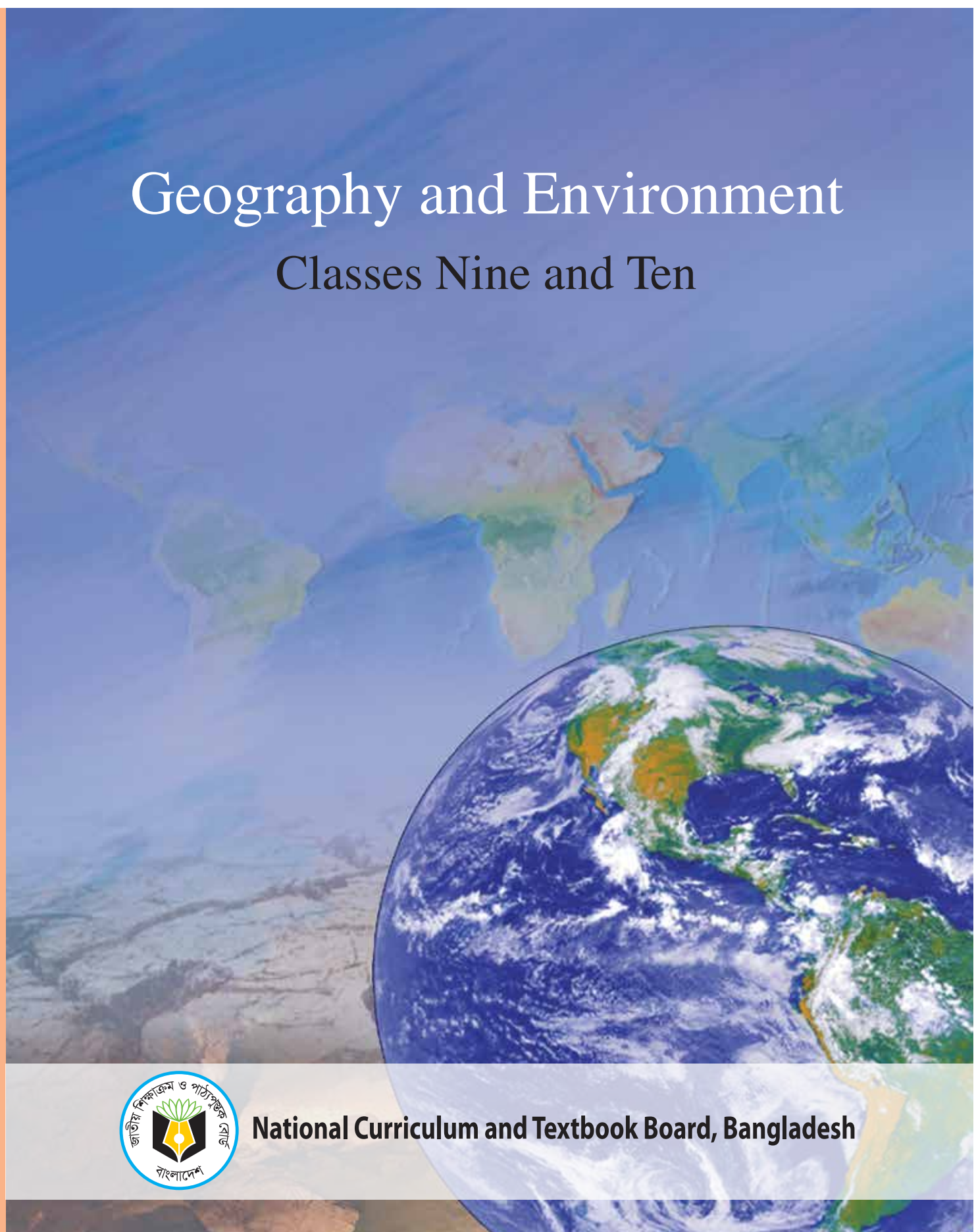
Geography and Environment

Classes Nine and Ten



National Curriculum and Textbook Board, Bangladesh

Prescribed by the National Curriculum and Textbook Board
as a textbook for classes nine and ten from the academic year 2013

Geography and Environment

Classes Nine and Ten

Revised for the year 2026

National Curriculum and Textbook Board, Bangladesh

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Preface

The importance of formal education is diversified. The prime goal of modern education is not to impart knowledge only but to build a prosperous nation by developing skilled human resources also. At the same time, education is the best means of developing a society free from superstitions and adhering to science and facts. To stand as a developed nation in the science and technology-driven world of the 21st century, we need to ensure quality education. A well-planned education is essential for enabling our new generation to face the challenges of the age and motivate them with the strength of patriotism, values, and ethics. In this context, the government is determined to ensure education as per the demand of the age.

Education is the backbone of a nation and a curriculum provides the essence of formal education. Again, the most important tool for implementing a curriculum is the textbook. The National Curriculum 2012 has been adopted to achieve the goals of the National Education Policy 2010. In the light of this, the National Curriculum and Textbook Board (NCTB) has been persistently working on developing, printing, and distributing quality textbooks. This organization also reviews and revises the curriculum, textbook, and assessment methods according to needs and realities.

Secondary education is a vital stage in our education system. This textbook is catered to the age, aptitude, and endless inquisitiveness of the students at this level, as well as to achieve the aims and objectives of the curriculum. It is believed that the book written and meticulously edited by experienced and skilled teachers and experts will be conducive to a joyful experience for the students. It is hoped that the book will play a significant role in promoting creative and aesthetic spirits along with subject knowledge and skills among the students.

The **Geography and Environment** Textbook has been developed in the context of the new lifestyle and environment of the 21st century. The Geography and Environment is no longer limited to the discussion of country, mountains, rivers, capital, import-export, industrial, and mineral resources. The scope of The Geography and Environment has extended to the relations between man and the environment, human life with huge changes of environment, and global initiatives of environmental development. Considering all these issues, the textbook has been developed with an emphasis on the needs and abilities of the students.

It may be mentioned here that due to the changing situation in 2024 and as per the needs, the textbook has been reviewed and revised for the academic year 2026. It is mentionable here that the last version of the textbook developed according to the curriculum 2012 has been taken as the basis. Meticulous attention has been paid to the textbook to make it more learner-friendly and error-free. However, any suggestions for further improvement of this book will be appreciated.

Finally, I would like to thank all of those who have contributed to the book as writers, editors, reviewers, illustrators and graphic designers.

October, 2025

Professor Robiul Kabir Chowdhury
Chairman (Additional Charge)
National Curriculum & Textbook Board, Bangladesh

Contents

Chapter	Title	Pages
One	Geography and Environment	1–6
Two	The Universe and Our Earth	7–29
Three	Map Reading and Its Uses	30–44
Four	Internal and External Structure of the Earth	45–69
Five	Atmosphere	70–92
Six	Hydrosphere	93–106
Seven	Population	107–125
Eight	Human Settlements	126–137
Nine	Resources and Economic Activities	138–147
Ten	Geographical Description of Bangladesh	148–165
Eleven	Resources and Industries of Bangladesh	166–189
Twelve	Transport System and Trade of Bangladesh	190–204
Thirteen	Development Activities of Bangladesh and Environmental Balance	205–215
Fourteen	Natural Disaster of Bangladesh	216–232
Fifteen	Sustainable Development Goals (SDG)	233–242

Chapter One

Geography and Environment

The earth is the planet where we live. We live in different regions with distinctive natural environments. Naturally, our lifestyles, societies, cultural, economic and political activities have unique characteristics. All these things are the topic of discussion in modern geography. So, geography is a science of nature and it is a science of environment and society. In this chapter, we are going to deal with geography and environment, their scope, different branches of geography and the importance of geography as a subject.



Some part of the Solar System



A natural scenery

At the end of this chapter, we will be able to–

- explain the idea of geography and environment;
- describe the scope of geography;
- explain the importance of studying geography and environment;
- explain the inter-relationship among different elements of geography and environment.

Concept of geography

We live in the earth and it is our habitat. As human habitat, the description of the earth is Geography. The word geography is derived from two Greek words 'geo' (earth) and 'graphy' (description). But the discipline does not simply describe the earth, it explores the planet as people habitats. Eratosthenes was the first Greek scholar who used the term 'geography' as the study of earth as human habitat. British Geographer Professor E.A Macnee said, 'geography is the study of environment of man both physical and social, particularly in its relation to human activities.' British Geographer L. Dudley Stamp has defined geography as, 'A description of the world and of its inhabitants.' German Geographer Professor Carl Ritter said that geography is concerned with the objects on the earth's surface around man. Geography is the science of nature, environment and social science. According to renowned American Geographer Prof. Richard Hartshorne, "Geography provides accurate, orderly and rational description and interpretation of the variable character of the earth's surface."

On the one hand, Geography is natural science, on the other hand, it is environment and social science. The main discussion topic of Geography is especial knowledge on nature, environment and society.

According to Alexander Von Humbolt, founder of Modern Geography, "Geography is a science related to nature and it includes descriptions and discussions all belonging to nature. Academy of Science of Washington D.C. gave a definition of Geography in 1965. According to them, Geography searches for how the sub-management of natural environment of the surface and how human beings adjust themselves with these natural phenomena or physical body.

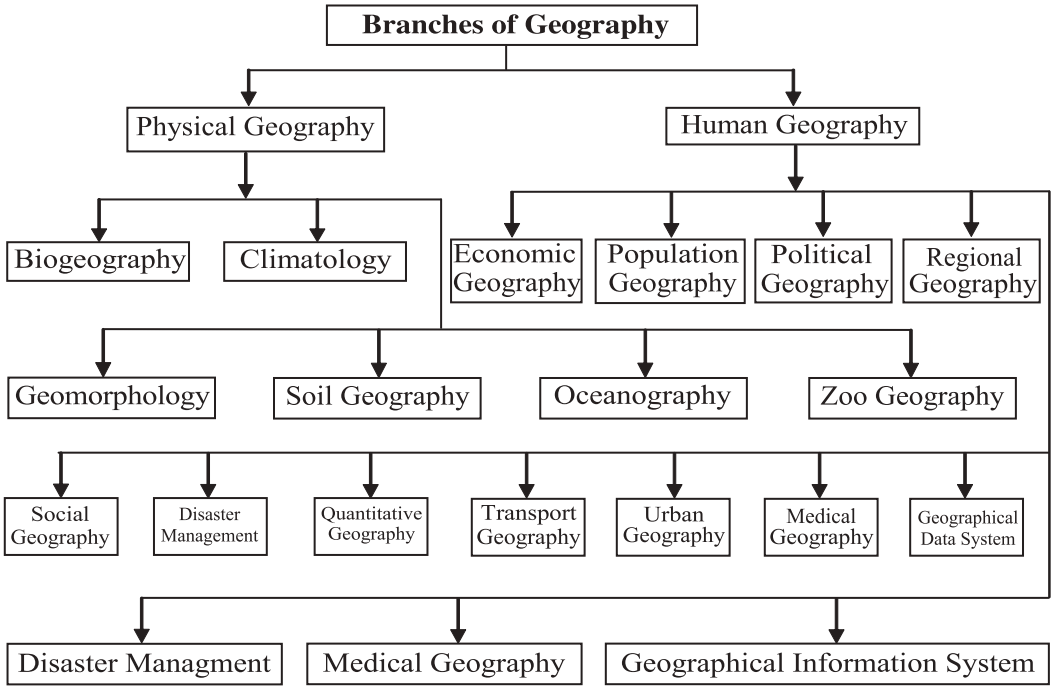
People live in this world and lead their life on it. The natural environment influences their way of living. Climate, physical features, natural vegetation, animals, rivers, seas and mineral resources influence the life of people in different ways. Activities of man change the environment, such as, their homes, roads, ports and cities and change the nature and environment in different ways. Settlement is built by cutting trees, by filling up canals, wetlands, and ponds. There is interaction between man and environment. The action of cause and effect is the root of this relation.

The main function of geography is to find out the cause of interaction between man and environment.

Scope of geography

Science and technological expansion, new inventions, innovations, expressions of thoughts, change of social values have extended the scope of geography. So, various subjects such as Geomorphology, Climatology, Oceanography, Soil Science, Botany, Sociology, Economics, Politics, etc. have been included in Geography.

Branches of geography



(a) Physical geography : Physical Geography is that branch of Gerography dealing with the natural features of the earth, the home of human beings. Physical Geography deals with water, air, animals, and the land of the planet earth i.e. everything that is part of the four spheres-the atmosphere, biosphere, hydrosphere and lithosphere.

1. Geomorphology : Geomorphologists study the landforms of the planet, from their development to their disappearance through erosion and other proceses.

2. Climatology : Climate geographers investigate the distribution of long term weather patterns and activities of the earth's atmosphere.

3. Biogeography : Biogeography studies the distribution of plants and animals on or near the surface of the earth.

4. Soil geography : Soil geographers study the upper layer of the lithosphere, the soil of the earth and its categorization and patterns of distribution.

5. Oceanography: About three fourth of the earth is water. Oceanography discusses the transport and communication among continents through ocean, the rise and fall of ocean surface, determination of chemical quality and salinity and the management of ocean resources.

(b) Human geography : Human geography is a major branch of geography that studies people and their interaction with the earth and with their organization of space on the earth's surface.

1. Economic geography: Economic Geography deals with economic activities people undergo to live and cope with nature and natural environment.

2. Population geography: Population Geography focuses on population, trend of population growth, its cause and effect, its influence on social and economic life.

3. Regional geography: As per regions, the earth has distinctive physiography, climate, vegetation, animals, population and lifestyle. Regional Geography focuses on studying geographical matters of different regions of the earth.

4. Political geography: Political Geography deals with political evolution, political division and boundary and geographical issues within the boundary.

5. Quantitative geography: Quantitative Geography uses quantitative techniques and models to test hypothesis. Quantitative methods are often used in many other branches of Geography but some geographers are specialized in quantitative methods only.

6. Transport geography: Transport geographers study both government and non-government transport system and transportation of people and goods from one place to another.

7. Urban geography: Urban Geography deals with the origin, evolution, classifications, environment and different areas of cities and towns.

8. Disaster management: Disaster management focuses on how to reduce loss during disasters and how to protect environment and oceans from disasters.

Whatever branch we discuss, environment is always an issue. At present Geography and Environment are taught in an integrated way. Natural and social environment bear equal importance in geographical science.

Concept of environment

People live in an environment. An environment is made up of rivers, oceans, mountains, forests, settlements, roads, plants, animals, water, soil and air. All activities of human beings have profound effect on natural and man-made features of the environment. Environmental scientist Arms said, "Environment is the surrounding organic and natural situations of animals."

C.C. Park says, "Environment means the sum of all the situations of humans at certain point of place and time."

Environment changes with the change of time and place. For example, at the beginning of mankind, water, air, plants and animals made up the environment. Later, human interference, social, economic, cultural and political activities developed a new environment i.e. human environment.

Elements of environment : Environment is made of two kinds of elements – living and non living elements. Those who have life, take food, have intelligence, have birth/death and growth are living things/elements.Trees, birds and animals, insects, humans and other animals are living things. These are the living elements of environment. Earth, water, air, mountains, rivers, seas, light, temperature, moisture are the non living things/elements. They make non living environment.

Task : Make inter-relationship among different elements of environment.

Types of environment : There are two types of environment--natural environment and social environment. Earth, water, air, mountains, rivers, seas, light, trees, birds, animals and insects, constitute natural environment. On the other hand, human behaviours, rituals, education, values, economics and politics constitute social environment.

Importance of studying geography and environment: Through reading Geography and Environment chapter, we can know-

- The nature and environment of a particular place of the earth.
- Cause of formation and features of mountains, hills, rivers, oceans, plateaus, plains and deserts.
- Acquisition of scientific conceptions about the evolution of the animal world since the birth of the earth.
- About plants and animals and their variety in conducts, food habits and lifestyles.
- Changes made in social environment due to the development in agriculture, industry, trade and commerce, transportation and communication
- About cause of natural disaster casualties and control, geographical position, pattern of climate and importance of communication system.
- Increase of temperature of the earth, greenhouse effect and its influence.
- Gaining economic solvency by man using natural resources.
- Ocean and ocean resource management.

Sample Questions

Multiple choice questions

1. Which is included in biogeography?

(a) Business and trade management
(b) Plants and animals
(c) Latitude and longitude
(d) Development of cities

2. The topics discussed in geography are-
   i. Physical environment of the Earth
   ii. Human lifestyle
   iii. Relationship between physical environment and lifestyle

Which of the following is correct?

(a) i and ii (b) i and iii (c) ii and iii (d) i, ii and iii

Read the following stimulus and answer questions 3 and 4:

Mr. Naeem filled the low-lying area at the intersection of four roads and constructed a shop with a house behind it.

3. Naeem's activity belongs to which geography?

(a) Biogeography (b) Human Geography (c) Climatology (d) Landforms

4. The activity mentioned is-
   i. Rural development
   ii. Urbanization
   iii. Settlement development

Which of the following is correct?

(a) i and ii (b) i and iii (c) ii and iii (d) i, ii and ii

Creative Questions

1.

Group-A	Group-B
Mountains People Climate Plants	Biogeography Physical Geography Human Geography Economic Geography

a. What is geography according to geographer Dudley Stamp?
b. Explain why the scope of geography has expanded.
c. Which environment do the elements of group 'A' belong to? Explain.
d. Analyze the effects of group 'A' and group 'B' on human life.

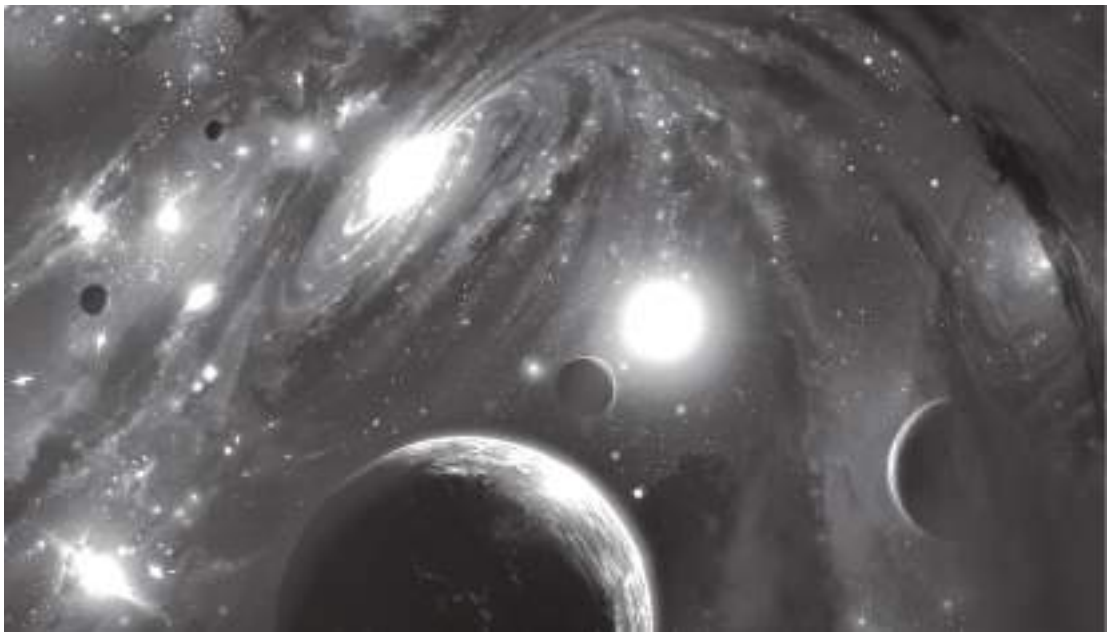
Short-answer questions

1. Provide the concept of geography defined by Alexander Von Humbolt.
2. Write about two topics each in economic geography and political geography.
3. Write four important aspects of geography and environmental studies.
4. Why is the environment closely related to all geography?
5. What does Park (C.C. Park) mean by environment?

Chapter Two

The Universe and Our Earth

The earth is our habitat. It is surrounded by the universe.The sun is at the centre of the solar system. There are many other stars in the space. Moreover, the Moon (satellite), the Earth (planet), comets, meteors and nebulaes are there in the space.The universe is made up of small particles, and insects on earth, distant seen and unseen stars. In this chapter, we will discuss space, universe, solar system, earth, etc.



The universe

At the end of this chapter, we will be able to–

- describe the location and characteristics of the solar system, earth and other planets and satellites;
- describe the nature and diameter of earth and satellite;
- explain the importance of lines of latitude and longitude;
- identify different places using latitude and longitude;
- explain rotation and revolution;
- analyze the cause of day and night, its increase and decrease and its impact;
- cause of season change and its impact;
- make the model of solar system using different materials;
- have more interest to know about our only place of habitat, earth.

Space and Universe

The sun is a star and the moon is a satellite. The sky is limitless. This is called space Our Earth, Sun, Moon and innumerable stars, plantes and sattelities are the parts of this sky. They move around the space their own axis at a certain motion. Among them some have light of their own and some don't have. At present Sun, Moon, planets, stars, comets, meteors, nebulaes, pulsars, black dwarfs, black holes etc. are called extra terrestrial body. Nobody knows how big the universe is. Nobody knows the nature and form of this universe. Many scientists believe that the universe has no beginning and ending. Some still believe that the universe has form and diameter. Scientists are discovering new things about the Universe everyday but most of the things are still unknown.

Stars

The terrestrial body which has light of its own is called Star. There are innumerable stars in the Universe (fig. 2.1). We can see only some thousands of them with our naked eyes. Some of them can be seen from the Earth only through powerful telescopes. The stars are burning gasballs, made of hydrogen and helium gases. These gases are burning at a very high temperature (6000 Celsius). Other stars are not seen at day time due to the scorching light of the sun.

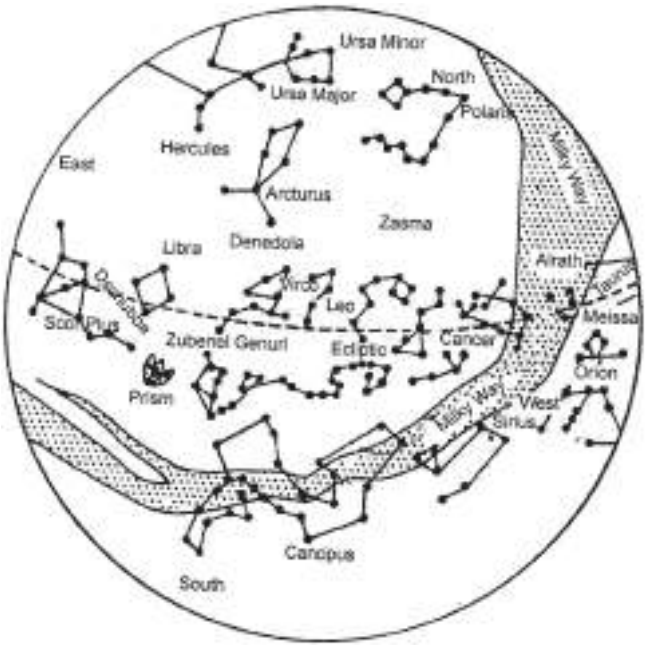


Fig. 2.1 : Location of different stars in the sky

It seems that all the stars are lying on the same level when seen from the earth. Actually, they are lying at different distances from the earth.The distances between the earth and stars are so great that it cannot be measured by kilometres.These are measured by light years. The distance covered by light in one year is called one light year. Light passes about three lakh kilometres per second. It takes 8 minutes 19 seconds to reach the earth.The closest star to the Sun is Proxima Centauri. Its distance from the Earth is about 4.2 light years.

Constellation : At night some stars are seen in groups.These groups of stars are called Constellation.Astrologers of ancient time gave them different names based on their appearance, some of them look like bear or hunter. Therefore, they are named as Great Bear, Orion, Cassiopea, Little Bear, Canis Major, etc.

Galaxy : Planet, stars, dust, comets, vapours together make a galaxy or star world. There are one hundred billion galaxies in the space (fig. 2.2).They are of different sizes and forms, but most of them are snakelike or parabolic. Snakelike galaxies are large in size and parabolic galaxies are very bright. They move at great distance from each other. The Milky Way is a galaxy.



Fig. 2.2 : Galaxy

Nebula: Nebulae are an interstellar in the outer space. They have peculiar appearances. Some nebulae are full of gases. They are located with wide distances. A nebula may contain millions upon millions of stars. The nebula may be made up of the remains of the dead stars or of a region where they are actively made. It remains as a part of a galaxy.

Milky Way: The galaxy in which we live in is called the Milky Way. In the dark sky their bright radiance looks like a long way. They cluster in millions. At winter nights, a big long lines of vivid radiant rays are visible to the north-south in the sky. This star lit way is called the Milky Way. Scientists named them a circular zone. There are almost 2000 nebulae in the solar system.

Meteor: Sometimes in a cloudless night, it seems that some stars are running very fast or a star is falling down. We call it 'a shooting star'. Actually they are not stars. They are meteors (fig:2.3). Innumerable objects float in the space. They get attracted by gravitational forces and come at the earth with a great speed (3km/s). They burn up in touch of air being collided with it. So, they seem to be running stars. Most of the meteors are very tiny.



Fig. 2.3 : Meteor

Comet: Sometimes in the sky a special kind of star appears. It has a head and a tail. It is called a comet. It is a wonderful star in the sky(fig: 2.4) . Though comes live in the solar system , they appear for somedays and disappear again. They move round the sun very afar. They can be seen when they are close to the sun. Their tails get longer as close as they advance towards the sun. As they orbit the sun in very long paths, they appear only once every many years. The comet discovered by Astronomer Edmond Halley is known as Halley's Comet. It is seen after every 76 years.

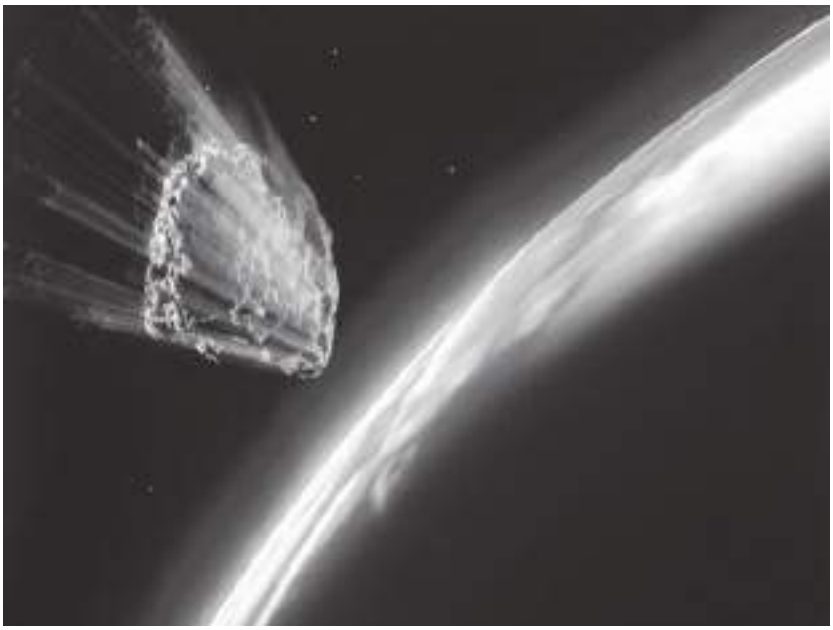


Fig. 2.4 : Comet

Planet : A planet is a celestial body orbiting a star or stellar remnant that is massive enough to be rounded by its own gravity. Unlike stars, planets do not give off light. They shine at night because they reflect light from the Sun. The planets and other objects which orbit the Sun travel in flattened circles called Ellipses. In the solar system there are eight planets, namely Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.

Satellite : A satellite is an object that goes around, or orbits, a planet.While there are natural satellites, like the Moon, hundreds of man-made satellites also orbit the Earth. The man-made satellites which are moving around the earth are used for weather forecasting, information technology, telecommunication, detection of mineral resources etc.

Solar system

Solar system consists of the sun and its planets, asteroids, satellites, innumerable comets and meteors. The sun lies at the centre of solar system. The Earth is one of eight planets which orbit the Sun, and these planets and their moons make up the solar system (fig. 2.5). The word solar means 'of the Sun'. The solar system also contains thousands of minor planets, called Asteroids, and countless comets. The planets, asteroids and comets are all held in their orbits by the Sun's gravity or Pulling force. The Solar System is too small compared with the vastness of the universe.

