. Apart from the deposits of common salt, bromine, magnesium chloride etc, the oceans contain iron ore, coal, petroleum and natural gas. Extraction of petroleum and natural gas from the oil field in the Arabian Sea about 162 km to the west of Mumbai shore started in 1974. This oil field is known as Mumbai High.

Power generation

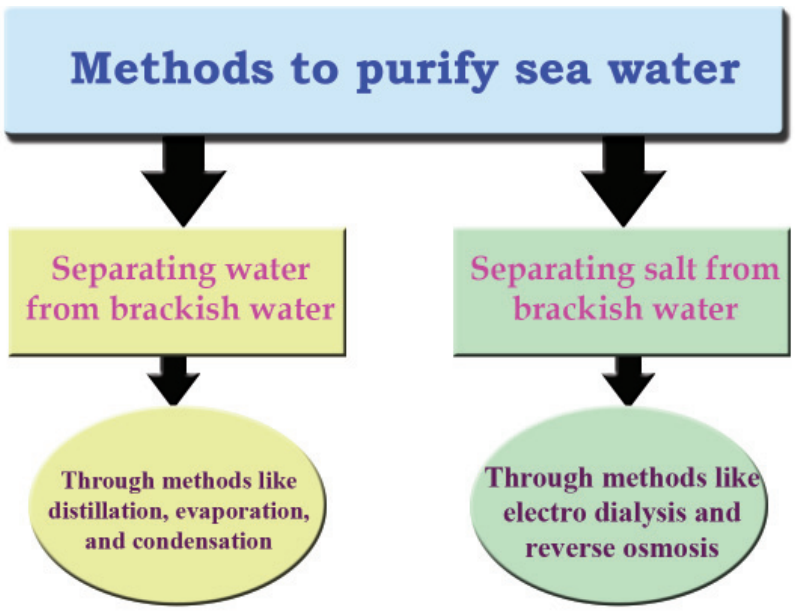
Waves and tides are used for the generation of electric power. The waves that strike the turbines on the shores produce electricity by turning them. Sometimes reservoirs are constructed for storing sea water. Seawater that enters the reservoir at high tides is released during low tide. The turbine moves at both instances and electricity is generated.

Oceans as a source of food

Fish is an important item of food. Japan, Peru, China, Norway, and the United States of America are the leading fishing nations. Marine organisms are the source of many medicines. They are used for the production of antibiotics, steroids, and vitamins.

Drinking water from the sea

We can purify sea water for drinking purposes. Which are the methods to purify sea water? Look at the following chart.



The ocean water is purified through distillation in some places in India. The people of Lakshadweep use water obtained through this process.

The following are the other uses of oceans to man. Find out more.

- Provide several job opportunities in various sectors like fishing, its processing, and marketing.

- Possibilities for tourism.
- Ocean transport is ideal for the transportation of heavy goods at cheaper rates from one continent to another.

You have learnt the uses of oceans. Conduct a seminar on the topic 'Influence of oceans in human life'.

Let us assess

- Which among the following statements is not related to the Indian Ocean?

  a. The southern part of this ocean extends up to the Antarctic Ocean.

  b. The average depth is more than that of the Atlantic Ocean.

  c. The Puerto Rico trench is situated in this ocean.

  d. It ranks third in area.

- Which among the following places record the least salinity? Why?
  - Land- locked sea.
  - Areas of heavy rainfall.
  - Areas of high evaporation.
- Is there any relation between the intensity of waves and the wave length? Sustantiate.
- High tide occurs twice a day. Explain this statement.
- Explain spring tides and neap tides with the help of diagrams.
- Oceans play an important role in human life and the environment. Justify.