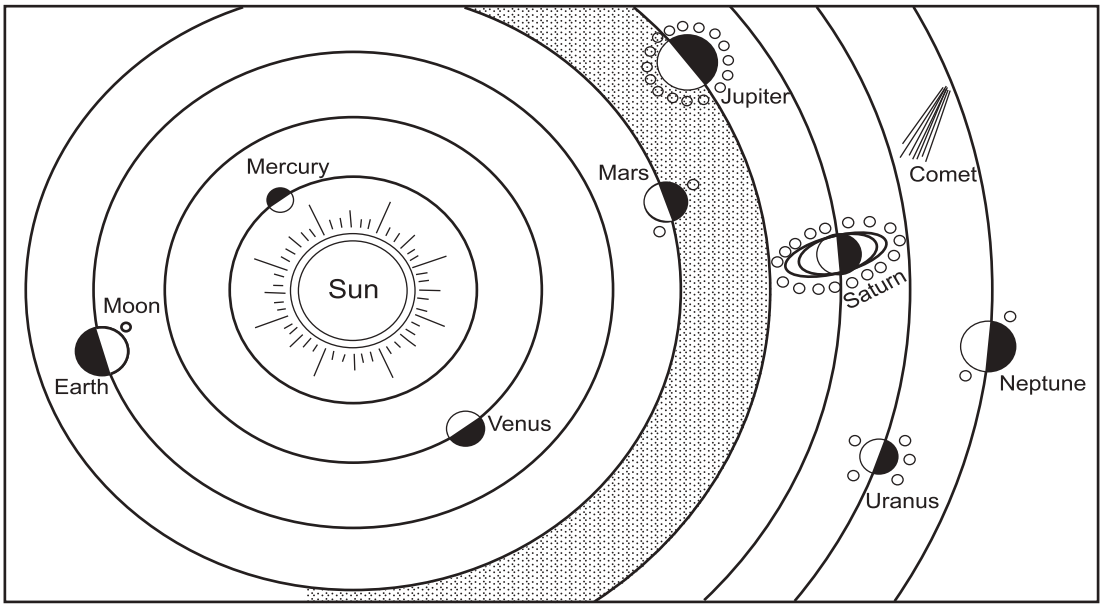


Fig. 2.5 : Solar system

Sun : The sun is a star. It is a middle sized yellow coloured star. The original source of heat and light of earth, other planets and their satellites is the sun.

Its diameter is approximately 13 lakh and 84 thousand kilometres and mass is 1.99×10^{13} Kilogram. Eight planets are moving round the Sun. They can be listed from the nearest to the furthest as follows: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune. The largest planet is Jupiter and the smallest one is Venus. Mercury, Venus, Mars, Jupiter and Saturn are quite bright and can be seen without any instrument from the earth. Uranus and Neptune are less bright and they cannot be seen without telescope.

Mercury : Mercury is the smallest and nearest planet of the sun. The average distance from the sun is 5.8 crore kilometres and its diameter is 4,850 kilometres. As it is closest to the Sun intense light sometimes makes it invisible. It takes 88 days to move around the sun and so, 88 days make one year in Mercury. Its gravitational power is so weak that it cannot retain in the atmosphere. There are no air, water, rain or clouds. So there is no existence of life. The surface of the mercury looked like that of the moon according to sending photos of American Mariner-10 in 1974. Mercury has no satellite.

Venus : You must have heard about the morning star or the evening star and might have seen it too. Venus in fact, is not a star. It glows in the sky like a star which prompts us to call it a star.Venus is covered with dark cloud. So, the sun can never be seen from its surface. Cloudy atmosphere mainly consists of carbon dioxide. It is the brightest and hottest planet of the solar system. The distance between venus and sun is 10.8 crore kilometres. No significant difference of light between day and night is seen. It rains here but it is acid Rain. Its diameter is 12,104 kilometres. It takes 225 days to move around the sun. So, its year is of 225 days. It doesn't have any satellite. Though all planets move around on their own axis from west to east, venus moves from east to west.

Earth : Earth is our habitat. It is the third nearest planet from the sun. The average distance from the sun is 15 crore kilometres, and the diameter is nearly 12,667 kilometres. Earth takes 365 days, 5 hours, 48 minutes and 47 seconds to orbit the Sun. Moon is the only satellite of the earth. Earth is the only planet where the atmosphere contains oxygen, nitrogen, and carbon dioxide in proper amount for the plants and animals to survive. Earth is the only planet in the solar system where life exists.

Mars : Mars is the nearest neighbour of earth. Average distance from the sun is 22.8 crore kilometres and the diameter is 6,787 kilometres. Length of day and night is equal. It takes 687 days to orbit the Sun. In this planet there is scarcity of water and the amount of carbon dioxide in the air is very high which is the cause of no life on Mars. Mars has two satellites. One of them is Phobos and the other is Deimos.

Jupiter : Jupiter is the largest planet of the solar system. Its diameter is 1,42,984 kilometres. It is 1,300 times larger than the Earth. It is 77.8 crore kilometres away from the Sun. Jupiter's atmosphere is made up of hydrogen and helium. It takes 4,331 days to orbit the Sun. Jupiter has 97 satellites.

Saturn : Saturn is the second largest planet of the solar system. Its distance from the Sun is 143 crore kilometres and the diameter is 1,20,000 kilometres. Atmosphere contains a mixture of hydrogen and helium gas, methane and amonia. It takes 29.5 years to orbit the sun once. Saturn has the brightest rings and 82 satellites.

Uranus : Uranus is the third largest planet of the solar system.This planet is 287 crore kilometres away from the Sun. It takes 84 years to orbit the sun once. Diameter of the Uranus is 49,000 kilometres. Methane gas is very high in the atmosphere. It has rings around it but not bright like the Saturn. Uranus has 27 satellites.

Neptune : Its distance from the Sun is about 450 crore kilometres. Light and heat of the sun is less here. Its diameter is 48,400 kilometres. Its area is as large as 72 Earths and the atmosphere is made up of Methane and Amonia. Neptune has 14 satellites. Neptune circumnavigates once around the sun in 165 years.

Task : Table below will be filled by the students in groups within 15 minutes.

Position of planets in terms of the distance from the sun	**Average distance from the sun**	**Time taken to move around the sun once**	**Number of satellites**	**Characteristics**	
				Structure	**Others**
Mercury				1. 2.	
Venus				1. 2.	
Earth				1. 2.	
Mars				1. 2.	
Jupiter				1. 2.	
Saturn				1. 2.	
Uranus				1. 2.	
Naptune				1. 2.	

Size and shape of the earth

The shape and size of the earth was a long debated thing but nobody was absolutely sure about its shape. When Astronaut Uri Gagarine moved round the earth on 12th April 1961 and could understand that the earth is round with a little flat in north-south. Moreover, the picture taken by him is also round, but a little swelling to east-west. It means the real shape of the earth is oblate spheroid.

As the shape of the earth is not fully round, so, its diameter in equatorial region from east- west is 12,714 kilometres and north-south polar diameter is 12,751 kilometres. For the benefit of measurement it is calculated as 12,800 kilometres. According to this measurement the average radius is 6,400 kilometres. Equatorial diameter is 40,009 kilometres but for the benefit of rounding it is taken as 40,000 kilometres.

Latitude, longitude and other important lines

To locate a certain place on earth or to know its location, it is necessary to understand the 'latitude' and 'longitude'. The time of a certain place can be known from the location of longitude.The location from south or north can be known from latitude, in the same way location from east or west can be known from prime meridian.

Latitude

A latitude is the angular distance of a place north or south of the Equator. There are 180° parallels of latitude. Each parallel of latitude is a circle. All the parallels of latitude are not of equal length. The Equator, at 0°, is the most important latitude and the largest circle. It divides the earth into Northern Hemisphere and the Southern Hemisphere. The distance between any two parallels of latitude is always equal. The North Pole and the South Pole are the fixed points and serve as basic points of reference (fig. 2.6).

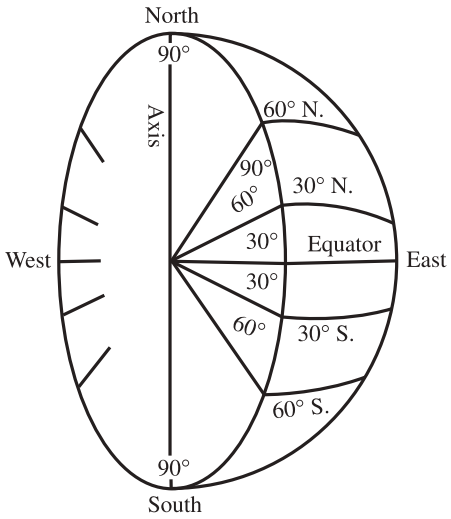


Fig. 2.6 : Angular distance from equator

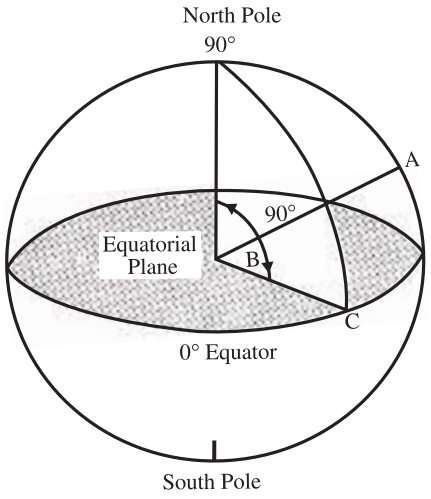


Fig. 2.7 : Equatorial plane, north pole and south pole

Determining latitude

It is very necessary to determine latitude for a geographer. We know that the angle of the centre circle of the earth is 360°. The imaginary line is actually the radius of the earth sphere. The value of the angle thus formed through those two lines is equivalent to the latitude of that particular place. Therefore, the latitude is the angular distance of a place north or south of the equator. If a line is drawn from any place on the earth to its centre then that line will create an angle with the equatorial plane. The value of that angle is

the latitude of that place (fig. 2.7). The latitude of a place situated to the north of the equator is designated as the north latitude and that of the south as the south latitude. The total value of the angle created by the circle at the centre of the earth is 360°. These angles are being divided into degrees (°), minuets (′) and seconds (″). Thus the value of the equator is 0°. The latitude of the north pole is 90° North and that of the south pole is 90° South.

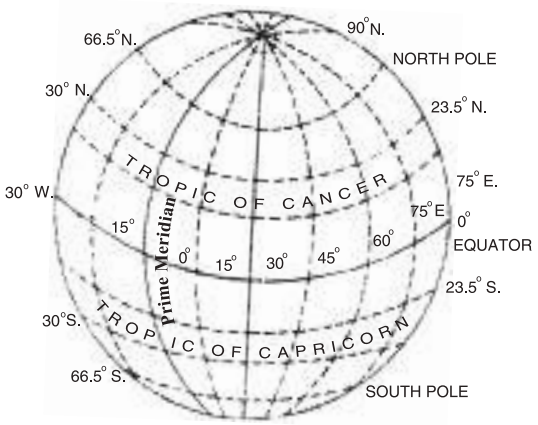


Fig. 2.8 : Latitude and longitude

Some latitudes are very famous. One of them is 23.5° north latitude, it is called the Tropic of Cancer and 23.5° south latitude is called the Tropic of Capricorn. 66.5° north latitude is called Arctic Circle and similarly 66.5° south latitude is called Antarctic Circle (fig. 2.8). The equator is known as the great circle.

There are different methods of determining the latitude of a place. Out of them we are discussing about two methods.

1. Determination of latitude by sextant : Sextant is an instrument by which the altitude of the sun can be measured. The latitude of any place can be determined after finding out the altitude of the noon sun with the help of a sextant. The following formula can be applied to find out the latitude of a place.

The formula is : 90° minus the altitude of the sun at noon ± the sun's declination.

So, the latitude = 90° – (altitude of the declination) = 90° – (50° + 12°) = 90° – 62° = 28° south. If the place under consideration is in the northern hemisphere it will require to add the declination value of north and to subtract the declination value of south. Similarly if the place is in the southern hemisphere the declination value of south is to add and that of the north to be subtracted.

2. Determining latitude with the help of a pole star : In the equator, the location of the pole star is in the horizon and its latitude is 0°. From the equator towards north pole for every 1° of approach the altitude also increases by 1°. Ultimately in the pole, the altitude of the pole star rises to 90°. So, the degree of latitude for the equator is 0° and that of the north pole is 90°. In other words, the degree of latitude increases with any approach towards the north pole.

Longitude

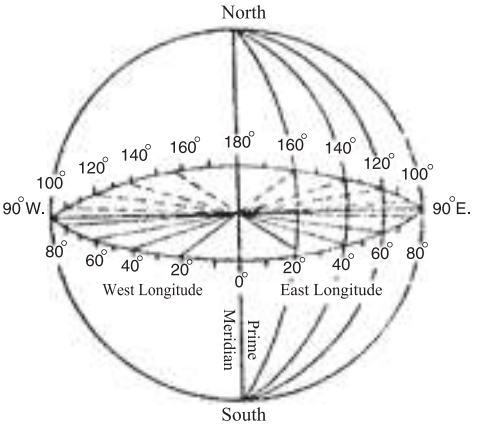


Fig. 2.9 : Longitude and angular distance

Longitude is the angular distance of a place from the divisional points of the equator into degrees, minutes and seconds covering from the north poles to the south poles. These lines are equal to the half of the circumference of the earth, i.e., they are half circles. We have known earlier that latitude and longitude are imaginary lines. The knowledge of the location of the Prime Meridian is necessary to discuss about longitude.The Prime Meridian is an imaginary line from the North Pole to the South Pole passing over the Greenwich Observatory near London, UK.

The longitude of Greenwich is 0°.Any angular distance from the Prime Meridian to the East or West is called longitude. The circumference of the earth produces 360° angle. The Prime Meridian has divided these 360° into two equal halves after every 1°, i.e., 180° to the East and West.

Since the earth is round,180° east longitude and 180° west longitude are the same meridian. The meridian located 30° east of the Prime Meridian is known as the 30° East longitude, and all locations along it from the North Pole to the South Pole share the same longitude.

Determination of longitude : The longitude of a place can be determined by two methods. These are : (1) by the difference of local time, (2) by Greenwich mean time.

(1) By the difference of local time : Whenever, the meridian of any place comes in front of the sun i.e. when the sun appears just overheads then it is considered as noon and the local time is taken as is noon. Ultimately other times of the place are determined on the basis of local time.We know that there is a difference of 4 minutes of time for 1° of difference of longitude. In other way, we can say that for every 4 minutes, the longitude differs by 1°. For example, if in any place, the local time is 12 noon, then the local time for any place located 10° east of the previous place will be 12:00 noon + (10 × 4) minutes or 12 hours 40 minutes. For the place lying 10° west of the former place, the local time would be 12:00 noon − (10 × 4) minutes or 11 hours 20 minutes.

(2) By Greenwich mean time : In order to maintain international uniformity, one uniform time, corresponding to the Prime Meridian, is adopted by all countries. Each place lying on this line of the world has the same time, called Greenwich Mean Time. Every 15° east or west of Greenwich Meridian, the time changes by one hour.

East is ahead and west is behind Greenwich Mean Time (GMT). The Greenwich Meridian is 0° and 90° meridian run exactly in the middle of Bangladesh. So, the time difference will be $90 \times 4 = 360$ minutes or 6 hours. This is the local time of 90° meridian which is considered the standard time of Bangladesh. When it is 12 noon in Bangladesh, London time is 6 in the morning.

Important lines

Equator : Keeping both the place in equal distance, an imaginary line has been drawn which encircles the globe from west to east is known as the equator. Other names of equator– 0° Latitude and Great Circle.

Tropic of cancer and tropic of capricorn : The 23.5° latitude in the northern and southern hemisphere are know as the Tropic of cancer and the Tropic of capricorn. The Tropic of cancer passes through the central part of Bangladesh. In the middle region of these two lines, sunshine falls on the earth perpendicularly.

Arctic circle and antarctic circle : The 66.5° north and south latitudes are known as the Arctic and Antarctic circles (fig. 2.10).

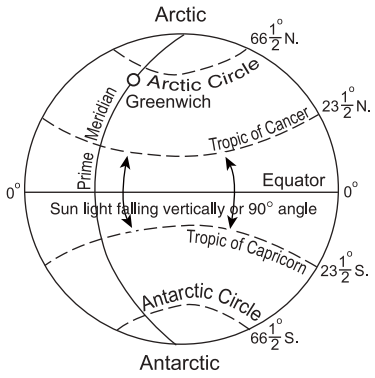


Fig. 2.10 : Some important latitudes and prime meridian

Task : Find out the capital cities of the neighbouring countries by their latitudes and longitudes.

International Date Line

To move from the east and west of the meridian according to longitudinal rules, 4 minutes vary for 1° longitude. We know that longitude of 180° east and west is just of the opposite side of 0°.

As per 1° for 4 minutes then 180° is equal to $180 \times 4 = 720$ minutes that means the difference is 12 hours. In this way 24 hours vary by 12 hours both in each direction east and west. To the east 12 hours leads to the increase and to the west 12 hours decrease. It means, 24 hours vary in the some longitude 180°.

In 1884 in United States of America, an international convention regarding 'Longitude and Time' created a special longitudinal line. It identified the 180° longitudinal line as the International Date Line (fig. 2.11).

We can see in the map at 6:00 am on 16 December at Greenwich if we count time to the eastward and reach at 180° East longitude the time is 6:00 pm on 15 December. Because time increases to the eastward and decreases to the westward. Time differs 24 hours and the date is different. To avoid this problem enervation date time has been introduced on the Pacific Ocean following 180° longitude of the map.

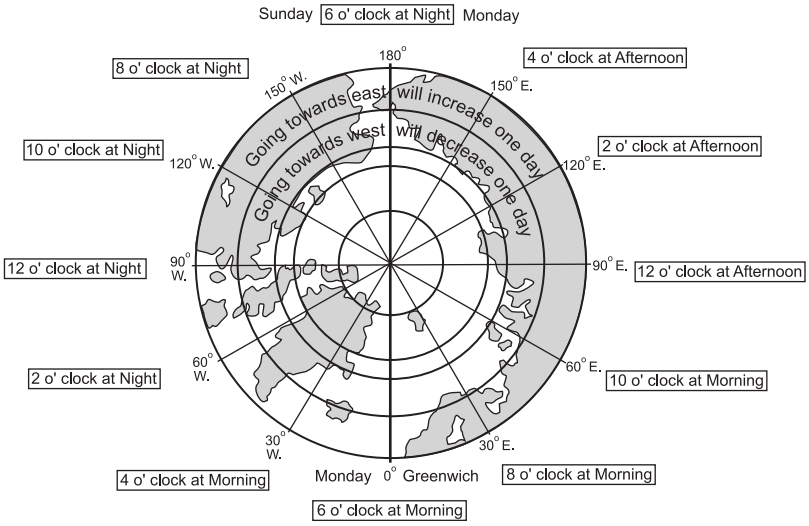


Fig. 2.11 : The difference betweens international date line and local time

Ships or planes when they cross the International Date according to the direction Line, add or subtract a day they are travelling in. When travelling eastward , they add a day. When travelling westward, they deduct a day (fig. 2.12).

The International Date Line is not a straight line. The longitude of 180° passes through many islands in the Pacific Ocean. The International Date Line has been curved in some places. Though running along 180° east and west longitude over the Pacific ocean but to avoid the land masses of north eastern Siberia and Aleutian, Figi and Chatham islands. The International Date Line has been curved 11° towards the east in Aleutian, Figi and Chatham islands to avoid land masses and 12° east in the Bering Strait over the water bodies. If it was not drawn this way, the people would have to count two different local times in the same place of the island.

Task : Write about the importance of International Date Line in human life (pair work).

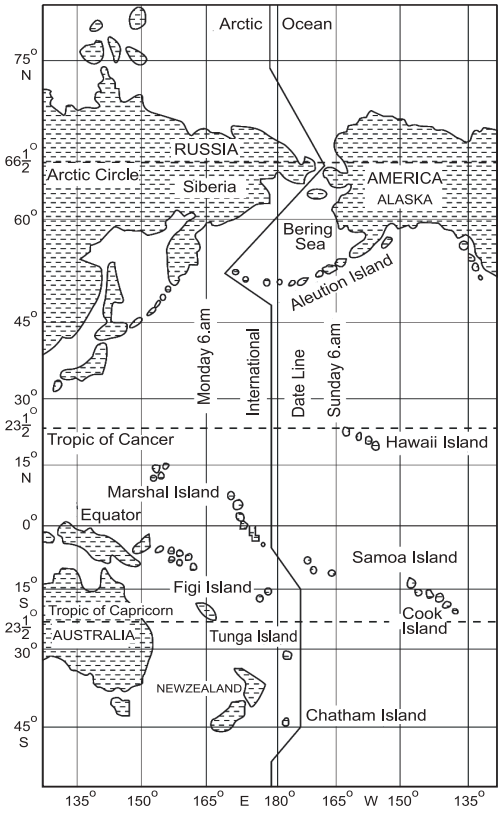


Fig. 2.12 : International date line

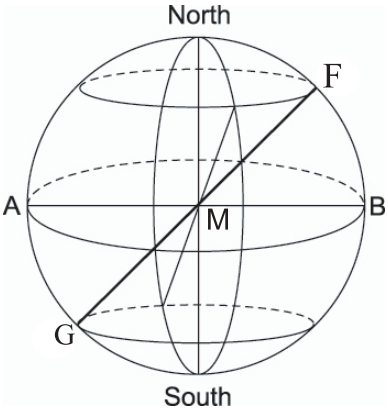


Fig. 2.13 : The antipodes

The antipodes : The earth is round, so it has an opposite place on the other side of the earth. From any point of the earth surface any imaginary line crossing through the centre of the earth is called the Antipode of the first point i.e. opposite side of the earth (fig. 2.13).

A certain place situated in a particular longitude is situated in the opposite longitudinal line. It means the summing up result will be 180°. As the distance between two longitudes will be 180° the time difference will be 180 × 4 = 720 minutes or 12 hours = 12 hours.

Task : Find out the antipodes of Dhaka in the globe in group.

Rotation of the earth

The Earth has two motions or movements, rotation and revolution. It was thought earlier that the earth was stationery and the sun moved round the earth. But it was proved later that the sun is stationery and the earth moves round the sun. The earth moves round the sun on its own axis once every 24 hours a day. The axis of the earth is inclined at an angle of 23 degrees 30 minutes with the perpendicular to its plane of orbit. The earth moves from west to east on its own axis a day. Movement on its own axis a day is called Rotation and movement round the sun a year on orbit is called Revolution.

Rotation

The movement of the earth around the Sun is called its Rotation. The path along which the Earth travels around the Sun is called the Orbit.

Different places on the Earth's surface move at different speeds. Places near the Poles hardly show any movement, while those at the Equator spin around at more than 1,600 kilometres per hour.

We are not thrown away from the earth surface and we don't feel it inspite of the motion of the earth. The reasons are :

1. Humans, animals, air, etc. move in the same speed along with the surface of the earth. So we don't feel the motion of the earth.

2. The earth attracts all the things towards its centre by its gravitation power, so we are not thrown away from it.

3. We don't feel earth's motion or we are not thrown away as we are too small compared to its huge size.

4. We don't feel the motion as the motion of moving of the earth is certain at every place.

5. If one thing out of two moves and another one keeps standing on earth, then it is understood that it has motion.Thus, there is no matter before the earth which is static or equal though we can understand the motion of the earth.

Proofs of rotation

The proof that the earth moves from the west towards the east on its own axis is :

1. Pictures sent by spacecraft : Pictures sent from the satellite and spacecraft show that the earth moves from west to east. These pictures are the most modern and correct proof of earth's movement or rotation.



Fig. 2.14 : Size of the earth

2. The size of the earth : If any delicate round shaped thing spins on its own axis like a top, a centripetal and centrifugal power develops at a time which makes the poles a little bit compressed and middle part a little bit enlarged. By virtue of movement at the time of birth the delicate earth got squeezed in the north and south poles a little bit and centre part swelled up. Scientist Newton said, this size of the earth has become like this due to this movement (fig. 2.14).

3. Cause of day-night : In most parts of the world there is day and night. It means 12 hours day and 12 hours night which are the principal reasons of rotation of the earth. If there was no rotation then one part of the earth would have been dark for ever and the other part would have been sunny.

4. Ferrel's law : We know that sea waves and air turns right hand side in the north pole and left hand side in the south pole. This turning away is known as Ferrel's law (fig. 2.15).

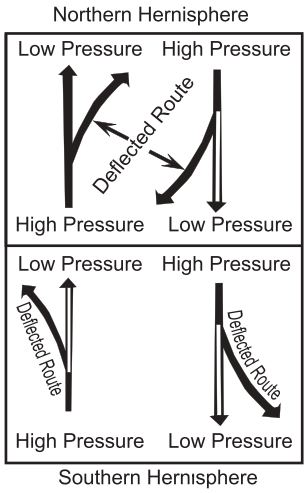


Fig. 2.15 : Ferrel's law

Results of rotation : The changes we see because of the rotation are :

1. Occurrence of day and night in the world : Day and night is the result of rotation. The earth is round and it does not have any light of its own. The earth gets light from the sun. The Earth during movement around its axis, becomes lighted with the rays of the sun. When it faces the Sun, that part is day. And the opposite side remains dark as the sunlight does not reach there. This dark part is night (fig. 2.16).

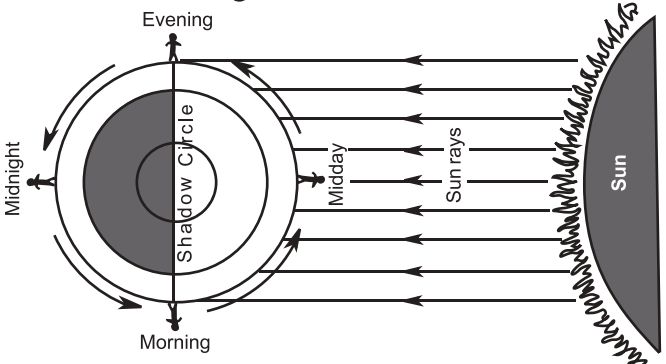


Fig. 2.16 : Occurrence of day and night

Due to rotation of the earth, alternately the illuminated portion becomes dark and the dark portion becomes illuminated and that is why the day and night occur. When the dark portion is illuminated, it becomes day and similarly the illuminated portion turns dark, it becomes night there. In this process, day and night occur. So, in some places it is 12 hours of day and 12 hours of night.

2. The cause of the high and low tide : High tide and low tide happen due to rotation of the earth. Tide does not occur at the same time everyday. For example, time of high tide in two consecutive days may vary by 52 minutes. This time difference occurs because of rotation.

3. The cause of air and sea wave : From the equator to both the poles the diameter of latitude and the motion of earth's movement become slower gradually near the two poles. The air wave or sea wave of the earth turn away towards right side in the north pole and left side in the south without going down directly from high pressure to low pressure zone.

4. The cause of temperature difference : At day time, temperature rises because of sunshine. At night it cools down after radiating heat. If there were no rotation, night would not have come after day and the difference of temperature would not occur. This difference of temperature is one of the results of rotation.

5. Measuring time : It becomes easier to measure time because of rotation. One-twenty fourth time which is full round of one movement is taken as one hour and its one sixtieth part is called one minute. And one sixtieth part is counted as one second.

6. Animal and plant world : Because of the rotation of the earth all parts of earth experience sunlight at day time and no light at night time. Sunlight is necessary for plants and animals. They collect energy from the sun at day time and utilize it for

their metabolism at night. Some animals collect food at day time while some do it at night. Day and night occur because of earth's rotation and the rules and regulations of plants and animals depend mostly on it.

Revolution

The earth moves continuously on its axis towards a particular direction because of the gravitation of the sun (opposite of the hands of watch) and moves round the sun at a certain period. This motion of the earth is called Revolution.

It takes 365 days 5 hours 48 minutes 47 seconds to move round the sun once. It is called Solar Year. But we take 365 days as one year. According to this account, extra 6 hours remain every year. To bring a balance for this extra time in every 4 years in the month of February, 24 hours or 1 day is added. Thus, in the year in which February is of 29 days there are 366 days and this is called a leap Year.

Task : Find out the Leap Years from 2013 to 2030.

The results of revolution : The results of Revolution are : (1) the increase and decrease of day and night, (2) season change.

The increase and decrease of day and night : The real causes of the increase and decrease of day and night are :

(a) Earth's round shape with curves in two poles, (b) Earth's parabolic orbit, (c) Earth's continuous rotation and revolution, (d) Location of poles in the one direction, (e) Angular location of the earth on its axis.

At the time of revolution earth leans itself on 66.5° angle towards the Sun. On 21st March the sunshines vertically on the equator. Then, the sunshine goes towards north pole gradually.

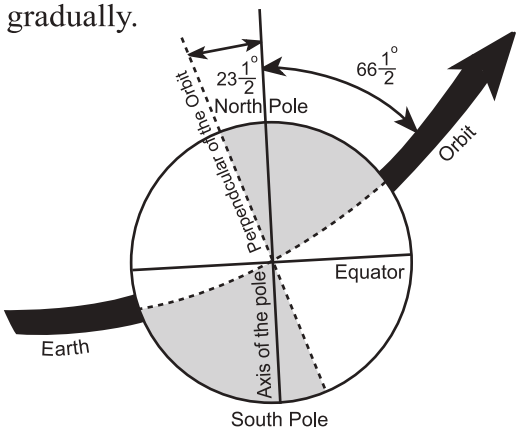


Fig. 2.17 : Angular location of the earth on its axis

On 21st June the earth comes to a certain place where the sun rays fall on the earth's surface at 23.5° north latitude (fig. 2.17). During this time the north pole leans toward the sun and south pole is far away from the sun. For this reason the length of the day is longer and the temperature is higher in the north pole. In the north pole the longest day and shortest night is June 21. On this day, the sun reaches the Tropic of cancer.

On the 23rd September the sun again shines vertically on the equator like 21st March. So, the day and night are equal. From 23rd September the sun starts moving again towards south pole. On December 22 the sun rays fall on the Tropic of capricorn causing the longest day in South Pole, and shortest day in the North Pole.

On 21st March and 23rd September the sun shines vertically on equator. These two days and nights are equal all over the world. That day is called Equinox. On March 21 there is Spring in the north pole, so it is called Vernal Equinox. On 23rd September there is Autumn in the north pole, and the day is called Autumnal Equinox.

Proofs of revolution

1. Displacement, disappearance and reappearing of stars in the night sky : In a cloudless night sky it is seen that the stars change their place from east to west. Then one day they disappear. After one year they come back to their original place. This change proves that the earth has motion.

2. The change of location of the sun in the sky : The sun is seen in different places in different times. It does not rise in the east from the same place everyday and does not set in the west in the same place. Six months of the year the sun moves a little towards south and rise from the east. The rest six months, it moves towards the north and then rises in the east. If the world had not moved and stayed in a fixed place, the sun would have risen from the same place. It happens due to the revolution of the earth.

3. The revolution of different planets : It is seen through the telescope that all the planets are moving round the sun. The earth is a planet, so it also has motion or revolution.

4. Direct experience : The astronauts saw the motion of the earth from the space.

5. Gravitational theory : The earth is very small compared to the size of the Sun. The Sun is 13 lakh times bigger than the earth. So, usually the earth moves round the sun because of its gravitational force.

Change of season

The entire year is divided into several parts according to the difference of temperature. Each part is called a Season. The whole year is divided into 4 parts according to the difference of temperature. They are : Summer, Autumn, Winter and Spring. We know, the entire world is divided into two poles. The northern part of the equator is north pole and the southern part is south pole. When there is summer in the north pole, winter prevails in the south pole. Again, when there is winter in the north pole, there

is summer in south pole. In the same way, when there is Spring in the north pole, there is Autumn in the south pole. And Autumn comes to the North pole and spring is in the South pole. The geographical location of Bangladesh is in the north pole. Here extreme heat is felt around the month of June. During this period cold winter prevails in the south pole.

Causes of seasonality : There are causes for changing the season on earth :

(1) Increase and decrease of heat because of the difference of temperature in day and night in different parts of the world : The sun comes near the pole which sees the longest day and shortest night because of the revolution of earth. Its opposite pole experiences longest night and smallest day. The earth receives temperature at day time and the land surface becomes heated. And at night, it becomes cool after radiating the heat. During this time the amount of temperature it absorbs in the longer day, the same amount of temperature cannot radiate in a shorter night. That place experiences hot weather because of the heat stored there and summer is felt there. In the opposite pole the day is small and the heat it absorbs cannot radiate at night and winter is felt there.

(2) The round shape of the earth : As the earth is round, the sun rays fall on somewhere vertically and somewhat obliquely. As a result, there is difference of temperature and the change of season.

(3) Parabolic orbiting path of the earth : The orbiting path of the earth is parabolic. So, the distance between the earth and the sun increases and decreases at different times of the year. Temperature changes because of it and so the season changes.

(4) Angular location on the orbit of the earth : At the time of revolution, earth's polar region lies towards the same direction at 66.5° angle without making a right angle. For this reason the north pole and the south pole come near the sun due to it once a year. The pole which bends towards the sun, experiences vertical sunshine. At that time it experiences the highest temperature. When the sun does not shine vertically, the temperature falls and the season changes.

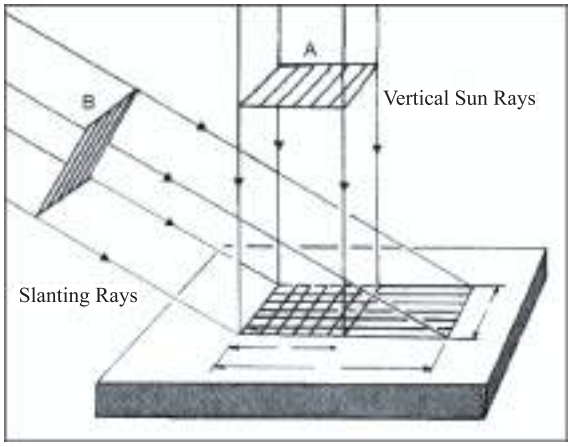


Fig. 2.18 : The sun light falling vertically on the 'A' location gets hotter then that of 'B' location

(5) Due to revolution : The sunshine falls on different places due to revolution and the difference of temperature of air occurs. As a result, the difference is seen in climate. It is called Changing of season.

The process of seasonality : We know there are four seasons on earth — Summer, Autumn, Winter and Spring. Now we will see how the season changes. The causes of changing season can be learnt from the four locations of the earth during its moving round the sun.

Summer in the north pole and winter in the south pole : After 21st March the earth bends towards the sun gradually when going forward on its axis, in this situation the greater is the lighted up days in the north pole. Following this system on 21st June the sun starts shining vertically on the Tropic of cancer. So, 21st June has the longest day and the shortest night in the North Pole. That day is the last day of the Sun to come towards the north, from next day it again starts coming back to the South Pole. In the North Pole before the beginning of summer it starts one and a half months earlier because of the day being bigger and the next one and half months Summer lasts. During Summer time in South Pole just the opposite situation is seen and winter is set. The sun shines for a lesser period because of its bending position. So, the day becomes shorter and night is longer. At day time the surface becomes heated, at night it becomes cooler because of the radiation of heat. Then winter weather prevails there. In the South Pole this time is called Winter Season (fig. 2.19).

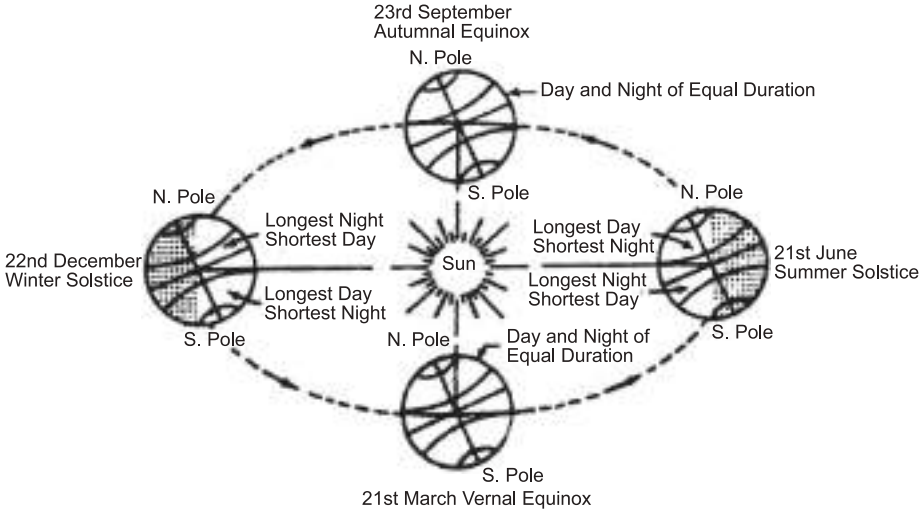


Fig. 2.19 : Revolution of earth – fluctuation of day and night – change of season

Autumn in the north pole and spring in the south pole : From June 21 the South Pole starts bending towards the Sun. The parts of South Poles experiences less sunshine and the parts of south see more sunshine. So, on September 23 the sun

shines vertically on the equator. Therefore, day and night become equal everywhere at that time. The heat absorbed at day time gets radiated at night. So, the amount of heat and cold in the weather remains same. During this time Autumn and Spring prevail in North and South Poles respectively. One and a half months before the 23rd September Autumn dawns in the North Pole and it lasts for one and a half months.

Winter in the north pole and summer in the south pole : After September 23 the earth starts bending towards the sun, during this time the South Pole comes closer to the sun. The North Pole starts going further away. So, the sun shines vertically in the south and angularly in the north pole. As a result, the day becomes shorter in the North and longer day and shorter night in the South Pole. On the 22nd December the sun shines vertically on the Tropic of capricorn. On that day, day becomes shorter and night becomes longer in North Pole, and so winter season dawns. That is the last day of the sun to go towards south and from the next day the sun again starts coming towards the north. Winter season begins in the North Pole before one and a half months of December 22 and continues upto one and half months. During this period summer prevails in the South Pole.

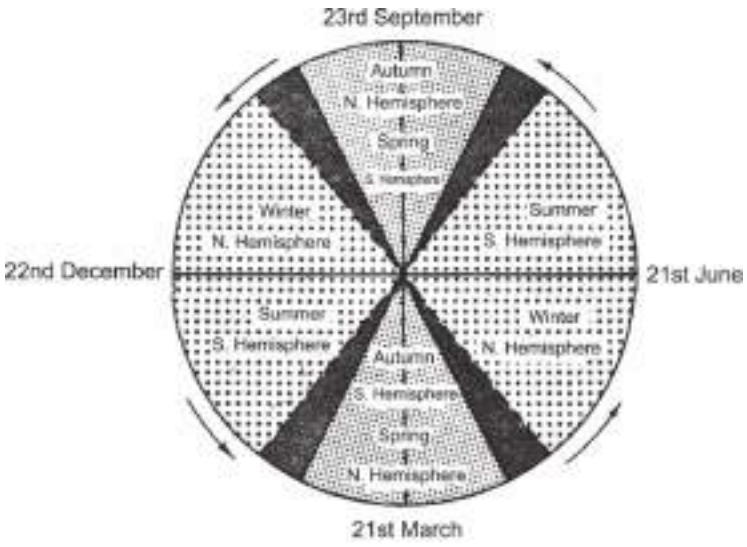


Fig. 2.20 : Seasons of the earth

Spring in the north pole and autumn in the south pole : On moving in its own orbit the earth comes back to such a place after December 22 up to such a place between December 22 and March 21 that it starts shining vertically on the equator. So, day and night become equal all over the world on March 21. The air space remains heated at day time because of sunshine and at night it gets cooled after radiating heat. During this period spring is in the North pole and Autumn in the South

Pole. On March 21 day and night become equal all over the world and that day is called Vernal Equinox (fig. 2.20).

Impact of changing season

- The change of season controls the lifestyles of human beings.
- It influences the economic activities as well as the professions of human beings.
- Many places in the world appear to be the centres of recreation due to season change.
- The change of season controls the growth and distribution of animal kingdom.
- Different kinds of natural disaster are related with the change of season.

Task : Fill in the blanks in the table below in a group.
What happens in the case of northern hemisphere?

Time	**The rays of the sun falling vertically on geographical lines during revolution of the earth**	**Information on day and night**	**Names of seasons**
21st June	Tropic of cancer		
23rd September	Equator		
22nd December	Tropic of capricorn		
21st March	Equator		

Sample Questions

Multiple choice questions

1. On which planet is a year 88 days long?

a. Venus b. Mercury

c. Jupiter d. Mars

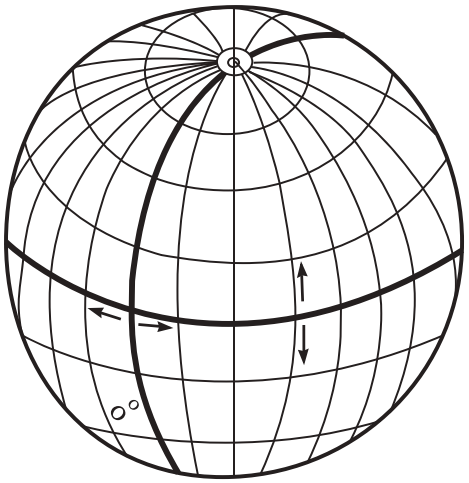
2. Due to the diurnal motion-

i. Day and night occur on Earth
ii. Seasons change
iii. Variations in temperature occur

Which of the following is correct?

(a) i and ii (b) i and iii
(c) ii and iii (d) i, ii and iii

Examine the image below and respond to questions 3 and 4:



3. Which of the vertical lines in the figure above is marked with 0^{o}?

(a) Equator (b) Polar line
(c) Prime meridian (d) Tropic of Cancer

4. These lines are important because they help.

i. To determine the local time and standard time for a location.
ii. To determine the precise location of a place.
iii. To establish a ship's position on the sea.

Which of the following is correct?

(a) i and ii (b) i and iii
(c) ii and iii (d) i, ii and iii

Creative Questions

1.

Scenario A: Sharmin stood on the balcony in the early morning, gazing at a star shining in the sky. She learned from her textbook that this shining star is a planet.

Scenario B: Roopam lives in Norway (66.50 degrees North Latitude). On June 1, he embarks on a work trip to Canberra, Australia (35.00 degrees South Latitude). He observes that the two countries experience different seasons simultaneously.

a. What is the Milky Way?
b. Why is the Earth's rotation speed fastest at the equator? Explain.
c. Describe the planet that Sharmin observed.
d. In which of the two countries that Roopam visited will the day be longest and the night shortest on June 1? Conduct a comparative analysis.

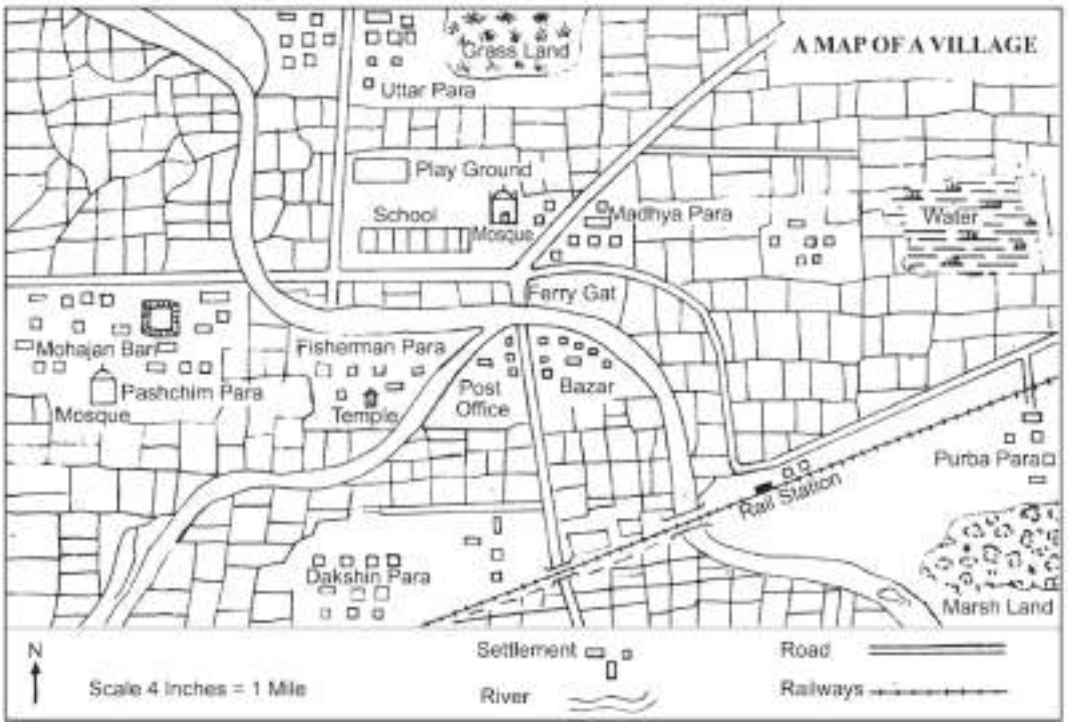
Short-answer questions

1. Write the names of four constellations.
2. What are the diameters and orbital periods of the planets Mars and Jupiter in the solar system?
3. If the sun's elevation at noon in the northern hemisphere is 40^0 and the longitude is 15^0, what is the latitude of that location?
4. How do day and night occur on Earth?
5. Explain one piece of evidence for annual motion.

Chapter Three

Map Reading and Its Uses

Map is a very important tool for a geographer. A clear idea can be formed about a region from it. We can show the whole world or a part of it through a map. We can provide information about a particular region by drawing a map and using some signs. A map is necessary not only for the geographer but also for all people especially travelers, administrators, planners, architects, engineers, agriculturists, meteorologists and even the common people. In this chapter classification of map, its importance, uses, local time and standard time, etc. will be discussed.



A sketch of a village

At the end of this chapter, we will be able to–

- explain the concept, importance and use of a map;
- describe the maps of various kinds;
- explain how to present information on a map for practical use;
- explain local time and standard time;
- explain why time changes from place to place;
- gain conception of the use of GPS and GIS in the map.

Concept of map, importance and use

Look at the following map. It is the administrative map of Bangladesh. On the paper the international boundary of Bangladesh, countries around the borders of Bangladesh are located and the sea is drawn. Besides these, it also shows the eight divisions, the districts in each division, their names and areas. The whole administrative area has been shown in one page (fig. 3.1). In this way, the whole world, different continents, countries or different divisions and districts can be shown on a map in one page.

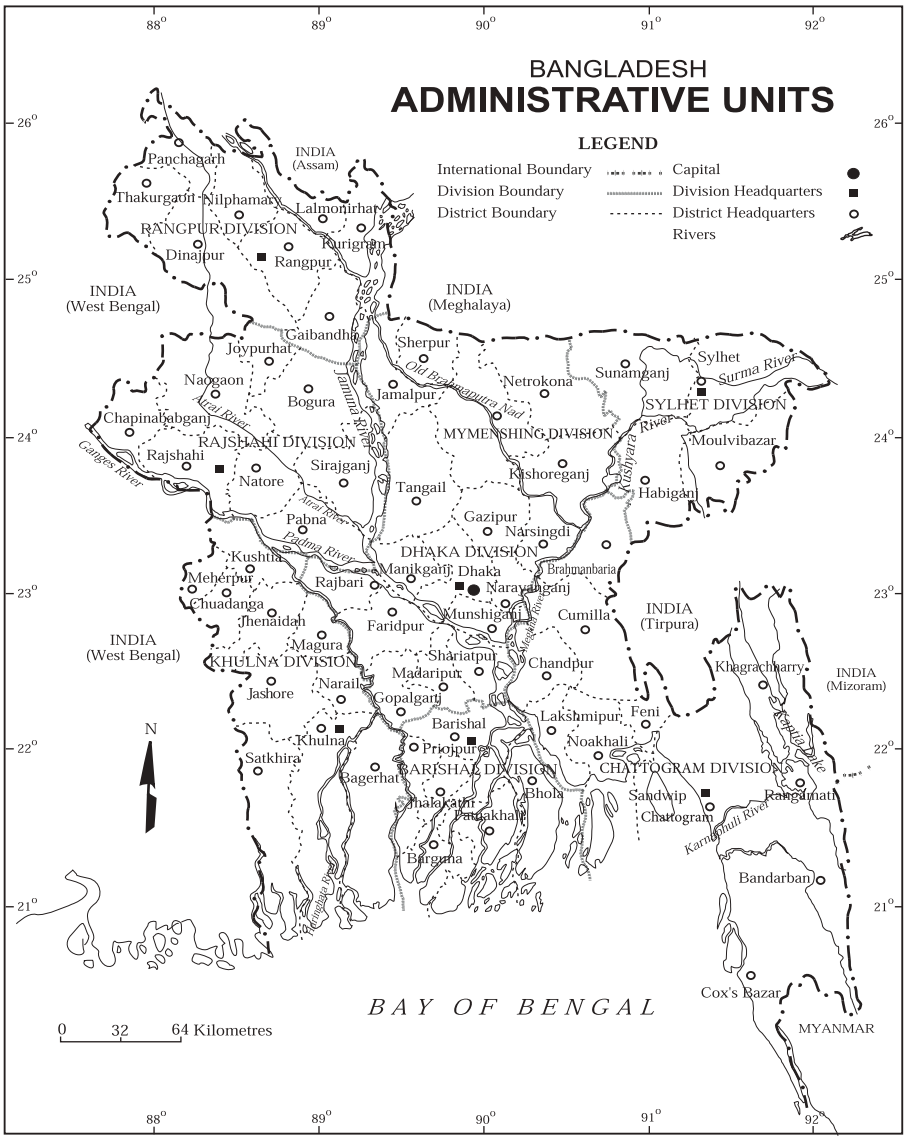


Fig. 3.1 : Administrative units of Bangladesh

You might have seen a wall map in your school. In your Geography and Environment books or in any atlas you might have seen maps. A map gives us ideas about a region, the nature of land, climate, plants, earth, water and many other things. We can learn a lot about different continents and oceans through it. The map may be defined as a representation of the earth's pattern as a whole or a part of it on a plane surface with conventional signs, drawn to a scale and projection so that each and every point on it correspond to the actual part.

The word map comes from the Latin words 'mappa'. In earlier times maps were drawn on clothes. The size of the map varies according to scale. There are three ways with which the scale of the map is shown.

Methods of showing scale

(a) By statement

(b) By graphical scale

(c) By representative fraction or R.F.

(a) By statement : We express the scale by statement such as four miles to one inch, one mile to 16 inches, etc. in every respect the first 1 (inch) is the map distance and second number (mile, yard, kilometre) is the distance on the ground.

(b) By graphical scale : The scale of map can be expressed by dividing a particular line into a number of equal parts and is marked to show what these divisions represent on the actual ground. By drawing a line of 5 centimetres and dividing it into 5 equal parts, each part is 10 kilometres (fig. 3.2). Leaving one centimetres on the left side and further dividing into equal parts of smaller sections each representing 2 kilometres.



Fig 3.2 : Linear scale

(c) By Representative Fraction: Individual units are used to measure distance in different countries. Thus units used in one country may not be useable to the people of another country due to language barrier. To get rid of this problem, Representative Fraction system has been innovated. Representative Fraction is commonly written as R. F. In a fractional scale, the numerator represents the map distance and the denominator represents the ground distance in the same unit.

For example, to express the scale 1 centimeter equals 1 meter in Representative Fraction (R.F.) form, the meter must be converted into centimeters and a ratio symbol (:) must be placed between the two values 1 meter=100 centimeter. Therefore, the numerator is 1 and the denominator is 100. Here the scale is 1:100 or 1/100. That is, it means when the map distance is 1 centimeter, the ground distance is 100 centimeters.

Again, in the British System, if the Representative Fraction is given as 1:36, it means that 1 inch on map represents 36 inches or 1 yard on the ground. Therefore, in statement form, 1 inch represents 1 yard. When the scale is stated as 1 inch equals 1 mile, the Representative Fraction (R.F.) is 1: 63,360 since 1 mile equals 63,360 inches.

We can show a bigger country or continent upon drawing upon the page of a small book or an exercise book. In addition. a scale can be used to represent the actual ground distance on the map. When we think of a map, we visualize a country, a region, a depiction of a landmass, a continent or even the entire world. By using various conventional symbols on a map, we can represent the countries within a continent and, with each country , the number of provinces, divisions, districts, roads, rivers, lakes, mountains and other features. Thus, we can represent a small place within a country or continent using conventional symbols. Above all, it can be said that there is no alternative to a map for understanding everything from the location of the place to its detailed features. Therefore, it can be said that maps have been invented to know about the whole world in easy ways within a very short time staying at home. The type of information contained in a map depends on (a) the scale (b) projection (c) the conventional signs (d) the cartographer's skills, and (e) the type of map drawn. In a large scale map, a place can be shown with more detailed information. Certain elements must be understood in order to draw a map. Every map contains various elements or features. They are understood through various colours, lines and conventional signs. These colours, lines and signs are the languages of a map. It is very essential to know these languages to know about a map in details.

Map plays a very significant role in modern civilization. Maps are an extremely important tool for students, teachers, historians, engineers, businesspeople, journalists, soldiers and sailors. A map is an indispensable tool for geographers and geography students.

Classification of maps

There may be various types of maps. Generally, on the basis of scale used in scale, again the maps and subject matter, the maps are classified into two groups. According to the maps are of two types : (a) large scale maps and (b) small scale maps.Navigation charts, aeronautical charts, mouza maps or cadastral maps are large scale maps. As a small area is enlarged, so many date or information can be

accommodated in the map. Atlases, wall maps are small scale maps. The whole world or the continent or any big region like that of a country when shown on a sheet of paper, small space remains in the map. So, a lot of information cannot be shown on this type of map.

The presented contents are also of two types in terms of levels (i) Qualitative Map (ii) Quantitative Map

(I) Qualitative map: This map covers Geological Map, Topographic Map, Landform Map, Soil Map, Wall Map, Atlas/Chorographical Map, Local Diversity Index Map, Cadastral/ Mouza Map, etc.

(II) Quantitative map: This map includes maps showing information of air temperature, precipitation, population distribution, population density, mineral production, forestry production, industrial production, etc.

There are many types of maps as per on functions:

1. Cadastral or mouza map : The term cadastral is derived from French word 'cadestre' meaning register of territorial property. The cadastral maps are drawn to register the ownership of landed property by demarcating the boundaries of fields and buildings. The village maps of our country and the city plan maps belong to this category (fig. 3.3). These maps are very large scale maps which are drawn on a scale of 16 inch to 1 mile or 32 inch to 1 mile.

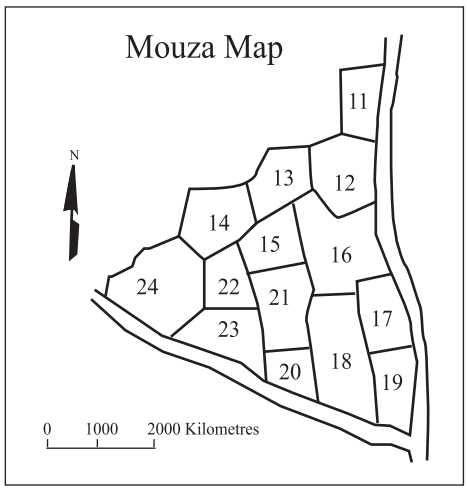


Fig. 3.3 : Mouza map

2. Topographic map : Topographic maps are made on a large scale on the basis of precise survey of the area. They show general surface features in detail which contain both natural landscape and man-made features. The scale of the topographic map varies from 1 inch to 1 mile to ¼ inch to 1 mile. Topographic map shows relief, rivers, forests, villages, towns, roads and railways (fig. 3.4). The topographic maps are prepared in different scales in different countries. The standard and most popular topographic survey map of British Ordinance Survey is 1 inch to 1 mile. Topographic maps of Bangladesh have been made into three scales. i.e. (i.) 1 inch = 1 mile, (ii.) 1:50,000 and (iii.) 1:250,000. The last two types of scales have been adopted for the latest topographic maps of Bangladesh. Different maps are made in different countries. British made maps are the best and popular at present. The scale of this map is from 1:25,000 and 1:1,00,000. In Bangladesh we follow the British scales.

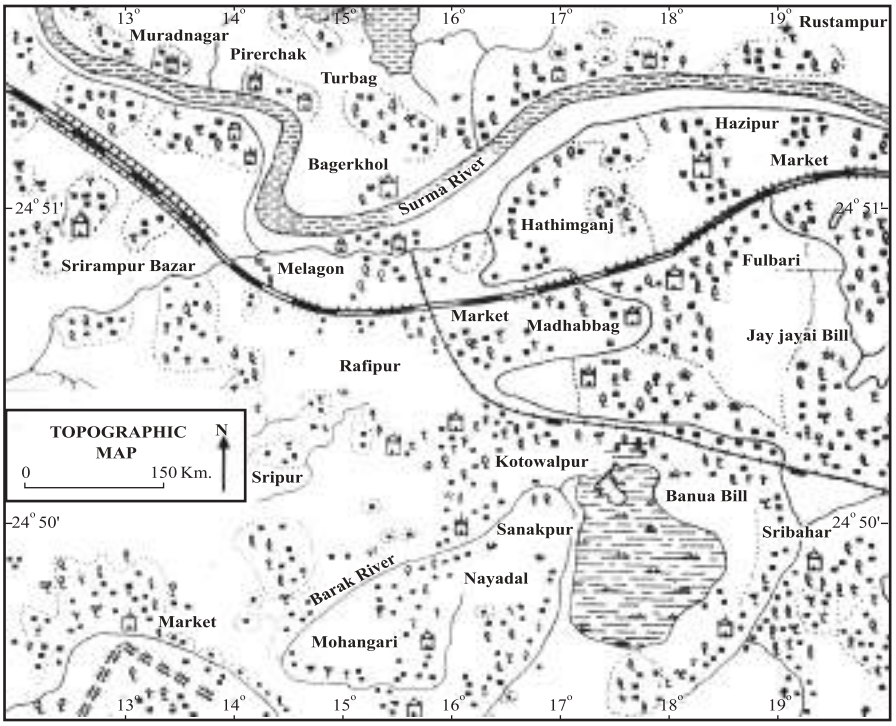


Fig. 3.4 : Topographic map

3. Wall map : Wall maps are generally drawn for using in the classroom. The world as a whole or in hemispheres are shown on the wall maps. Wall maps may also be prepared for a country or continent, large or small according to need (fig. 3.5). Their scale is smaller than topographic maps but larger than atlas map.

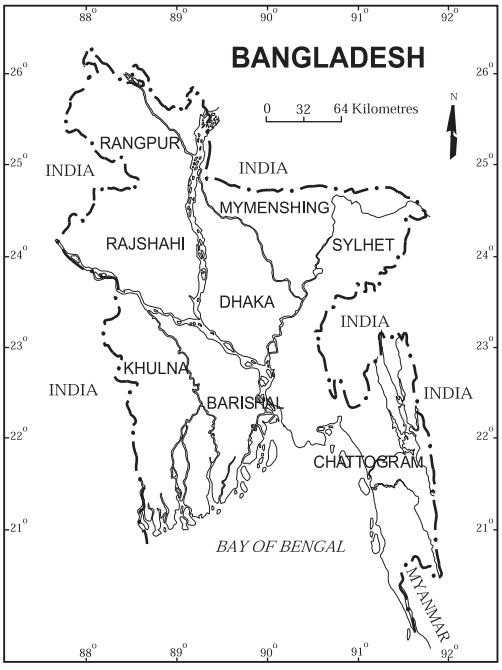


Fig. 3.5 : Wall map

4. Chorographical or atlas map : A collection of map is called an Atlas. The scale of the atlas map varies from 1:100,000 to 1:1000,000. These are small scale map which gives a more or less highly generalized information regarding the physical and economic conditions of different regions of the world. The whole world is shown in one

page in this map. The districts of Bangladesh are shown in one page. This map is made based on natural, cultural, economic and agricultural features.

5. Physical map: Map which shows the natural features such as mountains, plains, rivers, deserts, wetlands of a country or a region is known as physical maps.

6. Geological map : The rocks that form the crust of the earth, their mode of formation and deposition are shown on geological map.

7. Climatic map : The climatic map shows the average condition of temperature, pressure, wind and precipitation of a region over a long period of time.

8. Vegetation map : Vegetation map shows the natural vegetation of a region.

9. Soil map : The soil map shows the various types of soil covering the area. Agriculturists use this map usally as it highlights the quality of soil of a particular area for the proper production of crops.

10. Cultural map : Economic condition, political boundary, historical places are shown on cultural maps. Cultural map can be divided into some parts. These are :

a. Political map : Most widely used map showing the boundary of a region, country, division, districts etc. This also shows capitals and important cities of different countries.

b. Distribution map : Map showing the distribution of population, crops, animals, industries of a region or a country is known as the distribution map.

c. Historical map : Map showing places of historical importance is the historical map.

d. Social map : Map showing the distribution of religion, language, nationality is known as social map. Those who study on social customs and disparity, population, etc. use this map.

e. Land use map : Major land uses of an area or region are shown in land use maps. These maps show various kinds of land uses in urban and rural areas suitable for specific purposes.

Techniques of presenting information in a map

The preparation of Local Diversity Index Map is a major and essential aspect of geographical science. No other means can uphold social pictures of this vast earth or world rather than this kind of maps. We can see a nice representation of physical or cultural features through various symbols in the Local Diversity Index Map. On one hand, these symbols introduce hills and mountains, rivers plateaus, lakes, plains, ponds, marshes, forests, etc. and, on the other hand, they provide information regarding

roads, haats and bazaars, mosques, temples, hospitals, fields, habitats, population density, means of living, etc. along with various cultural details. For this, it is very essential to know about an area's advantages and disadvantages, surrounding conditions, and various problems which need to be solved. In order to study a map in any language, it is indispensable to take the help of various signs. Different countries of the world use signs in their Local Diversity Index Map. So, these signs are called International Conventional Signs (fig-3.6). The Local Diversity Index Map shows the Legend below them as it is very essential for the readers. A man can study the map so well as much as he is informed of the signs.

Table of international conventional sign used in map

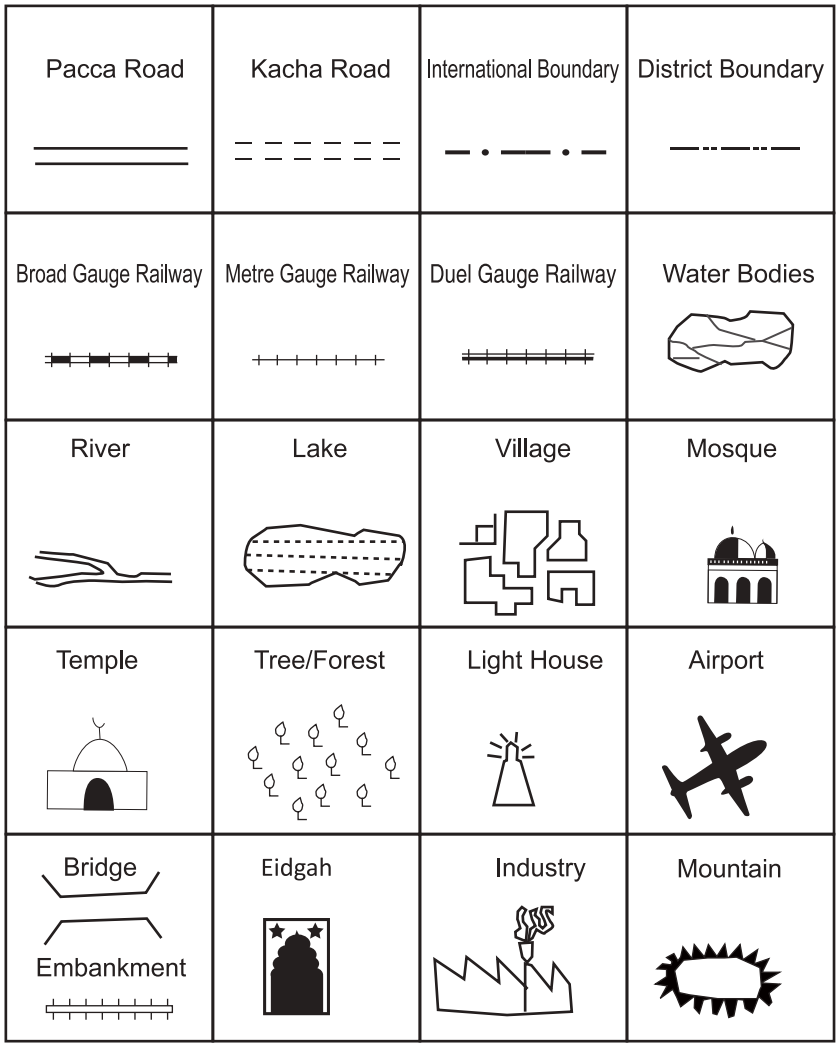


Fig. 3.6 : International conventional sign

Marginal information of a map : All the information required to understand a map should be around its margins. Marginal information includes (i) Title/heading, (ii) Scale, (iii) North line, (iv) Legend and (v) Source of data.

(i) Title/Heading : Each map has a title or heading. It shows the type of map. If it is a political map of Bangladesh, the title will be 'political map' followed by Bangladesh.

(ii) Scale : There are three common ways to show the scale by statement, representative fraction/R.F or linear or graphical scale. To make the map of an area we have to draw the volume in the form miniature. It is drawn in terms of scale. The more the scale is small the more the volume will be bigger. If it is written 1**:** 1,00,000 in the map it means 1= 1,00,000 units. It is shown in the scale that 1 inch= 1 mile.

(iii) North line : North line is important for a map. It is usually considered the top section of the map as northern part of the map. North line can be shown anywhere in the map within the margin of the map. The position of the north line depends on the layout and size of the map within the margin.

(iv) Legend : In each map some data is presented in the form of some conventional signs, colour or shades. The representing signs, colours and shades are shown in the legend.

(v) Source of data : All maps are drawn on the basis of information or data so the source of data should be provided outside the margin i.e. border of the map layout.

Local time and standard time

Our Earth has been divided by 360^{o} of longitude. These 360^{o} have been divided from the Prime Meridian into 180^{o} east and 180^{o} west. Actually this 360^{o} longitude is totally imaginary. We know that the earth is rorating on its axis from west to east ward. The earth comples the total rotation in 24 hours. Calculation shows that the rotation takes 24 hours, i.e., 24×60 = 1440 minutes. If we divide 1440 minutes by 360^{o} (1440÷360^{o}) = 4 minutes, we get 4 minutes for every 1^{o} difference. That is, 1^{o} difference takes 4 minutes to rotate.

Local time

Everyday the earth moves round her axis from west to east. As a result, the sun appears earlier in the places located in the east. Due to rotation of the earth, the sun reaches the zenith of the sky, or in other words, the sun reaches its highest altitude on a certain place and that hour is treated as 12:00 noon. On the basis of this noon time, the other time for the day is determined. The time thus determined is the local time for that place. So, the local time of a place is determined on the basis of the highest altitude of the sun which can be observed with the help of a sextant.

The earth at the centre creates 360°. The earth requires 1,440 minutes (24 hours × 60 minutes) to cover this distance of 360° for one time. So, the earth needs 4 minutes (1,440 ÷ 360) to rotate 1° of longitude. Therefore, for 1° difference of longitude, the difference of time will be 4 minutes.

Standard time

In any country there are many meridians of longitude that run through the country. If there are ten meridians running through a country as each meridian is 4 minutes apart so, $10 \times 4 =$ 40 minutes, so in that country there will be ten different local times according to the meridians. To avoid this confusion, the local time of a central meridian of a country is taken as the time for the whole country. This is called the Standard time. Some countries have great longitudinal extent, so they have more than one standard time. Example USA has five and Canada six time zones.

There is a general understanding among the countries of the world to select the standard meridian of any country in multiples of 7.5° longitude. Every 7.5° longitude makes a difference of 30 minutes.

Time difference on the basis of location

In the earlier chapter we have seen for 1° longitude, the time difference is 4 minutes. We know, earth rotates from West to East. For this reason, in Bangladesh day comes earlier in the places which are located in the East than those which are located in the West. From this we can understand that morning comes earlier in those countries which are located in the East of Bangladesh and those countries which are located in the West of Bangladesh, morning comes later.

We know for the difference of 1° longitude, time difference becomes 4 minutes. This 1° is divided into 60 minutes and for every 1 minute, time difference becomes 4 seconds. So, for 60 minutes it requires $60 \times 4 = 240$ seconds or 4 minutes.

On the basis of above discussion, some mathematical calculations will make it clearer.

Example 1 : The difference of longitude of a place east of Dhaka is 50°30′. When Dhaka sees 6 o' clock morning, what is the local time of that place?

Solution

The difference of the place from Dhaka = for 50°30′

$=(50\times4)$ minutes $+(30\times4)$ seconds (east longitude the difference of time will be added)

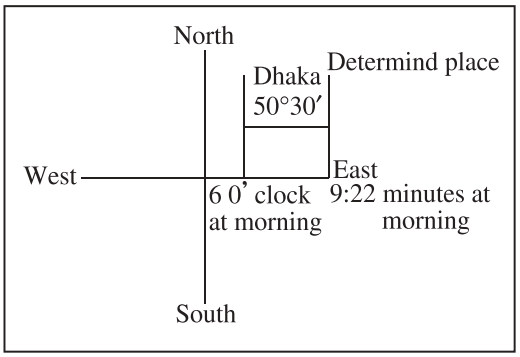
= 200 minutes + 120 seconds

= 200 minutes + 2 minutes (as 1 minute = 60 seconds)

= 202 minutes

Time difference will be 202 minutes or 3 hours 22 minutes.

Here, the place whose local time is to be determined lies to the east of Dhaka. So, local time will be greater because the sun rose earlier in the east. So, 3 hours 22 minutes is to be added to the time of Dhaka.



So, the time of that place

= Time in Dhaka + time difference

= 6 o' clock + 3 hours 22 minutes

= 9 o' clock 22 minutes

So, the local time of that place is 9:22 minutes

Answer : 9:22 minutes.

Example 2 : The longitude of Dhaka is 90° east and that of Riyadh is 45° east. When the local time of Dhaka is 2 o' clock noon, what is the local time of Riyadh?

Solution

We know that there is 4 minutes time difference for each longitude

The longitudinal difference between Dhaka and Riyadh 90°– 45° = 45°

Time difference will be $45 \times 4 = 180$ minutes or 3 hours.

We can understand from the question mentioned 45° east longitude that Riyadh lies to the west of Dhaka. So, this 3 hours will be deducted from Dhaka's local time.

So, the local time of Riyadh will be

= 2 o' clock at noon –3 hours (here 2 o' clock means 14 hours).

= 14 hours –3 hours

= 11 hours

Answer : The local time of Riyadh will be 11 o' clock.

Example 3 : The longitude of 'A' city is 70°45′ east and that of 'B' city is 15°15′. When the local time of 'A' city is 7 o' clock in the morning, what is the local time of 'B' city?

Solution

The difference of longitude of the two cities is

= 70°45′ –15°15′ = 55°30′

We know for each 1 degree time difference is 4 minutes and for each 1 minute time difference is 4 seconds. So, 55°30′ time difference will be

= (55 × 4) minutes + (30 × 4) seconds

= 220 minutes + 120 seconds

= 220 minutes + 2 minutes (as 1 minute = 60 seconds)

= 222 minutes = 3 hours 42 minutes

As the value of longitude of 'A' city is less than 'B' city, we can understand that 'B' city stands west of 'A' city. So, the local time of 'B' city can be obtained by deducting the local time of 'A' city.

So, the time will be at place 'B'

= 7 o' clock morning – 3 hours 42 minutes

= 3 hours 18 minutes means morning 3 hours 18 minutes

Answer : The local time of 'B' city is 3 hours 18 minutes.

Example 4 : The local time difference between Dhaka and Tokyo is 3 hours 17 minutes 16 seconds. If the longitude of Dhaka is 90°26′ east, what is the longitude of Tokyo?

Solution

The difference of time between Dhaka and Tokyo is 3 hours 17 minutes 16 seconds.
By calculating = (180 +17) minutes 16 seconds = 197 minutes 16 seconds
In every 4 minutes 1 degree and every 4 seconds 1 minute time difference. We can get
– For 196 minutes 49° and for rest 1 minute 16 seconds 19′ means 49°19′.
So, Tokyo lies to the east and its longitude will be = 90°26′ + 49°19′ = 139°45′ east
Answer : 139°45′ east.

GPS and GIS maps

At present the use of GPS and GIS are the most modern form of information for study and management.

The elaboration of GPS is Global Positioning System. If we want to know the global location of a certain place, the easiest way of knowing it is through GPS.

Through GPS the latitude, longitude, height and distance of a certain place can be found. Besides, the north line, date and time of that place can be known.

Working principle of GPS

GPS collects information from the land-satellite through its receiver (fig. 3.7). To collect this information GPS needs cloud free sky. The GPS machine can work accurately in the clear sky. Sometimes it faces problems to identify the location of steep high hills, buildings and it is time consuming also.



Fig. 3.7 : GPS

Benefits of GPS : Among many discoveries of technology GPS has earned a wide popularity as a very valuable tool for the geographers. With the help of this tool we can find out latitude, longitude and other matters within seconds. In our country a great problem lies in land surveying. We will be able to identify the boundary of our land without any problem. This will save much of our time. During any natural disaster we will be able to send relief goods to a certain place by identifying its exact location by latitude and longitude with this GPS.

Demerits of GPS : GPS has some demerits along with its merits. These are—its price is high, so it is not easily available. Most of the people are not familiar with it. Besides these, people tend to use traditional system.

Geographical information system

Storing and analyzing geographical information system is known as GIS. It is a computerized system of storing information and analysis. This system helps to prepare future plan through storing geographical information, analysis and management, identifying spatial problem. The use of GIS started first in 1964 in Canada. Gradually people started using it widely around 1980.

At present it is being used in land management, natural resource development, water research, urban and regional planning, population analysis, transport and communication system analysis.

The utility of a map is increased by it through the presentation of many kinds of data and analyzing those data in the map. For example, we can have a full idea of a particular place by showing its water management, topography, land use, communication, soil, road etc. in a map.

Sample Questions

Multiple choice questions

1. Which is shown on a natural map?
   (a) Desert (b) Air pressure
   (c) Wind flow (d) Humidity

2. How many minutes will the time difference be if we move 50^0 east from the original meridian?
   (a) 16 (b) 20
   (c) 24 (d) 28

Read the following paragraph and answer questions 3 and 4:

Suman resides in a village featuring both plains and lowlands. At the conclusion of the chapter on reading and using maps, he created a map of his village utilizing unique technology.

3. What kind of map is Suman's village map?

(a) Atlas (b) Natural
(c) Cultural (d) Cadastral.

4. Which of the following can be accurately identified using the technology depicted in the map of Suman's village?

(a) Plains (b) Population
(c) Land boundaries (d) Village market

Creative Questions

1. Flora Begum left Dhaka for London at 9 a.m. on Friday. After landing at Heathrow Airport, she noticed that the airport clock displayed 6 p.m., while her own clock read midnight.

a. What is a map?
b. What is meant by standard time? Explain.
c. If the longitude of the city visited by Flora Begum is 00, what is the longitude of Dhaka? Determine.
d. Analyze the reason for the time difference between Dhaka and the location men tioned in the stimulus.

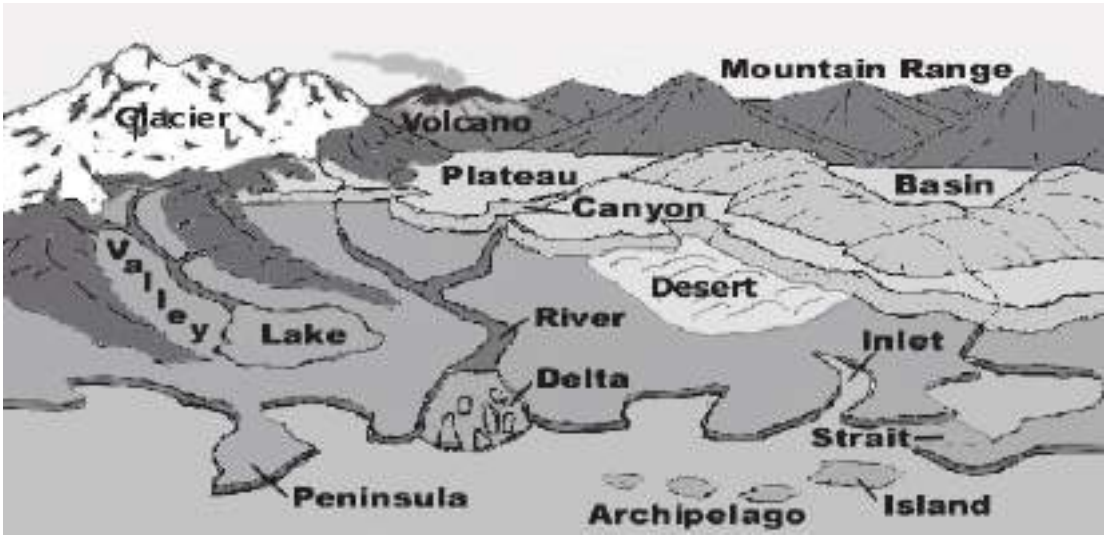
Short-answer questions

1. Describe the method using an explanation of the scale indication on the map.
2. What does the ratio of 1:36 mean in the British system?
3. What does a Mouza map mean?
4. Illustrate and present two symbols typically found on maps.
5. Identify two disadvantages of GPS.

Chapter Four

Internal and External Structure of the Earth

In the very beginning of earth's history, this planet was a hot gaseous ball. Gradually this gaseous sphere began to cool and solidified forming a thin crust on its surface. The earth consists of three main layers—the core, the mantle and the crust. The core is the inner part of the earth, the crust is the outer part and between them is the mantle. The crust of the earth is composed of a great variety of rocks. Enduring processes of the landforms of the earth are influenced by form of rocks and minerals.The surface of the earth is always changeable. This changing nature has two faces. One occurs suddenly and the other is a slow process. In this chapter we shall discuss internal and external structure of the earth, types of rocks, slow and abrupt change of the earth surface and different types of landforms.



The external structure of the earth

At the end of this chapter, we will be able to–

- describe the internal structure of the earth;
- describe the external structure of the earth;
- describe the landform change of the earth surface;
- explain the reason of the abrupt change of the earth surface;
- analyze the result and reason of earthquake, tsunami and volcano;
- explain the result and reason of slow change of the earth surface.

- explain the rivers path way;
- describe the landforms created by rivers;
- describe the characteristics of the main landforms of the earth;
- analyze on the basis of data, the impact of tsunami occurred in the past.

Internal structure of the earth

In the very beginning earth was a hot, gaseous ball. From that condition it became cool and solidified. During that period the heavy metals concentrated at the centre and comparatively lighter materials sequentially concentrated around that heavy core according to its density and weight. These different layers called Spheres. The upper most sphere is called Lithosphere. The upper part of lithosphere is known as Earth Crust.

The earth's crust : The hard stratum of the rock covering the outer shell of the whole earth is known as the earth's crust (fig. 4.1). The thickness of the earth's crust is the lowest in comparison to the other interior layers of the earth. On an average, it is about 20 kilometres. The thickness below the earth's crust on an average is about 35 kilometres known as SIAL which is composed of Silicon (Si) and of Aluminium (AL). On the other hand, the earth's crust beneath the ocean is composed of basalt which is heavier than that of Sial layer and its major elements are Silicon (Si) and Magnesium (Mg) and is generally known as SIMA. The external structures such as Mountains, Plateau, and Plains are visible. The temperature beneath the earth's crust is increased by 30° Celsius for each kilometre towards its centre.

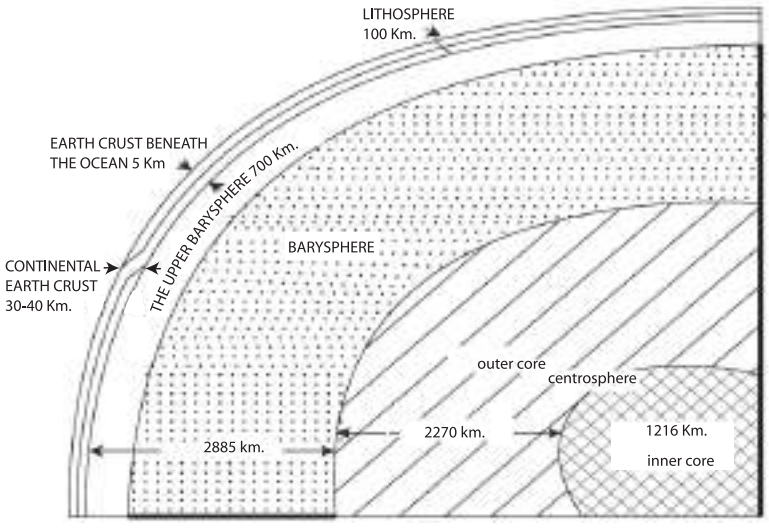


Fig. 4.1 : Cross section of the Earth's structure
Source : Trabuck and Lutgens (1994)

Barysphere : The stratum beneath the earth's crust which is about 2,885 kilometres thick is called the Barysphere. Barysphere mainly consists of Basalt rock. This sphere has silica, magnesium, iron, carbon, and other minerals. Barysphere is divided into two parts. (a) Upper Barysphere which is extended up to 700 kilometres. This stratum mainly composed with silicate minerals enriched with iron and magnesium. (b) Lower Barysphere mainly consists of minerals of iron oxide, magnesium oxide and silicon dioxide.

Centrosphere : Centrosphere is situated just after the Barysphere. It is extended from the lower parts of the Barysphere up to the centre of the earth. The thickness of this layer is about 3,486 kilometres. It is known from the seismic waves that the Centrosphere has a liquid cover which is about 2,270 kilometres thick and also has a hard inner-part which is about 1,216 kilometres thick. The scientists believe that iron, nickel, mercury and lead exist among the elements of Centrosphere. But the two major elements of Centrosphere are iron (Fe) and Nickel (Ni).

Rocks and minerals

Earth's crust is formed with rocks. Rocks are composed of different types of minerals. Mineral is the compound form of some basic elements mixed by natural process. Minerals are natural inorganic elements which have distinct chemical composition, physical and chemical characteristics. Though generally minerals are formed by two or more elements but some minerals can be formed with only one basic element. Such as, diamond, gold, copper, silver, mercury and sulphur.

Rock forming minerals have different characteristics and most of the rocks are composed with two or more minerals. In that sense minerals and rocks are the same things. For example, limestone which is a sedimentary rock also known as calcite is a mineral.

Difference between rocks and minerals : Minerals are homogenous inorganic matter and the rocks are heterogeneous materials. Minerals are solids and crystallized, though some rocks are solid but are not crystallized. Minerals have specific chemical composition but rocks have no such thing. The characteristics of minerals are determined by the nature of their constructing elements. Whereas, the nature of rocks are regulated by the nature of the minerals that compose them.

Task : Write the differences between Rocks and Minerals in the following columns.	
Rocks	**Minerals**
• • • •	• • • •

Classification of Rocks

The materials of the earth crust or lithosphere are generally called Rock. Every solid and fluid material which formed the earth surface is rock. Such as pebbles, sandstone, granite, clay, chalks etc. According to formation of rocks can be classified into three major parts : (1) Igneous rocks, (2) Sedimentary rocks, (3) Metamorphic rocks.

(1) Igneous Rocks : At the beginning the Earth was a hot gaseous spheroid. This gaseous spheroid was transformed into liquid by radiating heat. After radiating more heat its upper part became cool and solidified. Rocks which became solidified from liquefied state are called Igneous Rocks. As the igneous rocks form at the very beginning of earth's origin it is also called the Primary Rocks. There are no layers in this rock type. So, it is also called Unstratified Rock. There is no fossil in this rock type. The characteristics of igneous rocks are : (a) granular or crystalline rocks, (b) do not have strata, (c) hard and less fragile, (d) do not contain fossils, (e) comparatively heavy.

Often volcanism and earthquake create fracture at the weak part of the earth surface. Then the hot molten lava comes out from the interior of the earth and forms igneous rocks. In this way Basalt and Granite are created. Igneous rocks can be divided into two parts : (a) Extrusive igneous rocks, (b) Intrusive igneous rocks.

(a) Extrusive Igneous Rocks : The hot liquid material in the interior of the earth which is called Magma finds its way to the surface of the earth through the crack of the earth's outer skin. It is called Lava. The lava after cooling becomes extrusive lgneous rocks. The granules of the igneous rocks are refined and have deep colour. The examples of extrusive igneous rocks are Basalt, Rhyolite, Andesite etc.

(b) Intrusive Igneous Rocks : If hot magma solidifies underground without reaching the Earth's surface, it forms intrusive igneous rocks. The granules of these rocks are coarse and have light colour. Granite, gabbro, dolerite, laccolith, batholith, dike and sill are the examples of intrusive igneous rocks (fig. 4.2).

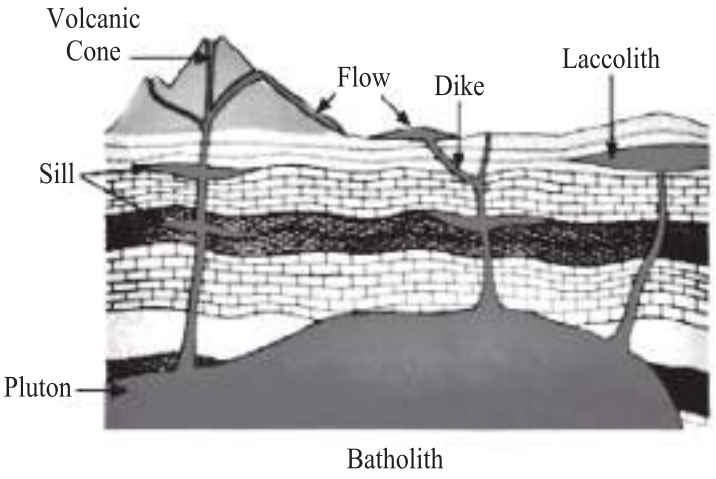


Fig. 4.2 : Igneous rocks

(2) Sedimentary Rocks : Sedimentary rocks are formed due to aggregation and composition of sediments. Due to influence of rain, wind, glacier, heat, wave etc. igneous rocks are eroded and disintegrated and transformed into gravel, mud, sand and dust. These eroded rock debris are transported by stream, wind and glacier and deposited in lowlands, lakes, ponds, basins, rivers and seas. So, sediments and debris are regularly deposited by layers. Continuous sedimentation increases the weight and pressure and different layers are consolidated and compacted to form sedimentary rock. Sedimentary rocks cover 5 percent area of total earth's crust. However, 75 percent of the continental land mass is sedimentary rock. This is called Sedimentary Rocks as this form from sediments or debris (fig. 4.3).

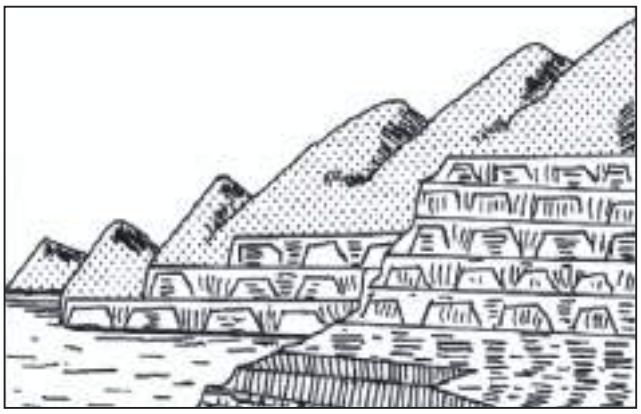


Fig. 4.3 : Sedimentary rocks

Sedimentary rocks are also called as Stratified or Layered Rocks because these rocks have different layers or strata of different types of sediments. Sedimentary rock can be formed by

mechanical, organic or chemical processes. Sandstone, coal, shale, limestone, claystone, kaolin are the examples of sedimentary rocks. As coal and mineral oil originated from organic body these are also called Organic Rocks. In many sedimentary rocks different types of fossils of plants and animals are found.

Characteristics of Sedimentary Rocks : Sedimentary rocks are stratified, soft and light, easy to erode. Fossils can be seen in sedimentary rocks. This rock is porous.

(3) Metamorphic Rocks : Metamorphic rocks is formed deep in the earth where high temperature, great pressure, and chemical reactions cause one type of rock to change into another type of rock. The rocks are partially melted and the chemicals within them are rearranged so that the final rock is very different from the original rock. One very common metamorphic rock is marble. Marble is formed when heat and pressure are applied to limestone for many thousands of years. Some other examples of metamorphic rocks are gneiss, slate, schist, and quartzite.

Characteristics of metamorphic rocks :

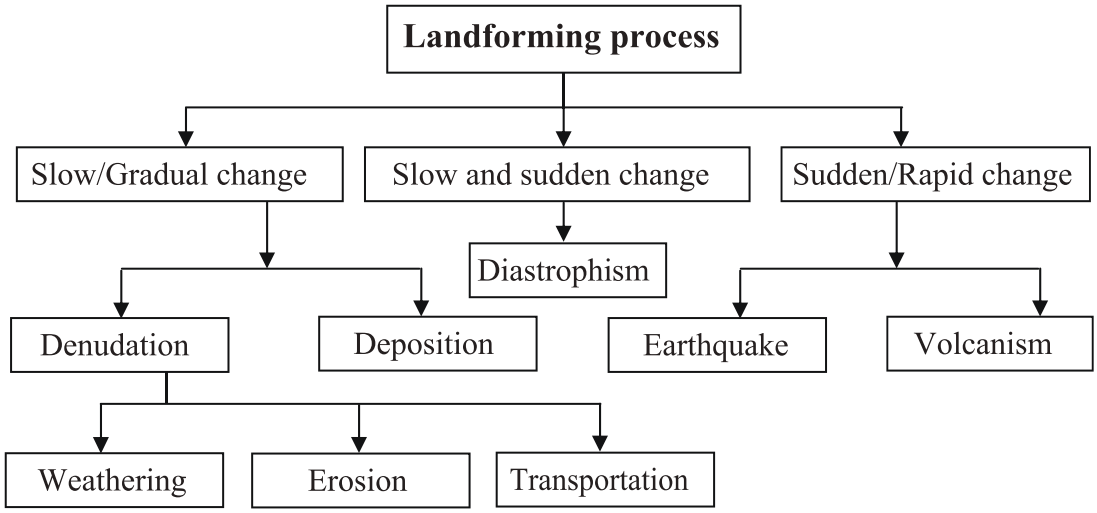
(a) This rock is crystaline.
(b) Rarely have fossils.
(c) Very hard
(d) May have layers of visible crystals.
(e) May have bent or curved foliation.

Task : Fill in the blanks of the classification of rocks in a group in the table below.

Classification of rocks on the basis of structure	**Types**	**Characteristic**	**Examples**
Igneous Rocks			
Sedimentary Rocks			
Metamorphic Rocks			

Changing process of the earth surface

The earth's crust is always changing. Different landforming process bring about this change. Landforming processes are the activities through which the changes are caused naturally in the formation of the land. For example, a river is building a flood plain through deposition. Therefore, the depositional activities of a river is a landforming process. The landforming processes are done with the help of different natural forces such as the gravitational forces, interior temperature, and the solar bring changes on the earth's crust either slowly or rapidly. Generally, energy. The different landforming processes with the help of the aforesaid agents external force like solar energy brings about a slow change in the formation of land. The changes brought about on earth's surface through longer period of time, is known as slow changes. The slow changes are caused in two processes, i.e; denudation and deposition.



Gradual change : This is the opposite of rapid change where changes occur due to natural forces like solar energy, wind, rain, stream, glacier etc. Generally slow process occur over a huge area.

Rapid change : The inner part of the earth is still hot and molten. When there is a difference in temperature and pressure within this portion, there causes earthquakes. Due to the earthquakes most of the changes occur. Rapid change of the earth surface mainly occurs due to Earthquakes, Volcanoes, and Tsunami.

Earthquake

An earthquake is a shaking of the ground caused by the sudden breaking and shifting of rocks beneath the earth surface. The shaking could last seconds or minutes, and there may be several earthquakes over a period of time. This shaking could be mild or sometimes very sharp.

Causes of earthquakes

Main causes of earthquakes:

- The surface of the earth is made up of some tectonic plates. The movement of these plates causes earthquakes.
- Volcanic eruptions cause earthquakes on tectonic plates.

Minor causes :

1. Rock displacement/Formation of folds in the rocks: Sometimes earthquake occurs due to any big rock displacement or formation of folds beneath the earth's surface in the rocks for any reason.

2. Heat radiation: When the earth's crust radiates heat and contracts, it creates fractures and folds that cause earthquake.

3. Subsurface Steam/Geothermal steam: Steams occur in the subsurface of the earth due to extreme heat . This steam pushes against the lower part of the earth's crust and then we feel tremendous shake.

4. Increase or decrease of pressure in the subsurface: Sometimes earthquakes occur due ton increase or decrease of pressure in the subsurface of the earth.

5. Influence of glacier: When glaciers come down the mountains all on a sudden, they shake the surface and earthquakes occur.

Effects of earthquakes

Earthquake is accepted as a natural calamity. Most of the times, it causes great loss of lives and wealth. Generally, it may be mentioned that the devastative nature of earthquakes brings the following damages and changes in the earth's crust.

(i) Faults, cracks or landslides occur in the earth's crust due to the earthquakes. The course of the rivers is also changed. For example, the bed of the Brahmaputra River was raised and the river changed its original course and started flowing through the channel of the Jamuna due to earthquake of Assam in 1787.

(ii) Earthquakes can cause severe and widespread damage to weak buildings or structures, or to those located on ground subject to fault breakage, strong shaking, or landsliding. The slip (movement) on the fault may break the surface of the Earth, offsetting roads and tearing apart buildings or pipelines built across the fault. Such damage can be spectacular, but it is limited to the vicinity of the fault.

(iii) Most damage results from strong shaking during the passage of seismic waves, which spread out from the fault over a large region. Shaking may be severe enough and long enough to collapse weak buildings, overturn furniture, topple water heaters and storage tanks, and collapse unsafe dams. These effects can result in further damage through fires resulting from broken gas pipeline and fallen electric wires, the loss of water to fight fires because of broken water lines, oil spills caused by failure of storage tanks, and flooding resulting from dam failure. Shaking can also cause landslides. These in turn can damage buildings, roads, and pipelines built on slide areas or downhill from them.

(iv) Due to earthquakes, glaciers often collapse from mountain slopes and rockfalls occur on the mountains.

(v) Sea-shores and adjacent areas suddenly get flooded due to earthquakes.

Tsunami

Tsunami is a Japanese term that means 'harbor wave.' Tsunamis are giant waves caused by earthquakes or volcanic eruptions under the sea. Tsunamis have very long wave lengths. Crest to crest they measure between 10 and 500 km and they travel through the ocean at more than 700 km/h. Sometimes there appears to be just one wave but often there are multiple waves travelling a few minutes apart. Most tsunamis are caused by submarine earthquakes but not all submarine earthquakes cause tsunamis. Movement on the fault must have a vertical component that generates sufficient displacement to set a tsunami running. Earthquakes, landslides, volcanic eruptions, explosions, and even the impact of cosmic bodies, such as meteorites, can generate tsunamis. Tsunamis can savagely attack coastlines, causing devastating property damage and loss of life. An under sea earthquake in the Indian Ocean on 26th December 2004 produced a tsunami that caused one of the biggest natural disasters in modern history. Over 200,000 people are known to have lost their lives.

Task : In 2004 and 2011 there were two tsunamis in Asia. By group list the badly affected countries.

Volcano

A volcano is an opening in the crust of the Earth through which molten rock known as magma and gases from the interior of the Earth reach the surface. The definition of volcano can include the mountain like structures that may be created from the material ejected at the volcano. Magma erupting from a volcano is called Lava and is the material which builds up the cone surrounding the vent (fig. 4.4). This opening allows hot ash, molten rock and gases to blow off from the underground spaces. Volcanoes generally acquire shape of a mountain. Volcanoes are usually found at places where tectonic plates get converged or diverged. But their existence at a particular place depends upon many environmental and geological factors.

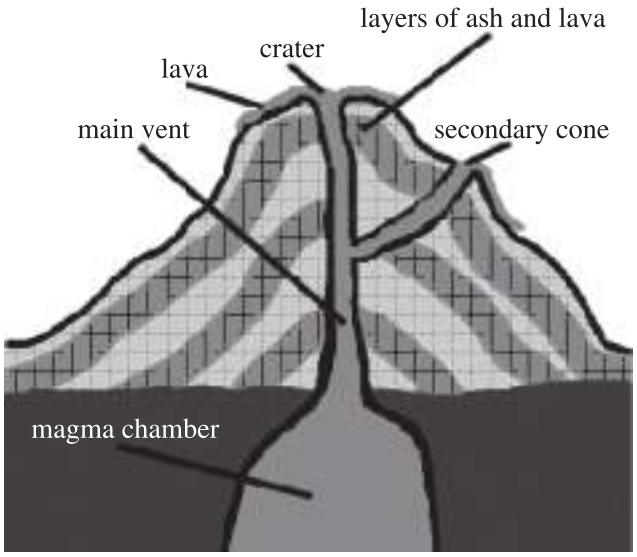


Fig. 4.4 : Volcano

Reasons of volcanic eruption

1. Volcanic eruption occurs due to the opposite or lateral movement of adjacent tectonic plates.

2. Eruption of melted magma, hot ash, and molten rock gases from the underground spaces causes volcanism.

3. When the pressure of the earth crust reduces underground rocks turn into liquid. As a result the volume of the rocks increases and the liquid lava comes out from the weak earth crust and causes volcanism.

4. One kind of gas is created for the reaction of the underground heat and molten rocks that create pressure and creates volcanism.

5. Hot liquid lava comes out for the pressure of the earthquake through the weak earth crust and causes volcanism.

Types of volcano

On the basis of eruption there are three types of volcanoes :

1. Active volcano : The volcanoes which are erupting or have erupted recently are known as active volcano. Mauna Loa and Mauna Keya of Hawaii are the best examples.

2. Dormant volcano : These volcanoes show no signs of activity. They have not erupted for a long time. A dormant volcano can be active again. Fujiama of Japan is a dormant volcano.

3. Extinct volcano : These volcanoes have remained dormant for many years and all volcanic activities have stopped. Kohisultan of Iran is an extinct volcano.

Volcanoes classified on the basis of shape and size

1. Shield volcano : Shield volcanoes are dome shaped mountains with broad bases and gentle slopes, commonly great in size. Shield volcanoes, formed when large flows of lava spread rapidly from central vents or rows of vents. Mauna Loa of Hawaii island is a shield volcano.

2. Strato volcano : It is formed as layers or strata of ash and lava from the erupting volcano. Most strato volcanoes are irregularly shaped mountains formed by material ejected from both central and other vents on the sides of the mountain.

3. Cinder cone volcano : Small volcanoes are called Cinder cone volcanoes. They are formed as a result of repeated small explosions of gas rich magma, which ejects small chunks of lava and ash onto small area around vent. The average size of cinder cone is about 800 metres wide base, and 100 metres high. Paracuting of Mexico is an example of cinder cone volcano.

Effects of volcanic eruption : Due to volcanic eruptions many changes occur on the earth's crust. On the other hand, volcanos have some good impacts.Various dimensions of volcanoes have been discussed below :

(1) Sometimes the molten materials are ejected from the volcano accumulated in the surrounding places and form a plateau. Black soil plateau of South India is formed from volcanic lava.

(2) There are many volcanoes in the ocean floor. Lava ejected from these volcanoes produces island. These are known as high island. Hawaii archipelago in the Pacific ocean is a volcanic island. Ridges are formed on the ocean floor.

(3) Volcanic eruption can create a deep trench in the surface of the earth. In 1883 a deep trench developed due to volcanic eruption between Java and Sumatra.

(4) A lake is formed in the crater of an extinct volcano. Mount Adakama of Alaska, Kosegaina of Nicaragua are this type of lakes.

(5) Lava flowing for a long time from the volcanic eruption forms mountain which is known as the volcanic mountain. Vesuvius of Italy is a volcanic mountain.

(6) A volcanic plateau is produced by volcanic activity. Lava plateau is produced by numerous successive eruptions through numerous vents.

Volcanic eruption destroys villages, cities, agricultural land, and everything. In 1879 AD eruption from Vesuvius mountain destroyed two cities of Italy Pompeii and Herculeum.

Volcanoes not only destroy the cities and agricultural lands but also increase the fertility of the soil. Layer of lava produces fertile black soil which is good for producing cotton. Many mineral substances flow with lava which is useful for the industrial activity.

Cause and effect of slow changes of the earth's surface

Sudden changes occur on the earth's surface and produce three types of landform.These are : mountains, plateaus and plains.These landforms gradually change through natural processes like solar heat, temperature, wind and rain and transform into a different landform.This process of change is known as slow change. In this process, solar heat, wind and rain erodes the surface layer of the earth very slowly. As a result, rocks of the upper layer of the surface break down. Rocks are eroded, transported and again this process takes place and new layer of rock is broken down. In this way, natural processes erode the surface.There are four processes through which the earth surface is changing. These are :

a. Weathering and erosion
b. Transportation
c. Denudation
d. Deposition

a. Weathering and erosion : Weathering is the process of decomposing the rocks. Rock particles are loosened, chemically or mechanically and stays in place is called Weathering.

When the rock particle is moved by some flowing agent such as air,water and ice it is called Erosion.

b. Transportation : Transportation is the movement of solid particles, typically due to a combination of the force of gravity acting on the sediment and the movement of the rivers, wind and glacier.

c. Denudation : Denudation is the long term process of wearing of the earth's surface leading to a reduction in elevation and relief of landforms and landscapes. Denudation can involve the removal of both solid particles and dissolved materials.

d. Deposition : Deposition is the geological process by which material is added to the landform or land mass. Eroded particles from wind, river and glacier are deposited to a new place.

The natural processes through which gradual change in the landform occurs are wind, rainfall, river and glacier. Erosional work of these agents are discussed below :

Wind : Air contains oxygen, carbon dioxide and water vapour. The chemical process of these three elements break down the rocks. Erosional work of the wind is more prominent in the desert. Desert areas are dry, rainless and are without vegetation coverage. Due to less vegetation coverage in the desert area the soil is not strongly compacted. The solar heat in the day time and radiation at night make the rocks expand and contract. As a result, the rocks prone to become erosion. Wind blows the loose rock particles from one region to another and slowly change the landform.

Rainfall : Rain water flowing on the surface of the land erodes it gradually in a large scale. Flowing rain water erodes the rocks partially and loosened eroded rocks are expanded. In high rainfall area the soils of cultivated lands are easily transported. In mountainous areas hard rock lies on the clay layer in a slanting position. When rainfall enters the cracks of the clayey layer of the mountain and erodes the hard rocks they become unstable and eventually fall down as landslide. In this way landforms change with the passage of time.

Glacier : Glacier is also an agent of change in cold region. The rocks underneath the passage of the glacier are eroded while it moves. When glacier moves through the valley in the mountains the rocks are broken into smaller pieces and moved away farther along its path. If there are cracks in the mountain sides water enters in those cracks, freeze and loosen the rocks and the pressure of glacier erodes the rocks from the sides of the mountain. This is the gradual process of change of the landform by glacier.

River : The natural process that is changing the earth's surface regularly is the river. When the river flows through the mountainous region the velocity of the current erodes the rocks into smaller pieces in the river bed and the sides of the mountain walls. In the mountainous stage of the river the work of the river is only erosion. When the river enters the plains it works both as an erosion and deposition agent. In the river course where the river flows over soft rocks it makes its way on it by erosion. Eroded materials are deposited in the course of the river and finally it reaches the sea.

Definition of river : In the high mountain, plateau or highland where rainfall, spring, glacier or melted waters from the glacier flow downwards due to gravitational force in a fixed course is called a River. The river flows in a course through plains and reaches at ocean or lake. The origin of the river is called the Source of river. The place where the river reaches the ocean or lake called the Mouth of the river. The extended area along the Mouth of the river is called the Estuary.

River course : River is important in the life of the people. All ancient civilizations flourished beside the river. At that time river was the only medium through which people could move around.

Doab : Land between two active rivers is known as doab.

Confluence : When two or more rivers meet together at a place is known as confluence.

Tributary : A stream or river that flows into a main stream or a lake is called a Tributary. A tributary does not flow directly into a sea or ocean.

Distributary : A stream that branches off and flows away from a main stream channel. They are common in the delta areas in the lower course of the river.

River valley : A valley formed by flowing river is called River valley.

River bed : The river bottom through which river flows is called the River bed.

River basin : The vast regions having branches of rivers through which water flows from its origin and fall into ocean and lake are called River basin.

Life cycle of a river

On the basis of area, depth, slope, velocity from the source to the mouth of the river, the life cycle of a river has been divided into three stages (fig. 4.5). These are :

1. Youthful stage/upper course
2. Mature stage/middle course
3. Old stage/lower course

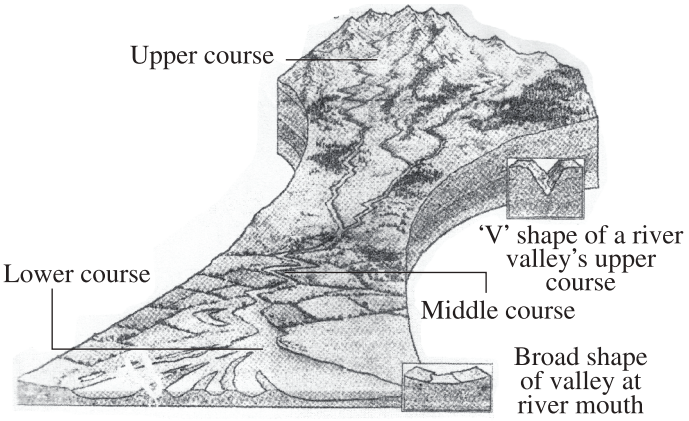


Fig. 4.5 : Life cycle of a river

1. Youthful stage/upper course : Youthful stage/upper course is the primary stage of the river course. The upper course of the river is from the origin in the mountain up to reaching the plains. In the upper course or youthful stage the main work of the river is vertical erosion. In the upper course the river erodes the landforms and transports it.

2. Mature stage/middle course : When the river enters the plains it is called the work starts. In Mature stage. In the mature stage the velocity of the river reduces and the deposition this stage lateral erosion is more than vertical erosion. In mature stage alluvium is deposited on the banks of the river which eventually forms the alluvial plains. Majority of lands in Bangladesh is alluvial plains.

3. Old stage/lower course : Lower course is the last stage of a river where it reaches the ocean. At this stage velocity of the river decreases. There is no vertical erosion and very less lateral erosion. River is very wide and shallow. Due to decrease of velocity of river flow, alluvium is deposited at the river mouth forming deltas.

Landforms created by river

'V' shaped valley : In the upper course of the river due to high velocity large rocks are broken down and transported downwards. Mountains are formed with

hard and soft rocks. In the river course soft rocks are eroded more and cutting downwards makes the channel shape like a 'V'. The sides of the mountains are less eroded as the lateral erosion at this stage is less (fig. 4.6).

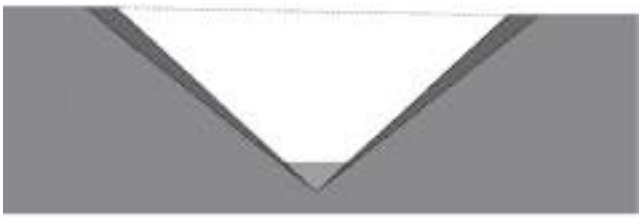


Fig. 4.6 : 'V' shaped valley



Fig. 4.7 : Gorge

Gorge and canyon : A gorge is a narrow valley with steep rocky walls located between hills or mountains. Rivers carve through hard layers of rock, breaking down or eroding. Sediment from the worn away rock is then carried downstream. Over time, this erosion will form the steep walls of gorge (fig. 4.7). The Indus river gorge is 518 metres deep, one of the deepest in the world.

Canyon :

Canyon is a steep sided valley where depth is considerably greater than width. These features are the result of river erosion in the upper course of the river in dry region. In North America Grand Canyon is the largest in the world which 137-157 metres wide, approximately 2.4 kilometres deep and 482 kilometres long.

Waterfall : Waterfalls are found in the upper course of the river. They happen when there is a piece of hard rock overlaying a soft rock which the river cannot erode. So, water has to drop from a high place to a low place (fig. 4.8). Most waterfalls are small but the biggest waterfalls are hundreds of metres high. In North America Niagara falls in the Lawrence river has been formed this way.

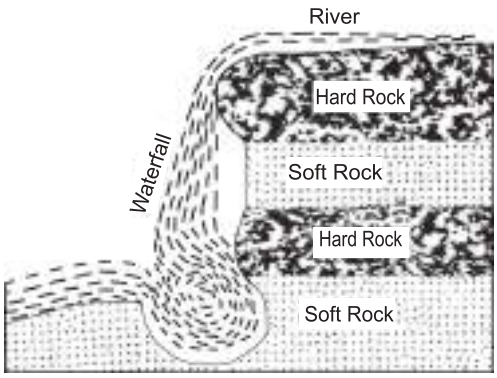


Fig. 4.8 : Waterfall

Landforms from river deposition

Alluvial cone and alluvial fan : An alluvial fan is a fan shaped or cone shaped deposit of gravel, sand and smaller materials.When water flows down a mountain, it picks up sand and other materials from the mountain. When the water reaches the base of the mountain and spreads out onto flat land, that material is deposited. As the materials builds up over time, an alluvial fan/and alluvial cone is created (fig. 4.9). In the foothills of Himalaya tributaries of Ganges forms these types of alluvial fans.

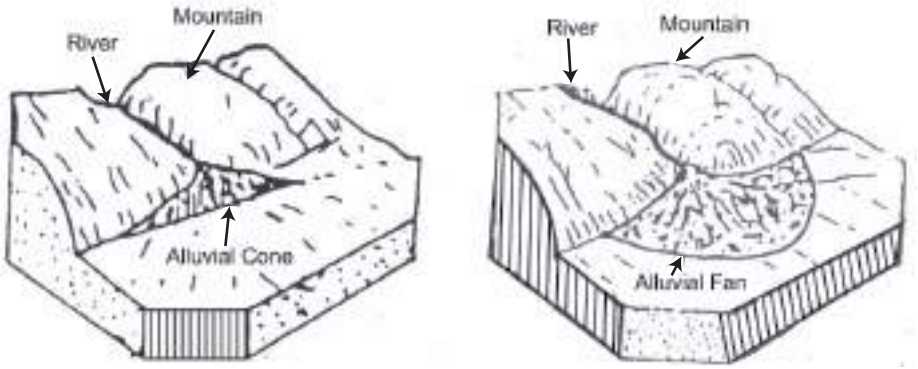


Fig. 4.9 : Alluvial cone and alluvial fan

Piedmont alluvial plain : Mountainous river deposits sediments at the foothills of the mountains. These deposits gradually form extensive plains.These type of plains are known as piedmont alluvial plains (fig. 4.10). Adjacent areas of the rivers Tista, Karatoa and Atrai in Rangpur and Dinajpur regions of Bangladesh are known as the piedmont alluvial plains.

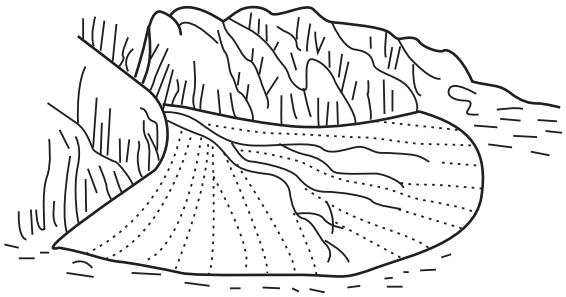


Fig. 4.10 : Piedmont alluvial plain

These rivers originated in the Himalayas and brought sediments from the mountainous region and deposited in those region forming the piedmont alluvial plains.

Flood plain : A flood plain usually is a flat area with areas of higher elevation on both sides. Flood plains can be very small or very large. Small flood plains sometimes

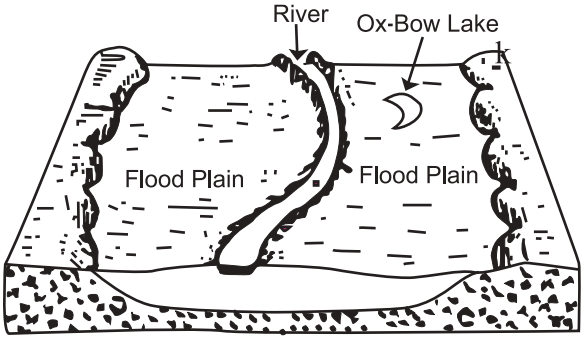


Fig. 4.11 : Flood plain

are part of a valley. Large flood plains can almost take up entire country. Flood plains usually are very fertile agricultural areas (fig. 4.11). Floods carry sediment rich in nutrients. They spread that sediment to a wide area. Flood plains are flat and have relatively few rocks or other large obstacles that may prevent farming. Floods are usually seasonal and can be predicted months ahead of time.

Delta : Deltas form as rivers empty their water and sediment into another body of water, such as an ocean, lake, or another river. A river moves more slowly as it nears its mouth, or end. This causes sediment, solid material carried downstream by currents, to fall to the river bottom. The heavier, coarser material settles first. Smaller, finer sediment is carried farther downstream. The finest material is deposited beyond the river mouth. This material is called Alluvium or Silt. Silt is full of nutrients that help microbes and plants grow. As the silt builds up, new land is formed.

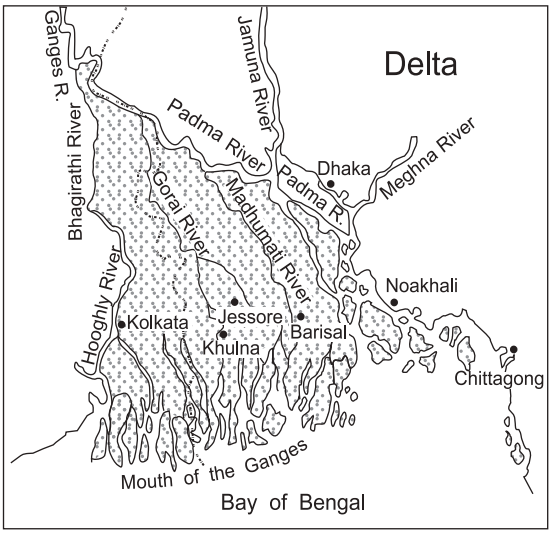


Fig. 4.12 : Delta

Not all rivers form deltas. For a delta to form, the flow of a river must be slow and steady enough for silt to be deposited and build up. Because many river deltas have a triangular shape, the term delta comes from the upper- case Greek letter delta, which is shaped like a triangle (fig. 4.12).

External structure of the earth

The diversified outward appearance of the earth is known as the external structure of the earth. Some principal and important examples are described below.

Main landforms of the earth

Earth's topography is made up of many different types of landforms. While the planet is covered primarily with water, the three major types of landforms are mountains, plains and plateaus. These can be formed by a variety of natural forces, including erosion from water and wind, plate movement, folding and faulting, and volcanic activity.

Mountains

While most mountains are created due to the slow and gigantic movement of the earth's tectonic plates, some are formed as a result of erosion and volcanic activities. Mountains are characterized by a higher elevation as compared to the surrounding areas. They are higher than 600 metres, and taller and steeper than the hills. The world's tallest mountains The Himalayas are located in Asia and the largest range of mountains is present in the Atlantic ocean. You will be surprised to know that some of the highest mountain peaks are located deep in the oceans. There are some mountain which is not a part of a mountain range but exists in isolation such as Mount Kilimanjaro in East Africa.

Mountains : types and their formation

An elevated landform is identified as a mountain. It has a summit and there are slopes on its sides. They are basically made up of earth and rock materials. Regarding mountain formation, the outermost layer of the earth or the earth's crust is composed of six tectonic plates. When two plates move or collide with each other, vast land areas are uplifted, resulting in the formation of mountains. Depending upon the geological processes responsible for uplift of mountains and landform characteristics. There are four major types of mountains.

Fold mountains : Fold mountains are the most common type of mountains. They are formed due to collision of two plates, causing fold that descends on both folding of the earth's crust. The sides is called Anticline, whereas, the fold that ascends from a common low point (on both sides) is called Syncline (fig. 4.13). Examples of fold mountains are the Himalayas located in Asia, Rocky mountains located in North America, and the Alps located in Europe.

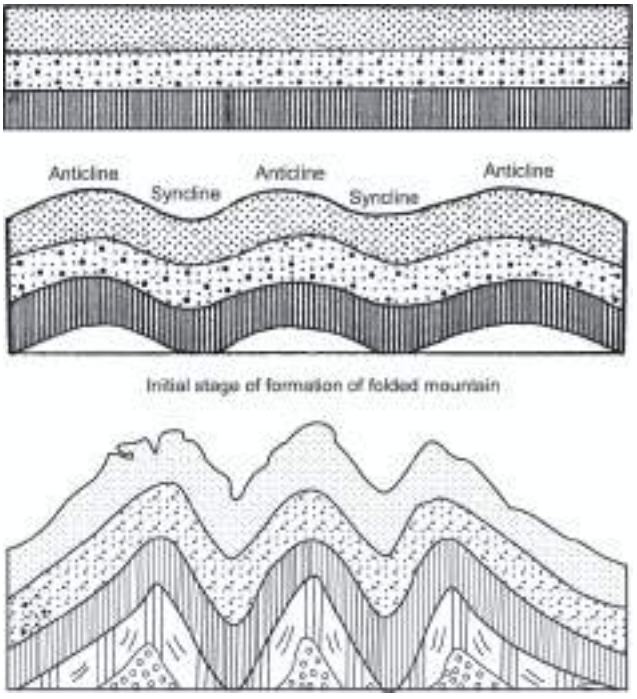


Fig. 4.13 : Fold mountains

Task : Collect information on famous fold mountains of the world and write it down.

Volcanic mountains : Volcanic mountains are created due to volcanic eruptions. When this lava erupts and piles up on the surface of the earth, it cools and solidifies to form a volcanic mountain. It is also called depositional mountain. In many instances, the volcanic materials erupt to great heights due to pressure from under the earth's crust (fig. 4.14). Examples of volcanic mountains are the Mount Fujiyama in Japan, Mount Vesuvius in Italy and Mount Pinatubo in Philippines.

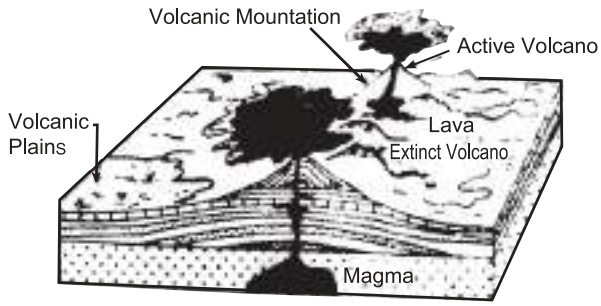


Fig. 4.14 : Volcanic mountains

Fault-block mountains : Due to tectonic movement in the earth's surface contraction and expansion of rocks takes place. This movement creates cracks in the earth's surface which leads to displacement of the earth's surface. It is called Fault. Fault mountains or fault-block mountains are created when blocks of rock materials slide along faults in the earth's crust. There are two types of block mountains, viz., the lifted and tilted. In the former type, the mountain has two steep sides, whereas, the tilted type has one steep side and a gentle sloping side (fig. 4.15). Examples of fault-block mountains are the Vindhya mountains and Satpuras mountain in India, Salt mountain in Pakistan and Black forest of Germany.

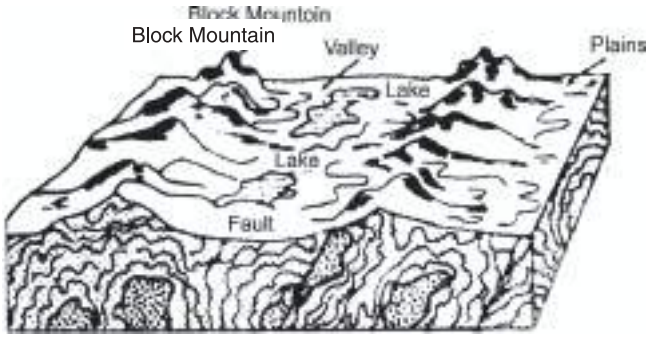


Fig. 4.15 : Fault-block mountains

Dome/Laccolith mountains : Dome mountains are built when the hot magma rises from the mantle and uplifts the overlying sedimentary layer of the earth's crust. In

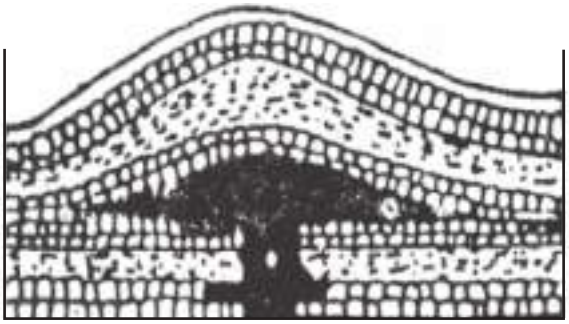


Fig. 4.16 : Laccolith mountains

the process, the magma is not actually erupted, but it cools down and hardens, thereby forming the core of the mountain. As their appearance resembles a dome shape, they are called Dome Mountains or Laccolith Mountains (fig. 4.16). These mountains do not have any summit. Example of dome mountains are the Black Hills Mountain of Dakota state and the Henry mountain of Utah state in USA.

Plateaus

Plateaus are formed by various geologic activities, such as immense lava flows, uplifting due to tectonic plate collisions, and sediment plateaus formed from eroded material from mountains. Plateaus are lower than mountains but higher than plains with steep slopes and extensive undulating surface is known as plateau (fig. 4.17). The height of the plateau varies from few hundred metres to few thousand metres. The height of the highest plateaus of the world varies from 4270-5190 metres.

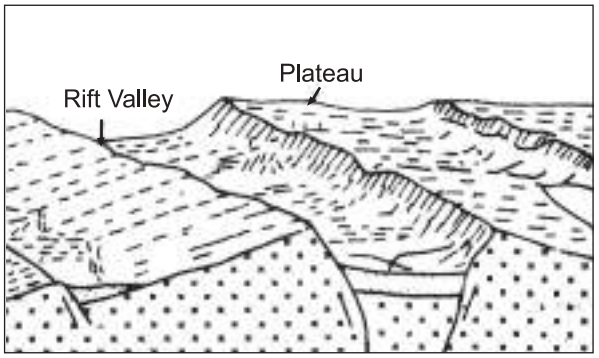


Fig. 4.17 : Plateaus

On the basis of the location, plateaus can be classified into three categories :

1. Intermontane plateau
2. Piedmont plateau
3. Continental plateau

1. Intermontane plateau : This type of plateau is surrounded by mountains. The Tibetan plateau is an intermontane plateau where The Kunlun mountain is in the north, The Himalayas in the south and in the east and west there are mountains. Bolivia in South America, Mexico in Latin America, and Mongolia and Tarim in Asia is this type of plateau (fig. 4.18).

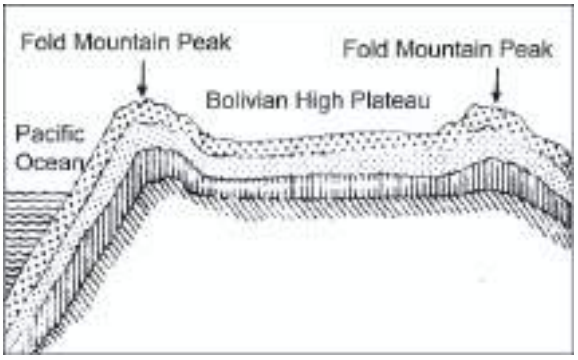


Fig. 4.18 : Intermontane plateau

2. Piedmont plateau : When high mountains are eroded and the sediments are deposited at the foothills and creates plateau is known as piedmont plateau. Colorado in North America and Patagonia in South America are the piedmont plateaus.

3. Continental plateau : Extensive highland surrounded by sea and lowlands is called Continental Plateau. These type of plateaus have no link with the mountain. Examples are Spain, Australia, Saudi Arabia, Greenland and India.

Plains

Extended lands with gentle slope a bit high from the sea level is called plain land. The plains are formed by the erosional and depositional work of different land forming agents like river, glacier and wind. Gently sloping and undulating land is suitable for agriculture, settlement and road construction.

On the basis of origin the plains are classified into two categories : Erosional and depositional plains.

Erosional plains : This type of plains are formed for erosion by river, wind and glacier. The upper rocks are eroded gradually and the lands with steep slope are transformed into plains. The plains at the foothills of Appalachian mountains and the plains of Finland and Siberia are these type of plains. The Barind and the Madhupur Tract of Bangladesh are examples of erosional plains.

Depositional plains: Natural processes of river, wind and glacier transport the sand dust and sediment, from one place and deposit in a lowland forming a depositional plain. Formation of depositional plains are found from the mountainous region to the sea coast. For example, flood plains formed by river sediment deposition, delta formed by river deposition near the river mouth and glacial plain formed by sediment deposited through moraines in cold regions.

Sample Questions

Multiple choice questions

1. From what is graphite produced?

(a) Limestone (b) Coal

(c) Sandstone (d) Granite

2. In a downstream river.

i. The speed of the current increases

ii. The depth decreases

iii. The lateral erosion decreases

Which of the following is correct?

(a) i and ii (b) i and iii

(c) ii and iii (d) i, ii and iii

Examine the images below and answer questions 3 and 4:

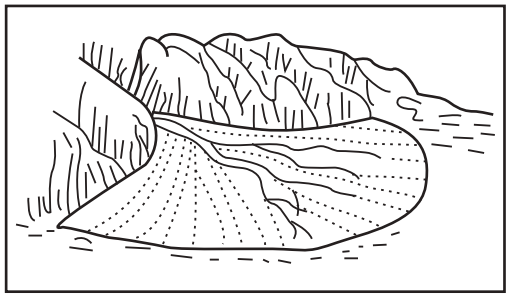


Fig.1

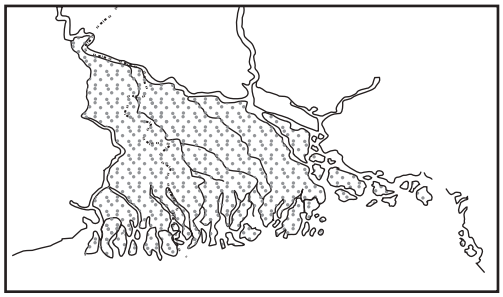


Fig. 2

3. In which region of Bangladesh is the landform of Figure 1 found?

(a) South-East (b) South-West
(c) North-West (d) North-East

4. The landforms of both Figure 1 and Figure 2 are formed-

i. By sedimentation
ii. In river mouths
iii. By erosion

Which of the following is correct?

(a) i and ii (b) i and iii
(c) ii and iii (d) i, ii and iii

Creative Questions

1. Bidhan and Himel went to Italy to find jobs. One afternoon, while walking around, they saw a place with steep slopes and cone-shaped land. During their conversation, they discovered that Bidhan's home is in Bandarban, Bangladesh, and Himel's home is in Khulna.

a. What is a river valley?
b. Why is a river valley 'V' shaped when it rises? Explain.
c. Describe the geomorphological characteristics of the landform that Bidhan and Himel observed.
d. Are the land structures of the two regions where both of their houses are located similar? Conduct a comparative analysis.

2.

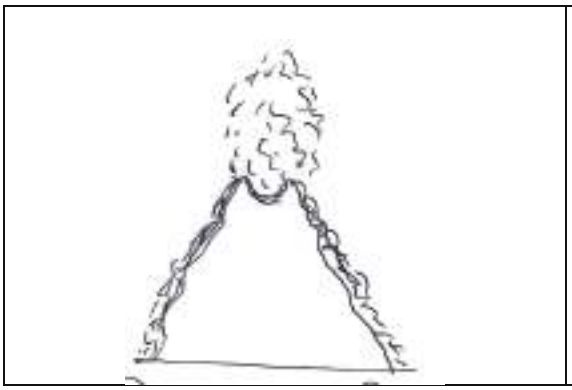


Figure 1: A kind of Volcanic Eruption

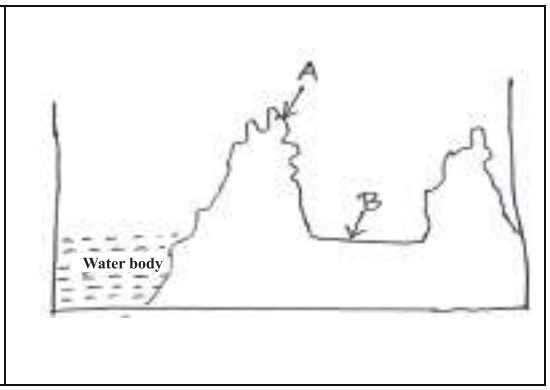


Figure 2: Landform

a. What is an earthquake?
b. Why do landslides occur? Explain.
c. Figure 1: Discuss the causes of its eruption.
d. Are the formation processes of the landforms labeled 'A' and 'B' in Figure-2 similar? Compare and discuss them.

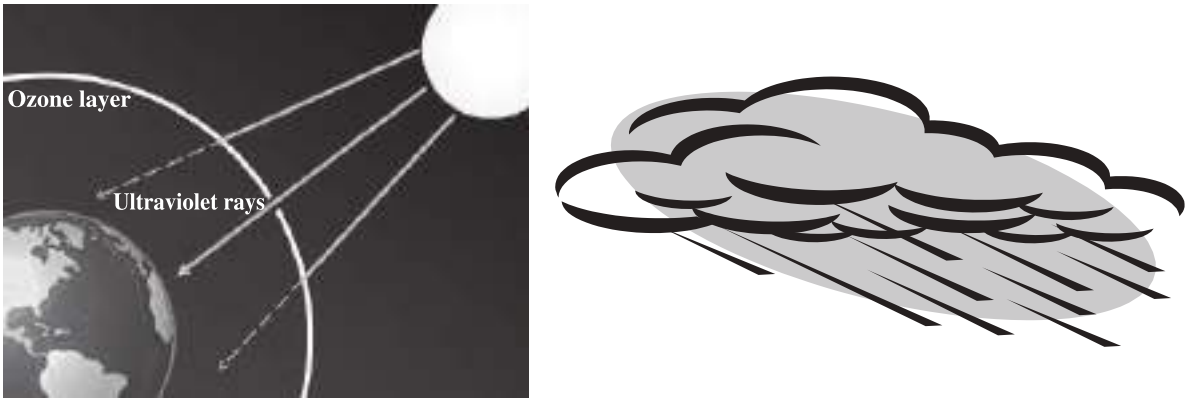
Short-answer questions

1. What is a “wavetrain”?
2. What is meant by primary rock?
3. Write four differences between rocks and minerals.
4. Why is Vesuvius in Italy called an igneous mountain?
5. What are alluvial cones and alluvial fans?

Chapter Five

Atmosphere

Earth is the only habitable planet in the solar system. The mixture of gases surrounding the Earth or other celestial body, held in place by gravity is the atmosphere where living things survive. We call it atmosphere. It forms distinct layers at different hights. In this chapter we would like to know how this atmosphere is important for the living things for their survival. A diagram shows the layers of the atmosphere in the earth.



The Atmosphere

At the end of this chapter, we will be able to–

- explain the elements of the air;
- explain the layers of atmosphere and their characteristics;
- explain the importance and analyze the different layers of the atmosphere;
- discuss the difference between weather and climate;
- explain the factors of climate;

- analyze the wind circulation and their impact;
- explain the water cycle;
- discuss different types of rainfall;
- discuss the inter-relationship of global warming and climate change;
- analyze global climatic change and its impact on different regions of the world;
- analyze the impact of climatic change on the people of Bangladesh in their living condition and economic activities and the environment.

Composition of the atmosphere

The Atmosphere is very important part of the biosphere. It is vital for life on earth. Without the atmosphere life would not be possible. It gives us air to breathe and also protects us from the ultraviolet rays of sun. It absorbs heat so that temperatures on earth are such that life becomes possible. It separates the earth from the space Air is made almost entirely of two gases. The most common gas is nitrogen (N_2), and the second most common gas is oxygen (O_2). Nitrogen and oxygen together make up 99 percent of the planet's atmosphere. All other gases together make up the remaining 1 percent. Although each of these trace gases is only found in tiny quantities, many such as ozone, serve important roles for the planet and its life. One very important minor gas is carbon dioxide (CO_2), which is essential for photosynthesis and is also a very important greenhouse gas.

In nature, air is never completely dry. Up to 4 percent of the volume of air can be water vapour. Humidity is the amount of water vapour in air. The humidity of the air varies from place to place and season to season.

Argon, neon, helium, xenon, and krypton are noble gases. They are colourless, odorless, tasteless, and they do not become part of ordinary chemical reactions because they are chemically inert. The noble gases simply exist in the atmosphere.

Particles of dust, soil, metals, salt, smoke, ash and other solids make up a small percentage of the atmosphere (Table 1) which are not gas.

Table 1 : List of elements in the atmosphere

Name of the Elements	Percentage
Nitrogen (N_2)	78.02
Oxygen (O_2)	20.71
Argon (Ar)	0.80
Carbon dioxide (CO_2)	0.03
Other Gases (neon, helium, krypton, xenon, ozone, methane and nitrous oxide)	0.02
Water vapour	0.41
Dust and particle	0.01
	Total 100.00

Atmospheric layers and it characteristics

The atmosphere can be divided vertically into five divisions according to the characteristics such as temperature, pressure and density. These layers are : Troposphere, Stratosphere, Mesosphere, Thermosphere and Exosphere (fig. 5.1).

Troposphere

This is the first layer of the atmosphere close to the earth's surface. Clouds, rainfall, thunderballs, wind, storms, fogs, dews, snowfalls everything is created in this layer. The last terminal of Troposphere is called Tropopause. It extends to a height of 16-19 kilometres at the equator and 8 kilometres in the polar region. The characteristics of the Troposphere are :

(a) In this layer temperature and density of air decreases with the increase of height. As the density of air is thin, the absorption capacity of heat is less. Generally in every 1,000 metres of height temperature decreases 6.5°c/TKM

(b) Velocity of the wind increases with the increase of height .

(c) Troposphere contains most of the water vapour, clouds form in this layer.

(d) The presence of dust particle in this layer makes the heaviest layer of the atmosphere and 75 percent of the weight of the atmosphere remains in this layer.

(e) The height at which the temperature stops decreasing is called the Tropopause. Here the temperature may be as low as –54° Celsius.

Stratosphere

This is the second layer of the atmosphere which extends from the tropopause to about 50 kilometres above the surface of the Earth. The characteristics of the Stratosphere are :

(a) Temperature increases due to the absorption of the ultraviolet radiation of the Sun, due to the presence of ozone, in this layer. The temperature slowly increases up to 4° Celsius.

(b) This layer is free from clouds and associated with weather phenomena. So, it is an ideal flying condition for large jet planes.

(c) At about 50 kilometres the temperature begins to fall again. This marks the end of the Stratosphere. The end of the Stratosphere is called the Stratopause. This layer is between Stratosphere and Mesosphere.

Mesosphere

The Mesosphere extends to a height of 80 kilometres. On this layer temperature stops declining. The characteristics of the Mesosphere are :

(a) In this layer temperature decreases again, falling as low as –83° Celsius. The Mesosphere has the coldest temperatures in the atmosphere.

(b) The meteor that comes from the outer space to the earth burns down in this layer.

Thermosphere

The Thermosphere lies above the Mesosphere up to 500 kilometres. The wind layer is very light and pressure is very low. The characteristics of the Thermosphere are :

(a) In this layer temperature rises considerably, reaching up to 1480° Celsius.

(b) The increase in temperature is due to the fact that the gas molecules in this layer absorb the x-rays and the shortwave ultraviolet radiation of the Sun. These result in the break-up of the gas molecules into positively and negatively charged particles. These electrically charged particles are known as ions. The process by which molecules of certain substances are electrically charged is known as ionization.

(c) The electrically charged gas molecules of the Thermosphere reflect radio waves from the Earth back into space which helps in long distance communication. This layer is also known as Ionosphere.

(d) Different radio wave sent from the earth return to earth again by facing obstacle by Ionsphere.

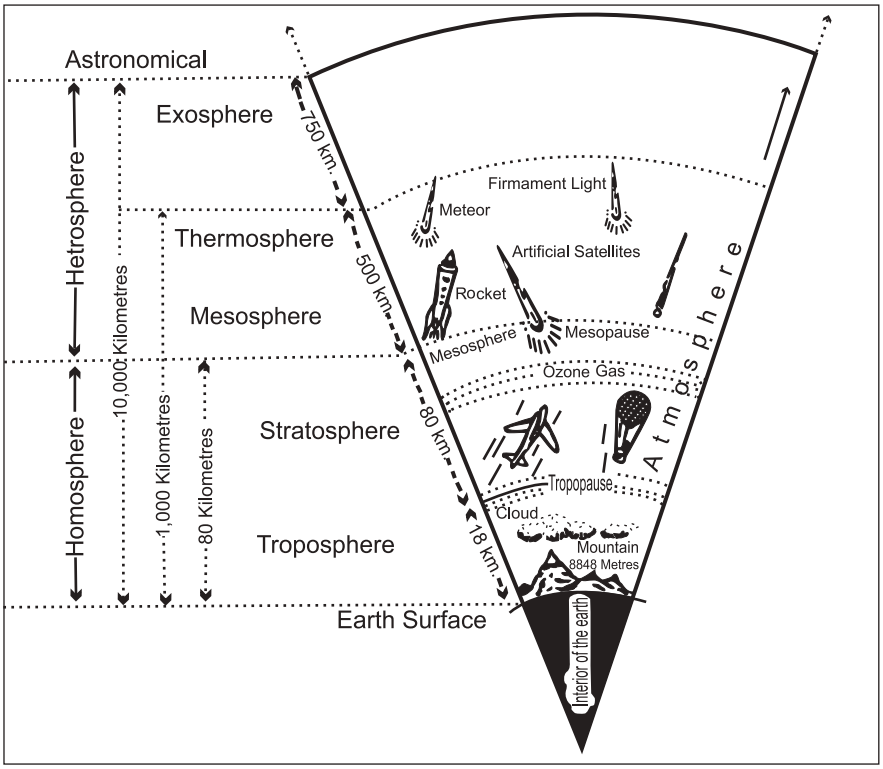


Fig. 5.1 : Atmospheric layers

Exosphere

This layer lies above the Thermosphere up to 960 kilometres is called Exosphere. The dominance of helium and hydrogen gases is observed at this layer.

The characteristics of the Exosphere are :

(a) The Exosphere extends beyond the Thermosphere up to 960 kilometres. It gradually merges with interplanetary space.

(b) The temperature in this layer range from about 300°–1650° Celsius.

(c) This layer contains only traces of gas like oxygen, nitrogen, argon and helium as it lacks the gravity which allows the gas molecules to easily escape into space.

Task : Write down the characteristics of layers of atmosphere in the table (in groups).				
Troposphere	**Stratosphere**	**Mesosphere**	**Thermosphere**	**Exosphere**

Importance of different layers of atmosphere

- Sound waves cannot travel without the atmosphere. Radio waves sent from the Earth's surface is reflected back to the Earth as it is obstructed in the Ionosphere layer.
- Weather condition like rainfall, snowfall, cloud, fog, dew and hailstorm would not develop without the Troposphere layer. Rainfall is important for the croplands and forests.
- The Earth is saved from the meteors as they are destroyed in atmospheric layers.
- If there was no atmosphere there would be no life, it would be a desert like environment of moon.

Elements of weather and climate

The daily average condition of temperature, pressure, wind, humidity and precipitation for a place is known as weather. Generally, climate is the average condition of the weather for 30 to 40 years.

Elements of weather and climate are wind pressure, temperature, wind pattern, humidity and precipitation.

Factors of climate

Climate is not same in the world. Some regions are hot and some are cold, some are wet and some are deserts. Due to geographical location, the climate varies. Factors of climate is discussed below :

1. Latitude : Sun's ray varies with the latitude. The Sun ray falls vertically on the equator and as a result the temperature is high in the equtorial region. In higher latitudes inclined sun rays decreases the temperature. Generally, the atmospheric temperature decreases from the equator towards the poles.

2. Altitude : The atmospheric temperature decreases with the increase of altitude from the sea level. With the increase of every 1,000 metres of altitude, the temperature decreases 66° Celsius. If two places are situated on the same latitude, their climate will vary due to the difference of altitude. Even though Dinajpur and Shillong are located in the same latitude, but the climate varies due to altitude. The temperature in Shillong is much lower than Dinajpur.

3. Distance from the sea : Location of the land mass sometime makes a mild climate. Cox's Bazar, Chittagong, Patuakhali located in the coastal area are milder in climate than Rajshahi. In the coastal area there is equable temperature where the difference between summer and winter is very less. But regions located far away from the sea have extreme climate with very hot summer and very cold winter. Land mass get warmer quickly than water bodies and radiates heat rapidly. So, during summer inland continental areas become warmer rapidly and in winter becomes very cold.This type of climate is known as continental or extreme climate.

4. Wind movement : Wind movement plays an important role on the climate of an area. If water vapour is saturated wind blows and abundant rainfall occurs in that area. During monsoon season the wind blows from the Bay of Bengal saturated with water vapour which causes heavy rainfall all over Bangladesh. In winter the opposite occurs as the wind blows from inland, the continental air is dry and there is no rainfall and the temperature decreases.

5. Ocean currents : The air of the coastal area becomes either cold or warm due to the influence of cold or warm ocean currents. It may be mentioned that the south -eastern coast of the United States of America has higher temperature due to the influence of the Warm Gulf Stream, again the cold Labrador Current keeps the temperature low in the eastern coast of North America.

6. Location of the mountains : Wind movement, when obstructed by the high mountains can influence the climate. The monsoon air is obstructed by the Himalayas in the north, which brings heavy rainfall in Bangladesh, India and Nepal. During winter the cold airmass of Central Asia cannot cross the Himalayas and so the climate of the sub-continent (India, Pakistan, Bangladesh and Sri Lanka) never gets cold like Europe.

7. Slope of the land : The air and the land become warm where the sun's rays fall directly on the slopes of the highlands. But in the opposite side of the slope, the air remains cold due to the inclined sun rays or meager sunshine.

8. Composition of the soil : The structure of the soil or texture plays a vital role in the conservation of temperatures. Exposed sandy soil becomes hot and cold quickly. But the alluvial soil and the clayey soil take much time to get warm or cold due to heat conservation of the soil.

9. Location of the forest : The vegetation from its evapo-transpiration activity helps air to saturate with water vapour. This saturated air condenses and rainfall occurs. The intensity of storms and cyclones are reduced due to the forest.The air of the dense forest remains cold as the sun rays cannot penetrate into the soil.

Task : What factors of climate is influencing the climate of Bangladesh? Explain it by brain storming in a group. Each group will be given 15 minutes time to finish the work and the whole group will make a 10 minutes presentation on the topic.

Hydrological cycle

Hydrological cycle: Generally water is never stationary anywhere. It is always moving and changing its position. That is, water exists in vaporous, liquid and solid forms. The largest and constant source of water supply across the world is the oceans. Sea water gets heated , becomes light and gets up as vapours and, then, mixes the limitless atmosphere. Besides, water mixes with the atmosphere through transpiration from trees. This cool and condensed wind full of vapours come down on earth as cloud, rain, dew, fog, frost, ice, etc. for gravitational force. Again, in different ways, some of this water fallen on earth mixes with atmosphere through vaporization. Some get run off by river and fall into the seas. Trees absorb some of this water through Osmosis process. The rest enters into the rock layers of the crust through percolation. Thus, water cycle/Hydrological cycle continues in nature (fig-5.2)

(1) Evaporation : Evaporation occurs at all temperatures. However, evaporation is more rapid at higher temperatures. At lower temperatures, it takes place slowly. The rate of evaporation is directly related to the temperature of air. When the temperature increases, the rate of evaporation also increases.

Warm air can hold more water vapour than cold air. When the temperature of air increases, the capacity of air to hold water vapour increases. However, there is a limit on how much water vapour the air can hold at any given temperature.

(2) Condensation : Condensation is the process by which water vapour is converted into water. Condensation can only occur when the air becomes saturated.

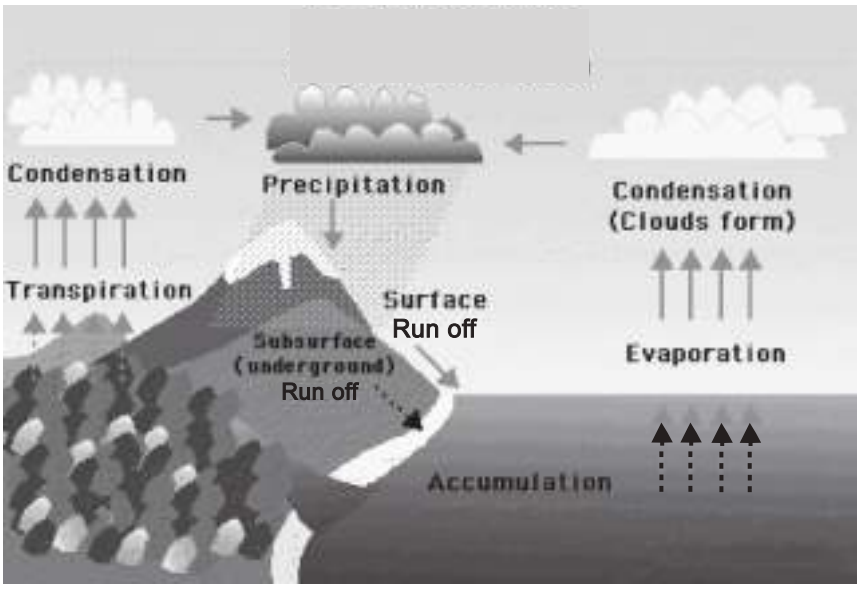


Fig. 5.2 : Water cycle

Air can become saturated in two ways :

1. By cooling of air : When the temperature of air decreases, its capacity to hold water decreases. The air can become saturated with the same quantity of water vapour by a fall in temperature.

2. By the addition of more water vapour : When more evaporation occurs, the air can become saturated in nature. Saturation of air in this manner is not a very common occurrence.

When the air becomes saturated, it cannot hold water any more. Any extra water that may be present, is given out in the form of droplets of water. These condensed droplets are very small and may be seen in different forms.

Different forms of condensation

1. Cloud : Droplets of water suspended in the sky is called Cloud.

2. Mist : Droplets of water suspended near to the surface of the earth is called Mist.

3. Fog : A dense mist is called Fog.

4. Dew : Tiny drops of water are formed when water vapour condenses on the ground or cool surfaces is called Dew.

5. Frost : It is the coating of ice left when moisture in the air freezes or dew freezes into ice is called Frost.

Saturation and dew point

The temperature at which the air gets saturated is known as dew point.

When the air is holding the maximum amount of water it can hold, the air is said to be saturated.

The amount of water needed to saturate the air changes with temperature since the capacity of air to hold water is related to the temperature.

When the temperature is high, more water will be needed to saturate the air. At low temperatures a smaller quantity of water would be enough to saturate it.

Humidity : Humidity refers to the amount of water vapour present in the air. Amount of water vapour in the atmosphere is less than 1 percent. The air which contains no water vapour is called Dry air and the air which contains more water vapour is called Humid air. Humid air contains 2%-5% water vapour. The amount of water vapour is measured with hygrometer. Humidity in the air is expressed in two ways : by Absolute humidity and Relative humidity.

Absolute humidity : It refers to the total amount of water vapour present in a given volume of air.

Relative humidity : Relative humidity is a ratio between the actual amount of water vapour present in the air and the maximum amount of water the air can hold at a given temperature.

(3) Precipitation : A form of water, such as rain, snow, or sleet, that condenses from the atmosphere, becomes too heavy to remain suspended, and falls to the Earth's surface by the action of gravity. Different atmospheric conditions are responsible for the different forms of precipitation.

Types of condensation

- Clouds
- Fog
- Dew and White Frost

Condensation

- Condensation occurs when water vapour changes to a liquid.
- For condensation to take place, the air must be saturated and there must be a surface on which the vapour can condense.
- In the air above the ground, tiny water-absorbent particles known as condensation nuclei serve as the surfaces on which water vapour can condense.

Fog

Fog, generally considered an atmospheric hazard, is a cloud with its base at or very near the ground. Fogs is formed in cold weather.

Dew and white frost

- Dew is the condensation of water vapour on objects that have radiated sufficient heat to lower their temperature below the dew point of the surrounding air.
- White frost forms when the dew point of the air is below freezing.

Forms of precipitation

Rain : Precipitation that reaches the ground in liquid form is called rain. Rain drops are 0.5 milimetres to 6.35 milimetres in diameter. Rain is the most common form of precipitation.

Drizzle : The lightest form of precipitation is drizzle which occurs in fine drops falling close together. Drops are less than 0.5 milimetres in diameter.

Snow and snow fall : Snow is a precipitation composed of powdery mass of ice crystals. Snow forms in the extremely cold upper clouds.

In cold regions, the temperature often falls below freezing point and the water vapour of the air condenses into ice crystals. These ice crystals grow in size and form ice which fall on the ground. This form of precipitation is called Snow fall.

Sleet : Sleet is a mixture of rain and snow. When rain falls through a layer of cold air near the Earth's surface, rain drops get frozen into ice.

Hailstone : Hailstones are frozen lumps of ice produced by thunderstorms. They form inside tall cumulonimbus clouds which are warmer at the bottom and freezing at the top. Rain occur when warm moist air cools and condenses. Warm air can hold more water than cool air. So when the warmer air is cooled the moisture condenses to liquid, it rains.

(4) Run off : The movement over ground of rain water is run off. Run off occurs when the rainfall is very heavy and rocks and soil cannot absorb any more. Run off flows into lakes, rivers and oceans. Run off are divided into four categories. They are :

(a) Surface flow

(b) Subsurface flow

(c) Percolation

(d) Infiltration

The water stored underneath the earth return to air through the process of transpiration and evaporation.

Task : What do you understand from the words below? Discuss in a group and write it in the table.			
Evaporation	**Condensation**	**Precipitation**	**Surface flow**

Rainfall: Naturally rainfall is drops of water coming down on earth from condensed floating clouds being pulled by gravitational forces. This rainfall is sometimes dense in nature and sometimes it drizzles. Rainfall is measured by Rain Gauge.

Causes of rainfall: The upper vapours created by sun heat come in contact with cool wind and easily get saturated. Then this saturated wind turns into very small droplets. Then they float in the sky being condensed with dusts of the atmosphere. When wind temperature further decreases for any reason, the cloud turns into waterdrops or ices. Next they come down on earth for gravitational force. Thus rainfall occurs on earth. So the reasons of rainfall are- (1) presence of vapour in the air, (2) upward movement of wind and (3) Decrease of temperature in the atmosphere

Classification of rainfall

Convectional rain : The formation of precipitation due to surface heating of the air at the ground level (fig. 5.3). If enough heating occurs, the mass of air becomes warmer and lighter than the air in the surrounding environment, and just like a hot air balloon, it begins to rise, expand and cool. When sufficient cooling has taken place saturation, occurs forming precipitation. This process is active in the interior of continents and near the equator forming cumulus clouds and possible later thunderstorms. Rain is usually the precipitation type that is formed, and in most cases this moisture is delivered in large amounts over short periods of time in extremely localized areas.

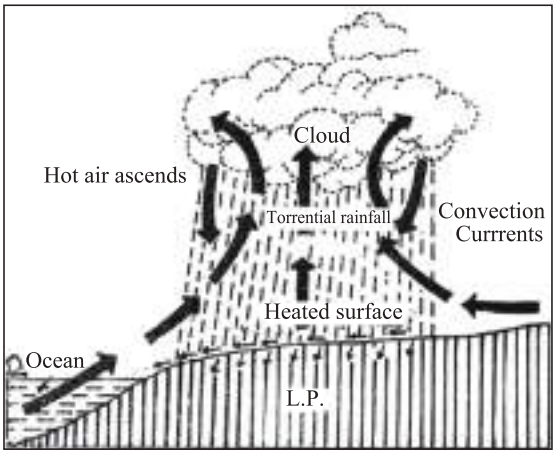


Fig. 5.3 : Convectional rain

Orographic rain : Orographic rainfall is produced as a result of clouds formed from the topography or shape of the land. Where there is high ground or mountain moist air is forced upwards producing cloud and rainfall. Rainfall occurring in the slopes of the mountain is known as the windward side and after crossing the mountain it is known as the leeward side. No rainfall occurs in the leeward side of the mountain as the descending air is dry and it is called the Rain Shadow Area (fig. 5.4).

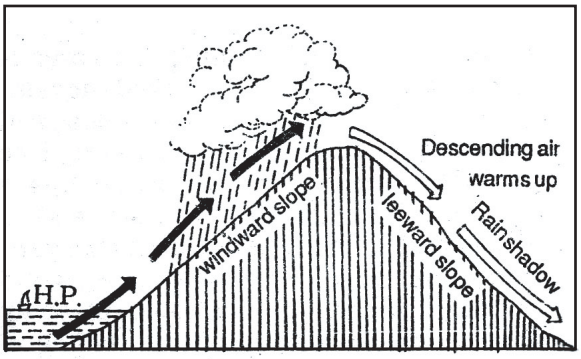


Fig. 5.4 : Orographic rain

Mountainous areas close to prevailing westerly winds are most likely to experience this type of rainfall. South-west monsoon wind blowing from the Arabian Sea towards South India obstructed by the Western Ghats mountain causes heavy rainfall in the western slopes . The Deccan plateau located on the eastern side which has less rainfall is the rain shadow area.

Frontal rain : Frontal rain occurs when two air masses meet. When a warm air mass meets a cold air mass, they don't mix as they have different densities. Instead, the warm and less dense air is pushed up over the cold dense air creating the 'front'. As a result, much like when it is forced up over mountains, it cools, and the water condenses and falls as rain drops (fig. 5.5).

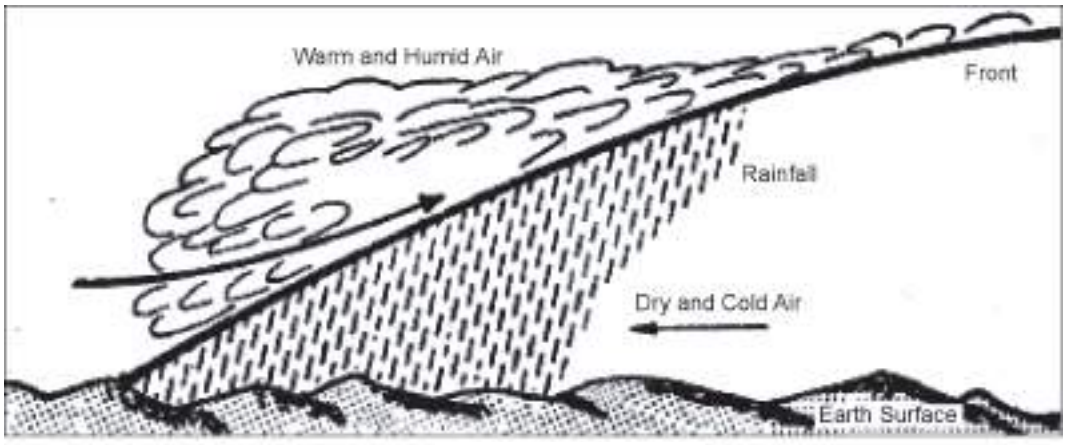


Fig. 5.5 : Frontal rain

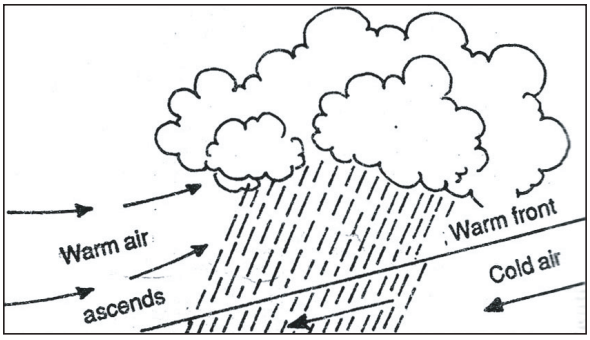


Fig. 5.6 : Cyclonic rain

Cyclonic rain : If a low pressure originates in a land mass in a region, soon saturated warm air from the land mass blow towards the low water bodies and dry air from the pressure centre. Warm air blowing from the water is lighter and full of water vapour. It rises above the dry dense cold air and causes rainfall. This type of rainfall is known as cyclonic rainfall (fig. 5.6).

Task : What type of rainfall occurs in Bangladesh and why? Discuss this in your class in a group and find the answer.

Movement of wild

Due to the difference in temperature and pressure the air moves from one place to another.This movement of air is known as wind.The wind has certain characteristics :

1. The cold and heavy air moves from the high pressure areas to low pressure area.

2. The Earth is rotating from west to east. Due to this reason the air moves towards right in the northern hemisphere and towards left in the southern hemisphere.

Pressure belts : Due to the variation of temperature in different latitudes and the rotation of the earth, several pressure zones have been formed. These are known as pressure belts. Those are : (1) Equatorial low pressure belt, (2) Tropical high pressure belt, (3) Subpolar low pressure belt, (4) Polar high pressure belt.

Some major wind system of the earth are : Planetary winds, Seasonal wind, Local wind and Irregular winds.

Planetary winds

These winds are controlled by the pressure belts, blow towards same direction throughout the year. The planetary winds are three type : the trade winds, the westerly's and the polar winds (fig. 5.7).

The trade winds : The Sun's ray falls vertically on the equatorial region. So the warm and light air is rises upward. Cold and dense air from the subtropical high

pressure belts blows towards the equator. According to Ferrel's Law, the trade wind blows from north-east in the northern hemisphere and south-east in the southern hemisphere as south-east trade wind. In the ancient time the merchant ship used to travel to the direction of the wind and so this wind is known as the trade wind. The speed of north-east trade wind is 16 kilometres per hour and south-east trade wind 22.54 kilometres per hour. As the air in the equatorial region rises upward, there is no horizontal movement of air around 5° north and south latitude of the equator, a calm sphere exist which is known as Doldrums.

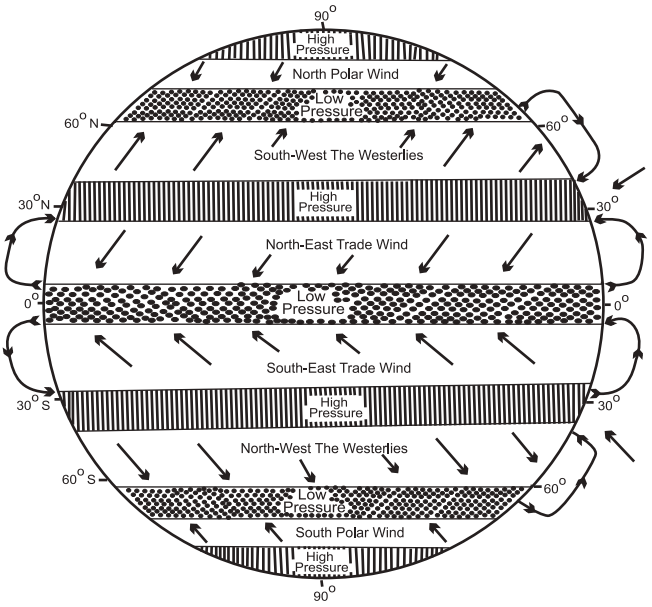


Fig. 5.7 : Planetary winds

The westerlies : The subtropical high pressure belt lies from 30° north and south latitude, and the air blows towards the subpolar low pressure belt at 60° latitude. The air is warm and light as it blows from the tropical area. It rises above the dense cold polar air and a part of it blows towards the subpolar low pressure belt. This is known as the Westerly's. In the northern hemisphere, it blows from south-west and in the southern hemisphere from north-west direction. In the northern hemisphere land mass is greater. So the changes occur locally. However, in the southern hemisphere, the maximum area consists of water bodies and the Westerly's blow without any interruption. The velocity of the Westerly's reaches the highest between 40°-47° south latitude and so it is called the 'Roaring Forties'. In ancient times when merchant ship travelled over Atlantic ocean to America from Europe for exporting horse and other goods the ship could not sail at 30°-35° north latitude as there was no horizontal movement of air. The sailors threw their horses in the sea due to crisis of water and food. So, the calm belt on the Atlantic ocean is known as Horse Latitude. In northern hemisphere, between 30°-35° north latitude due to the influence of westerly's, rain falls in winter.

Polar winds : Two more air masses regularly blow from north and south polar high belts towards the subpolar lows. These are known as North-east and South-east Polar wind.

Sea and land breeze : In the coastal regions, the temperature of adjacent land mass rises with the advancement of day time. Therefore, a low pressure is formed locally and comparatively the cool air from the high pressure area sea blows toward the land. This is known as sea breeze (fig. 5.8). The velocity of this air reaches to its maximum in the afternoon.

After the sunset, the land mass cools quickly than the sea. During that time, the high pressure prevails over the land mass. So, the air blows from the high pressure area to the land mass towards the sea. This is known as the land breeze (fig. 5.9).

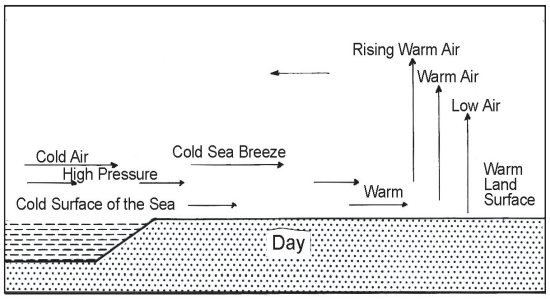


Fig. 5.8 : Sea breeze

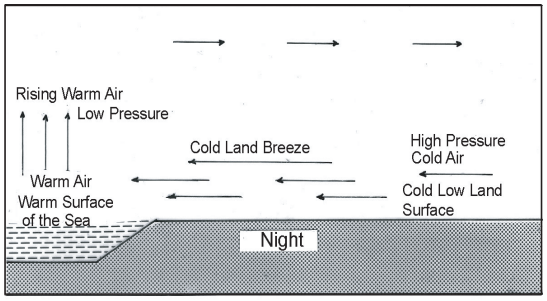


Fig. 5.9 : Land breeze

Monsoon wind : Monsoon is an Arabic word meaning season. A monsoon is a seasonal wind which changes direction with season. Monsoons cause wet and dry seasons throughout much of South Asia (India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan and Maldives). Monsoons are most often associated with the Indian Ocean.

Monsoons always blow from cold to warm regions. The summer monsoon and the winter monsoon determine the climate for most of India and South-east Asia. There are two branches of monsoon winds : one is the Arabian ocean branch and the other is the Bay of Bengal branch. The Arabian ocean branch provides rainfall in Pakistan and Western India. The Bay of Bengal branch provides rainfall in Bangladesh, Eastern and northern India, Nepal, Bhutan and Myanmar.

During winter the interior part of Asia remains very cold and so some high pressure calls are created. The cold air blows from the north-east high pressure area of the land mass towards the low pressure zone of the ocean. As this air originates in land mass, it is dry and it doesn't contain any water vapour. When this air crosses the equator according to Ferrel's Law blows over North Australia as the north-east monsoon.It acquires large amount of moisture from the Indian Ocean causing heavy shower to northern Australia.

The air which changes its direction with the change of season is known as Andotropic wind. Monsoon wind and the Mediterranean winds are the Andotropic wind.

Local wind : Natural characteristics or variation of temperature of an area are the causes of local winds. Chinook from the Rocky mountains, Mistral from the Central plateau region of France, Pampero originating in Argentina and Pampus region of Uruguay, Bora in the Eastern coast of Adriatic sea, Sirocco in North Africa and South Italy, Simoom in the Arab plateau, Khamsin in Egypt and Loo in the Indian sub-continent are some of the local winds.

Task : Write down the origin and direction of the winds given below by reading the planetary wind system.		
The Trade winds	**The Westerly's**	**The Polar winds**

Global warming and climate change

Global warming is one of the environmental problems of the world today. Climate change is gradually taking place due to the global warming. Climate has been changing since the begining of the Earth. Sometimes it was very hot, sometimes very dry. Sometimes ice covered the whole earth. But the change was very slow. Millions of years passed through slow change and some the change was natural such as the change of the orbit of the Earth or the rotation of the Earth. But the change that is occurring now is very fast and so it is a matter of concern for everybody. This rapid change is due to various activities of human being. In the last hundred years the average temperature increased only 0.60° Celsius. But the scientists now forecast that at the end of the 21st century the average temperature will increase between 2.5°- 5.5° Celsius. As a result, there will be greater impact on the Earth's surface such as ice cap

on the mountains will melt, glaciers will melt in the polar region which will eventually increase the sea level.

Atmosphere is playing a vital role to control the Earth's Temperature. In this field, atmosphere is the roof of greenhouse or the roof of glass wall of the glass house. Sunshine is the main source of heat and energy of the earth. The earth's surface absorb the incoming sunshine that reaches the earth which eventually warms the environment. Various activities of human beings such as burning of wood and coal, cutting tree, smoke of the factories, increase carbon dioxide (CO_2), methen etc. in the atmosphere. These gases are called 'Greenhouse' gas, gradually it creates a thick gas layer in the atmosphere. For this reason, heat from the earth surface cannot go back again into the atmosphere. The amount of absorbsion of heat increases and gradually the temperature rises. The heating process is known as 'Greenhouse' impact or reaction.



Fig. 5.10 : Greenhouse

In the polar region, polar heat is kept confined within the glass house and vegetables are cultivated in it and that is why it is called 'Greenhouse' (fig. 5.10).

Activities of man led to the increase of certain greenhouse gases which is one of the cause of global warming. This is known as the greenhouse effect. Carbon dioxide and Nitrous oxide, Methane gases are responsible for global warming. Industrialization, increase of transport, deforestation, and agricultural extension are some of the causes which increased the amount of harmful gases in the environment. Due to global warming higher rainfall, too much flood, strong cyclones, drought can cause climate change in Bangladesh. Conservation of environment and sustainable development techniques can save the world as well as Bangladesh and other low lying countries of the world from the

Task : Find out the latest information on climate change of the world from greenhouse effect by browsing in the internet at school or home.

Effect of climate change

The pattern of climate in the world is gradually changing. Normal seasonal pattern is not found in the nature anymore. Drought in rainy season, rainy season in drought, cold air during summer and warm air during winter are some of the unnatural pattern of the climate. According to the scientists, greenhouse effect will be beneficial to some countries like Canada, Russia, Norway, Finland, Sweden and

South America. But 40 percent of the worlds area will suffer where people live in poverty. Along with Bangladesh there are many low lying countries in the world whose coastal areas will be submerged under water. Many coastal cities of the world will be destroyed (fig. 5.11).

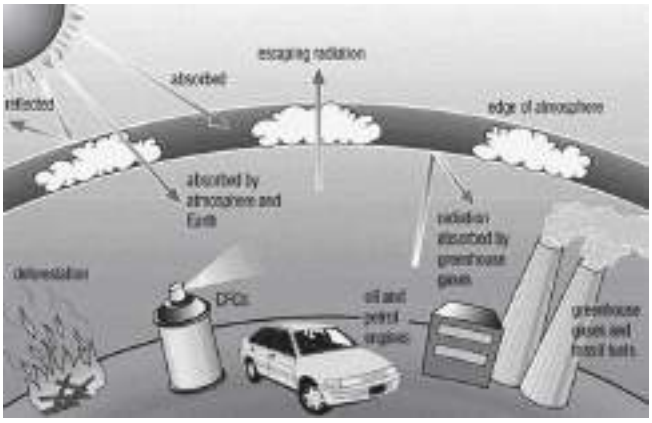


Fig. 5.11 : Greenhouse effect

In the middle of the 21st century 20 percent of the world's population will face misfortune. Sea level will rise in the Pacific region and Asia which will change the nature of climate. Tidal wave may destroy the crops, sweet water will be polluted, saline water will enter inland, forests will be destroyed, wild animals will decrease and the people of the country will migrate to other region of the country as climate refugee. In Bangladesh people living in low lying coastal areas will be the first victims.

Worldwide greenhouse effect will create an upheaval and chaos in the developed and the developing world in social, economic and political sectors. Developed countries will feed the animals with their excess production of food crop and the people of the developing countries will suffer in starvation and become refugees crossing the borders of their own country. In the meantime economic recession in many countries is going on. In the developing countries majority of the poor is leading a life below poverty line. Bangladesh is not different from them. In India, Pakistan, Indonesia, Malaysia and China the pattern of climate is drastically changing in the recent time. In Australia, summer is getting long and the winter is becoming more rainy.

Task : Each student may Make a list of misery due to climate change in different regions of the world.

Impact of climate change in Bangladesh

Developing countries of the world already started suffering due to global warming and climate change. Natural disaster has already started in Bangladesh. In the near future the intensity will increase. According to UN forecasting, in the next 50 years if the sea level rises 3 feet a large part of the coastal area of Bangladesh will go under water which will be around 17 percent of the land surface. Approximately 3 crore people will lose their cropping land and home and become a climate refugee.

According to the information of International Panel on Climate Change (IPCC) by 2030 the river flow will drastically reduce, which will result in water scarcity by 2050 and 100 crore people will be affected. Due to high temperature frequent floods, storms, drought and sea level rise, Bangladesh is experiencing some of the weather disturbances now and the intensity will rise in future.

According to ADB (Asian Development Bank) report, if the present trend of global warming continues till 2050 crop production in South Asian countries will drastically reduce. Impact of climate change will directly affect more than 150 crore people of South Asia of food and water. It has been predicted that due to global warming at the end of this century farming in the world will decrease between 20%-40%. According to the research of the economists of MIT (Massachusetts Institute of Technology), the global warming will increase the gap between rich and poor countries.

In 2009 the World Bank has pointed out 5 risky areas for global warming. These are: desertification, flood, storm, sea level rise and uncertainty in the agriculture sector. According to The World Bank there are 12 countries in the world which have the possibility of all hazards and Bangladesh is one of them. (Table 2).

Table 2 : List of 12 countries in 5 category of global warming risk

Desertification	Flood	Storm	Sea level rise	Uncertainty in the Agricultural sector
Malawi	*Bangladesh	Philippines	Low Island	Sudan
Ethiopia	China	*Bangladesh	Vietnam	Senegal
Zimbabwe	India	Madagascar	Egypt	Zimbabwe
India	Cambodia	Vietnam	Tunisia	Mali
Mozambique	Mozambique	Moldova	Indonesia	Zambia
Niger	Laos	Mongolia	Mauritania	Morocco
Mauritania	Pakistan	Haiti	China	Niger
Eritrea	Sri Lanka	Samoa	Mexico	India
Sudan	Thailand	Tonga	Myanmar	Malawi
Shad	Vietnam	China	*Bangladesh	Algeria
Kenya	Benin	Honduras	Senegal	Ethiopia
Iran	Rwanda	Fiji	Libya	Pakistan

Source : World Bank, 2009

In 1992, one of the organizations of United Nations named UNFCCC (United Nations Framework Convention on Climate Change) decided to organize a conference of the

world leaders on world climate every year. Its main aim is to resolve the problems of the change of world climate. This conference is precisely called as COP (Conference of the Parties).

A three page Memorandum of Understanding (MOU) was recognized as a note in the world climate conference of the United Nations in 2009 in Copenhagen, the capital city of Denmark. It was decided in that MOU to limit the rise of temparature within 2° Celsius at the end of this century, in order to face the situation out of climate change and a fund of three thousand dollar for the years 2010-2012 was also mentioned. The money of climate fund would be spend for aforrestation, hand over of technology and achieving sustainability. As a result, developing countries like China, India, Brazil and other than poor countries should get the money from this fund. The United Nations has mentioned this as political understanding.

Task : From the table 2 find out the position of Bangladesh in Asia among 12 countries in the list of five categories of risk.

Sample Questions

Multiple choice questions

1. In which layer of the atmosphere does argon gas exist?

(a) Stratosphere (b) Troposphere
(c) Exosphere (d) Thermosphere

2. The characteristics of the stratosphere are that it-

i. Contains moist air
ii. Suitable for aviation
iii. Capable of absorbing ultraviolet rays

Which of the following is correct?

(a) i and ii (b) i and iii
(c) ii and iii (d) i, ii and iii

Read the following passage and answer questions 3 and 4:

Ananya and her father traveled to Sylhet. From there, they went to see the Jaintia Hills. They observed rain on one side of the hill from a distance, but not on the opposite side.

3. What type of rainfall did Ananya see?

(a) Convection (b) Meteorology

(c) Cyclone (d) Wind-wall

4. The reason for the lack of rain on the other side of the hill is-

i. Lack of water vapor in the air
ii. Warm and dry air
iii. Change in the direction of the wind flow

Which of the following is correct?

(a) i and ii (b) i and iii
(c) ii and iii (d) i, ii and iii

5. One of the characteristics of monsoon wind is-

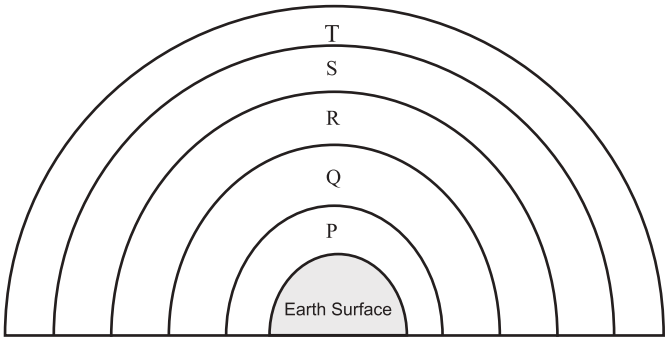
i. It is a regional wind
ii. Seasonal wind
iii. The direction of this wind varies with the winter and summer seasons.

Which of the following is correct?

(a) i and ii (b) i and iii
(c) ii and iii (d) i, ii and iii

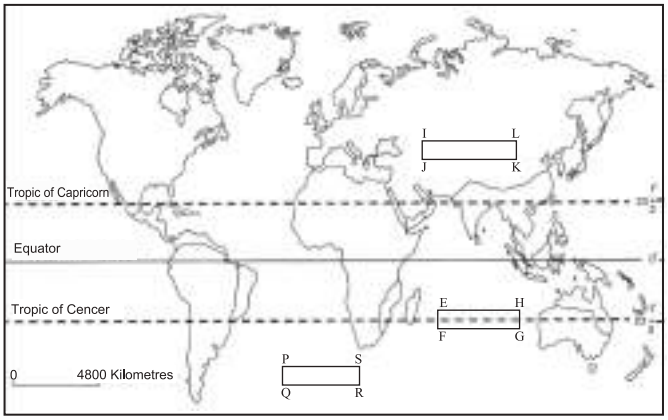
Creative questions

1.



a. What is the atmosphere?
b. Discuss the advantages of having a significant amount of nitrogen gas in the atmosphere.
c. Explain the characteristics of the 'Q' layer.
d. Which is more important for us, the 'R' layer or the 'S' layer? Conduct a comparative analysis of the two layers.

2.



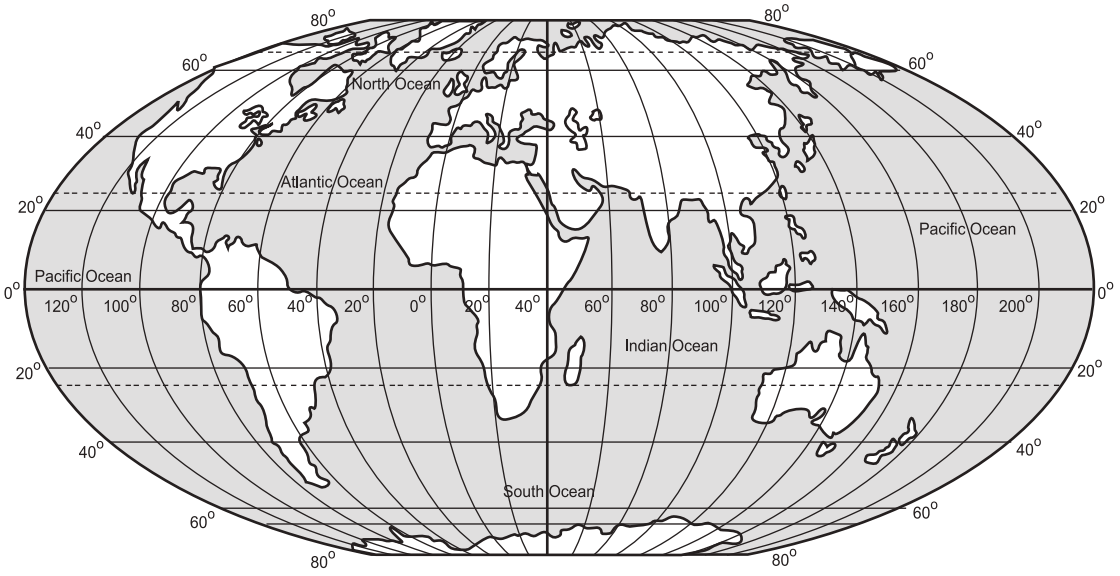
a. What is meant by Khamsin wind?
b. Explain Ferrell's formula.
c. Explain the wind flow prevailing at the location 'EFGH' on the map.
d. Do the wind speeds at the locations 'IJKL' and 'PQRS' match? Share your analysis.

Short-answer questions

1. What is extreme weather?
2. In which layer of the atmosphere do meteors burn up? Explain.
3. Explain the layer of fog formation.
4. What is saturated air?
5. What is meant by rain shadow?

Chapter Six
Hydrosphere

Our knowledge regarding hydrosphere is limited. Since the number of population all over the world is increasing day by day at an alarming rate with a decreasing rate of resources on the land/biosphere, people are attracted towards the hydrosphere rapidly. The reason behind this is the multidimensional structure of the ocean floor and its abundant natural resources.



Hydrosphere of the earth

At the end of this chapter, we will be able to–

- explain the concept of hydrosphere;
- describe oceans, seas and bays;
- describe the topography of ocean floor and marine resources;
- explain the causes and effects of ocean currents;
- explain the causes and effects of low and high tide.

Concept of hydrosphere

'Hydro' means water and 'sphere' means the portion. It is known to all that water exists all over the world. This huge volume of water exists in different parts of the world in different forms – solid (ice), gasious (water vapour) and liquid. Water exists in the atmosphere as a form of water vapour, on the surface as solid and liquid and beneath the surface as liquid form. So, hydrosphere indicates the distribution of the volume of water (Table 1). Oceans hold about 97 percent of total volume of water (oceans, seas and bays). Rivers, glaciers, ground water, lakes, soils, atmosphere and biosphere contain only 03 percent of water. The total volume of water of the earth can be divided into two types, such as salt water and fresh water. Salt water exists in all the oceans, seas and bays and fresh water in rivers, lakes and under ground.

Table 1 : Distribution of water and its percentages

Name of location	Volume (M^3 × 1,00,000)	Percentage (%)
Ocean	1370	97.25
Glacier	29	2.05
Ground Water	9.5	0.68
Lakes	0.125	0.01
Soil Moisture	0.065	0.005
Atmosphere	0.013	0.001
River	0.0017	0.0001
Biosphere	0.0006	0.00004

Ocean, sea and bay

The vast and open body of salt water of the hydrosphere is identified as ocean. There are five oceans in the earth known as Pacific ocean, Atlantic ocean, Indian ocean, Northern/Arctic ocean and Southern/Antarctic ocean (fig. 6.1). Pacific ocean is the largest and deepest among the oceans (Table 2). Atlantic ocean is characterized

with deep coastline and it creates a number of enclosed seas. Indian ocean is encircled with Asia and Africa. The Southern ocean is located in between 60° north latitude and the glaciers of the Antarctica. Antarctica continent is located in the south of Southern ocean that is covered with ice round the year. Arctic sea is located in the northern part of north pole and is encircled with land mass.

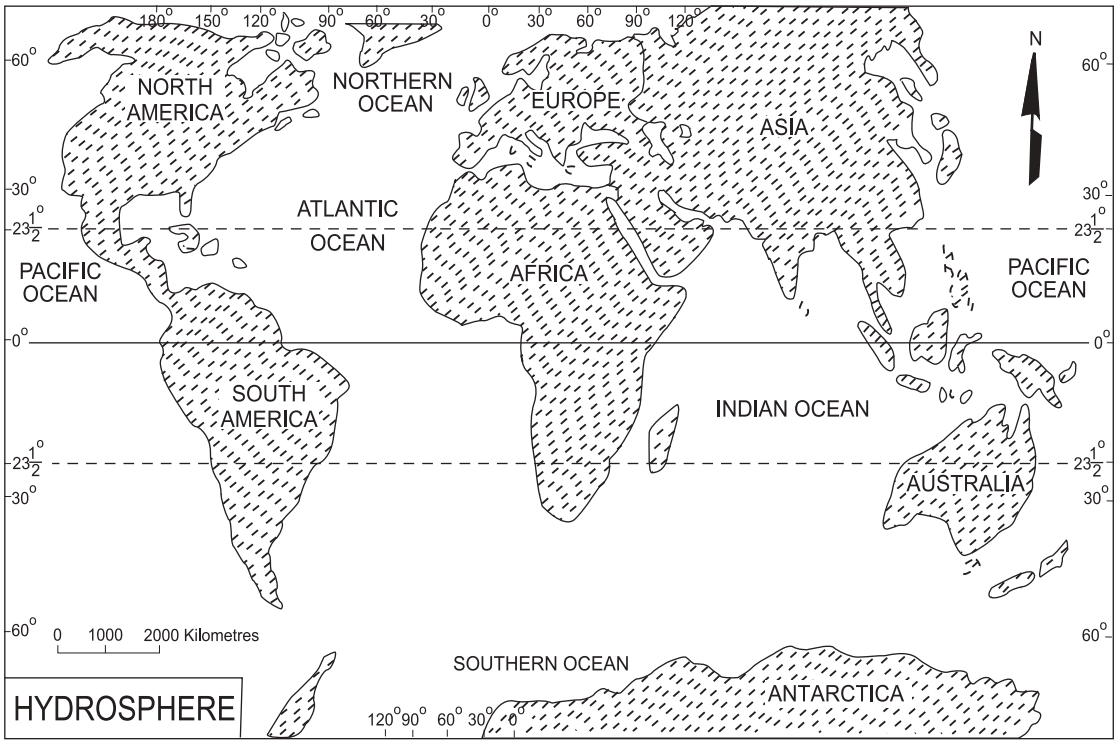


Fig. 6.1 : Location of ocean in the world

Table 2 : Area and average depth of the oceans

Oceans	Area (square kilometres)	Average Depth (metres)	Location
Pacific ocean	16 crore 60 lakh	4,270	Between Asia and America
Atlantic ocean	8 crore 24 lakh	3,932	America, Europe and Africa
Indian ocean	7 crore 36 lakh	3,962	Africa, India and Australia
Northern ocean	1 crore 50 lakh	824	North pole
Southern ocean	1 crore 47 lakh	149	Between 60º north latitude and the glaciers of the Antarctica

Seas are comparatively small, in volume of water than oceans. Mediterranean sea, Red sea, Caribbean sea, Japan sea are the notable seas of the world.Water bodies enclosed by land in three sides but open with a wide mouth in one side is called a Bay. Examples are Bay of Bengal, Persian bay, Mexican bay etc. Water body surrounded by land is called a Lake. Such as the Lake Baikal of Russia, the Lake Superior in between the United States of America and Canada and the Lake Victoria of Africa.

Task : Indicate the location of the oceans in world map with a pointer to your class mates.

Topography of ocean floor and marine resources

The ocean floor is as rough as the surface of the earth. The reason behind this is the presence of volcano, ridges, highlands and trenches beneath the seas. By means of sound wave the depth of the seas can be measured. This sound wave can be traveled through water under 1,475 metres deep and come back again. The instrument named Fathometre is used to measure the depth. The land configuration of the ocean floor can be divided into five classes (fig. 6.2) such as :

1. Continental shelf
2. Continental slope
3. Deep sea plains
4. Oceanic ridges
5. Oceanic trench

1. Continental shelf : A submerged border of a continent that slopes gradually and extends to a point of steeper descent to the ocean bottom can be identified as a continental shelf. The depth of the shelf is generally limited to water shallower than 150 metres. The general gradient of the shelf is 1°.

The average width of continental shelf is 70 kilometres. The innermost part of continental shelf is called the Littoral Zone. The width of the continental shelf varies considerably. It depends on the ruggedness of the coast. If the coast represents a vast plain then it creates a wide continental shelf. The presence of hills or plateaus make the continental shelf steeper. Because of the existence of vast plain at the north of Europe, the continental shelf of Arctic ocean is very wide (about 1,287 kilometres). But the widest continental shelf is located at the north-western part of Europe. The second widest northern part of the continental shelf can be seen at the eastern coast of North America. The western part of the coast is much narrower than the east. This is only because of the existence of folded Rocky mountain. Since the major part of the continent of Africa is like a plateau, the eastern and western continental shelves are very narrow.

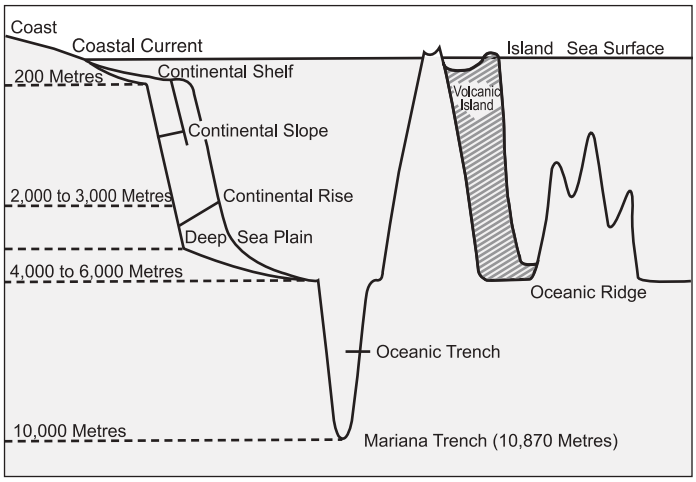


Fig. 6.2 : The submarine relief

The reason behind the formation of continental shelves is the subduction of continental margins or the variation of sea level. Besides these, wave actions also help to produce continental shelf.

2. Continental slope : The continental shelf is linked to the ocean floor by a steep slope known as the continental slope. The slope descends steeply almost to the bottom of the ocean. The depth of the continental slope starts from 200 metres and stretches up to 3,000 metres. Because of its steepness this portion of ocean floor is not wide like the continental shelf. The average width varies from 16 to 32 kilometres. The surface of continental slope is not smooth. Oceanic trenches produce the rough surface. The deposition of corals and sediments can be found in gentle sloping areas of continental slope.

3. Deep sea plains : The deep sea plains are broad and almost plain that extend from the margin of continental slope. The average depth is 5,000 metres. The deep sea plains are not flat as was formerly thought. This is because of the presence of a huge number of highland and trenches on the deep sea plains. In certain areas volcanic peaks rise steeply from these plains, and sometimes reach the surface as isolated islands. Landforms produced by submarine volcanic activities or by folding and faulting tend to keep their original form.

4. Oceanic ridges : Volcanoes can be found under water of the seas. Mid-oceanic Ridges are found in places where the earth's tectonic plates are in constant motion. When two adjoining tectonic plates in motion produce a gap the uprising magma fills the gap, so that new oceanic crust is formed. Mid-Atlantic ridge is a well known submerged oceanic ridge.

5. Oceanic trench : Narrow topographic depressions can be found in sea floor. This type of narrow, elongated, v-shaped depression in the ocean floor is known as oceanic trench. Trenches have formed when two plates come into contact and the denser of the two sinks below the other plate. The average depth of the trenches is above 5,400 metres.

Most of the trenches can be found at the western part of the Pacific ocean. Mariana is the deepest trench which is located 322 kilometres south-west of Guam island in the western Pacific ocean. The average depth of Mariana trench is 10,870 metres and is the deepest trench of the world. Other notable trench are Puerto Rico Trench in Atlantic ocean (8,538 metres) and Sunda trench in Indian ocean.

Task : Write down the characteristics in the table (in groups).				
Continental shelf	**Continental slope**	**Deep sea plains**	**Oceanic ridges**	**Oceanic trench**
•	•	•	•	•
•	•	•	•	•
•	•	•	•	•

Ocean currents

The regular movement of water from one part of the ocean to another is called Ocean currents. Ocean currents are mainly caused by the difference of density of sea water and wind force. A change in density is due to the variations in temperature and salinity. Ocean currents can be classified into two types based on temperature such as : A. Warm currents and B. Cold currents (fig. 6.3).

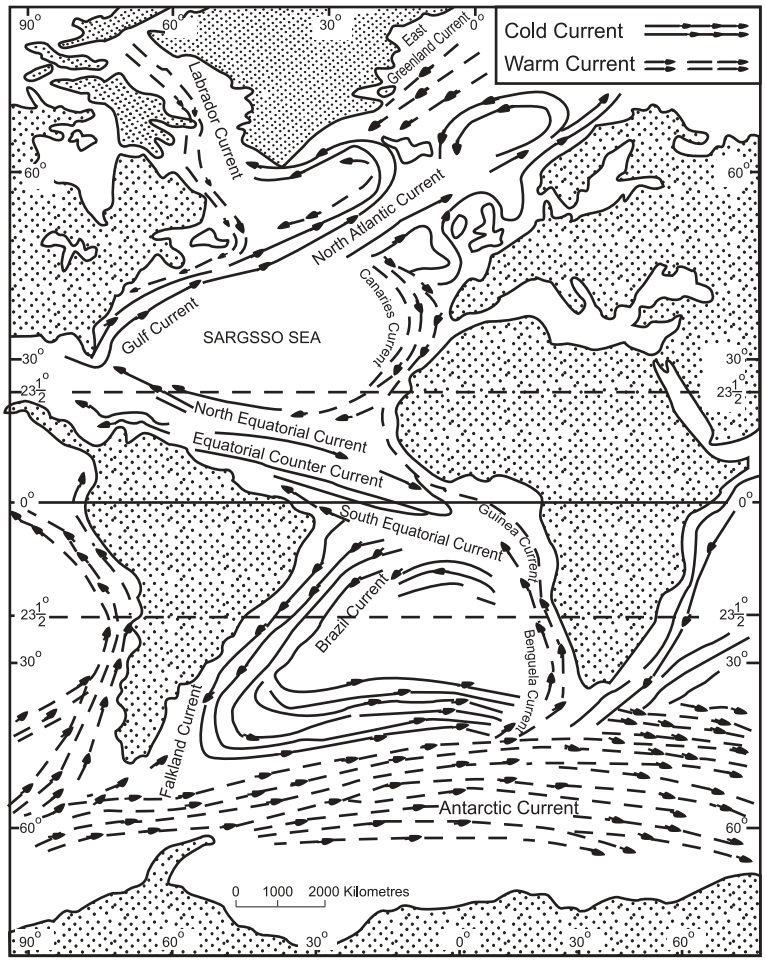


Fig. 6.3 : Warm and cold currents of Atlantic ocean

A. Warm currents : The temperatures are higher at the Equator than that of Poles. The water in the ocean near the Equatorial region is heated more than the Polar region. The warm waters of the Equatorial regions are light and move along the surface towards the Polar regions which is called the Warm currents.

B. Cold currents : The cold current originates from the Polar region. The cold water is dense and heavy. It sinks downwards from the surface and moves slowly towards the Equator is called the Cold currents.

Causes of ocean currents

1. Planetary winds : Circulation of planetary winds is the prime cause of ocean current. These winds control the direction and speed of ocean currents. Trade winds, Westerly's and Polar winds create the major ocean currents (fig. 6.4).

2. Rotation of the earth : Earth's rotation results in the Ferrel's Law which also influences ocean currents. This phenomenon causes ocean currents in the Northern Hemisphere to bend to the right and in the Southern Hemisphere to the left.

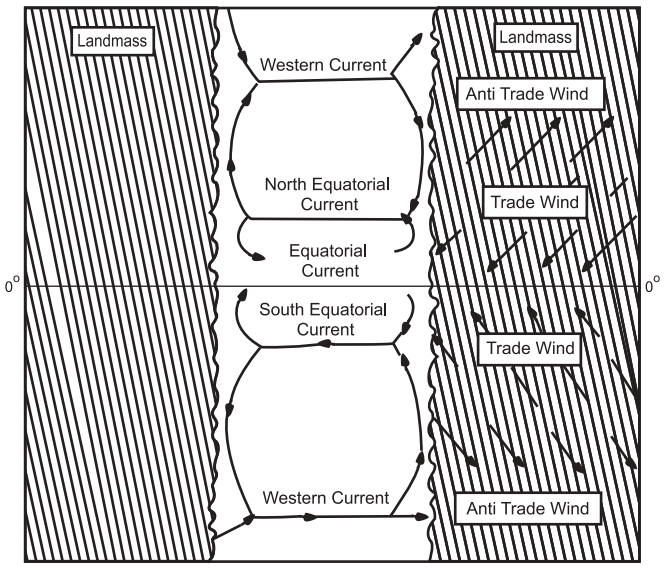


Fig. 6.4 : Impact of wind on ocean currents

3. Variation of ocean water temperature : Variations in temperature produce equatorial warm water and flows toward the poles as surface warm currents. On the other hand, cold and dense water flow from the poles to the equatorial region as cold under currents.

4. Melting of polar ice caps : Melting of polar ice caps expands the volume of water that lessens salt in the water. This less salty water helps to generate ocean currents.

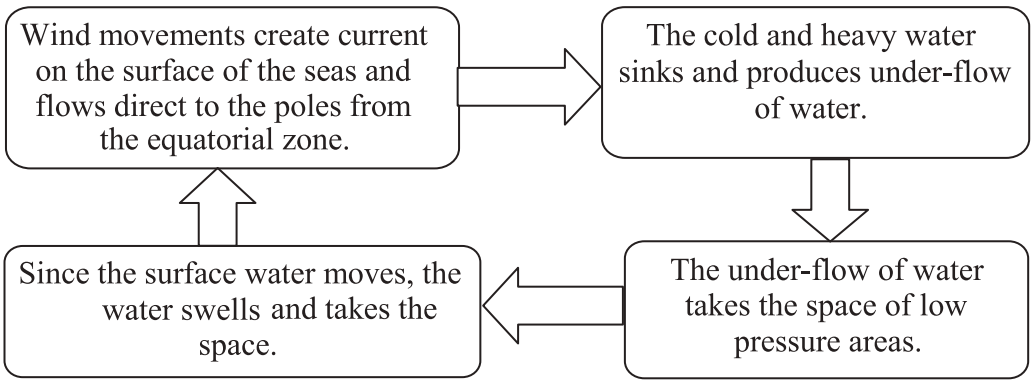
5. Variation of ocean depth : Temperature of ocean water depends on the variation of ocean depth. The water volume in shallow depth warms quickly and swells up. Then the deep sea water cools and go downward. These produce warm and cold ocean currents. The speed of surface flow is very high. The speed of ocean current decreases below 100 metres.

6. Density of water caused by salt : Salty water is denser than less salty water; cold water is denser than warm water. Less dense water tends to rise while denser water tends to sink.

7. Existence of land mass : The existence of continent, islands and any other land mass protect, lessen and divert the flow of water. In most of the times this bifurcates ocean currents.

Influence of ocean currents

The influence of ocean currents is important for different reasons. The direct effects of ocean currents is much higher on climate and trade in different regions of the earth.



Flowchart : Surface and deep ocean current together produce convection current that results the movement of water in the oceans.

1. Influence of warm ocean currents : Warm ocean currents increase the temperature of any area. So, cold regions can be found warmer if warm ocean current passes through that area. The ports can be usable round the year in those areas, such as, Norway and the west coast of British islands are free from frost during winter for warm gulf current. But, the east coast of Canada is covered with ice having the same latitudinal location.

2. Influence of cold ocean currents : Winds blowing from a cold ocean current bring down the temperatures in places, which would have been much hotter. The California (cold) current, which flows along the western coast of USA, makes the region much cooler than other places in the west coast at the same latitude.

3. Influence on transportation : Boats and ships can easily sail to the direction of ocean currents. Warm ocean currents helps transportation rather than cold ocean currents. North Atlantic ocean current help the major transportation routes in the world. Extreme cold and icebergs is a barrier for movements of ships in cold ocean currents. Ships sailing with a current gain speed, which helps to save fuel and time. Ships moving against a current have less speed. Warm currents keep the Arctic regions free from icebergs, which can be dangerous for ships.

4. Influence on weather : Surface currents are warm which carry water vapour. This warm current makes heavy rainfall over the coasts. For example, the Gulf Stream makes the north-west Europe much more temperate than any other regions in the same latitude and makes heavy rainfall there. On the other hand, cold ocean current makes the winds moisture free and produces less or no rainfall. For example, this may create cold desert like Atakama in South America. This desert is due to the cold Peruvian current.

5. Fog and storms : Variation of temperature can be found in small areas where warm and cold ocean currents merge. Fog and cyclone can form storms in this area. The movements of ships and air plane can be difficult. For example, the merging of cold Labrador current with warm Gulf current in the eastern coastal area of North America and the merging of cold Kamchatka and Bering current with warm Japan current make bad weather conditions.

6. Creation of under water plateau : Warm currents melt the iceberg that results the deposition of existing sands, grains and stones under the water. For a long time the process makes under water plateau and highlands. Grand Bank of Newfoundland, Dogger Bank of coastal British islands are the true examples.

7. Influence on commercial fishing : Places where cold and warm currents meet are ideal breeding grounds for Planktons. These are very small organisms, which are foods for fishes. These regions support a great number of fishes. They have developed into major fishing grounds of the world. Newfoundland on the eastern coast of North America is the meeting point of the Gulf Stream and the Labrador Current. It is one of the major fishing grounds of the world.

8. Incidence from iceberg : The iceberg that float on the cold ocean currents hamper the free movement of ships. For example, the famous ship of United Kingdom 'Titanic' sunk into the water in its maiden voyage colliding with an icebarg.

Causes of high and low tide

There are two prime causes of tides. These are : 1. The gravity of the sun and moon and 2. Centrifugal force produced from rotation of the earth.

1. The gravity of the sun and moon : When the Sun and Moon are aligned with the Earth, water levels in ocean surfaces fronting them are pulled and subsequently rise. The Moon, although much smaller than the Sun, is much closer. Now, gravitational forces decrease rapidly as the distance between two masses widen. Thus, the Moon's gravity has a larger effect on tides than the Sun. In fact, the Sun's effect is only about half of the Moon's.

2. Centrifugal force produced from rotation of the earth : The centrifugal force produced from the rotation of the earth draws away from the centre of rotation. The creation of tides also at the opposite of high tides (fig. 6.5).

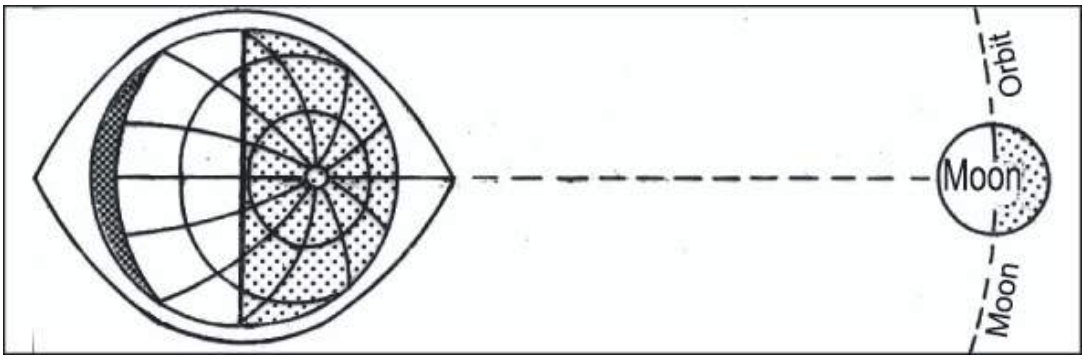


Fig. 6.5 : Influence of centrifugal and gravitational force of the earth

High tide : A high tide can be defined as the cyclic rise and fall of sea level caused by the gravitational pull of the sun and moon. There are usually two high tides and two low tides in each lunar day.

Low tide : Low tide refers to the movement of the high tide out to the sea. In other words, it is the time during the tidal period when the high tide is falling.

Effects of tides

Tides have a vast influence on human life. The following effects can be exerted by tides on the coastal countries of the world.

1. Tides can bring all the river wastes collected from lands and fall into the oceans.
2. The occurrence of tides twice a day causes no siltation and wastes can be deposited in the estuaries.
3. Tides can deepen the passage of the rivers through undercutting.
4. Hydroelectricity can be produced by creating dams on the tidal rivers.
5. Tides facilitate irrigation and ultimately help the agricultural sector.
6. In Polar Regions the salty ocean water enters into the lands through rivers that help to free the flow of river water.
7. Tides help the free movement of vessels that generate trades. During tides the estuaries get sufficient water that helps the vessels to enter into the lands. During tide the vessels can go out from the inland rivers to the ocean. Patenga and Mongla, the two prime ports of Bangladesh like other coastal river ports, operating the activities tuning with the tides.
8. During full moon, tidal surge can submerge boats, ships and might be the cause of the loss of lives and properties.

Marine resources of the Bay of Bengal

The 716 kilometres long coastal region of Bangladesh along the Bay of Bengal is full of marine resources. It has 442 near shore fish species, 336 species of Mollusks, 19 species of prawn, crabs, mangrove forest including other marine vegetations. Nuclear minerals like Zircon, Monazite, Ilmenite, Magnetite, Reolite and Leucoxene have been found in the coastal zones of Cox's Bazar.

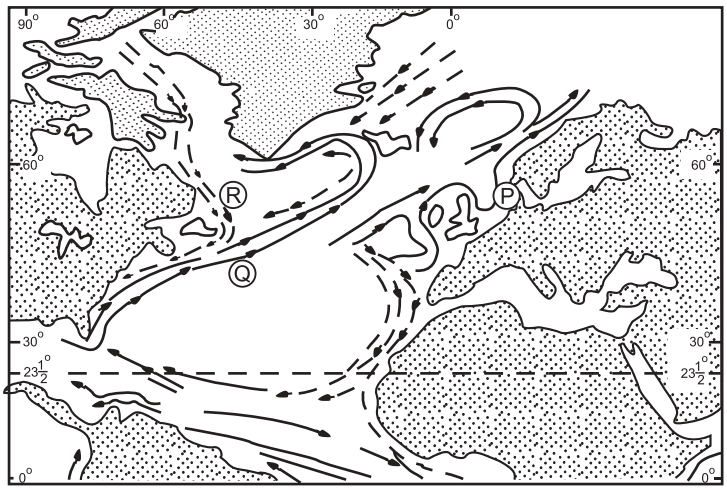
Sample Questions

Multiple choice questions

1. What is an iceberg?
   (a) Ice frozen in Antarctica
   (b) Ice frozen in Greenland
   (c) A large iceberg floating in the ocean currents
   (d) Ice frozen on the peaks of the Himalayas

2. The depth of the ocean is related to:
   i. Temperature
   ii. Ocean currents
   iii. Salinity
   Which of the following is correct?
   (a) i and ii (b) i and iii
   (c) ii and iii (d) i, ii and iii

Answer questions 3 and 4 by examining the map below:



3. Why can ships navigate the current area marked 'P' throughout the year?
   (a) For the depth of the sea
   (b) For the broken coast
   (c) For the warm current
   (d) For the power of the ship

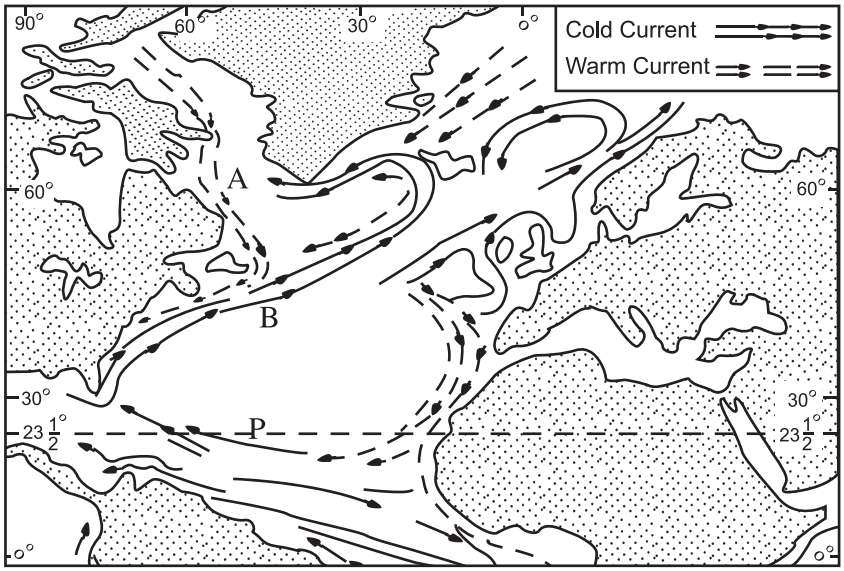
4. The combination of the currents 'Q' and 'R' creates-
   i. Igneous current
   ii. Icecap
   iii. Iceberg

Which of the following is correct?

(a) i and ii (b) i and iii
(c) ii and iii (d) i, ii and iii

Creative questions

1.



a. What is the sea?
b. What causes the east coast of Canada to be covered with ice? Explain
c. Explain how the water flow at the place marked 'A' will affect the land.
d. Analyze the potential effects on trade in the area if the water at the locations marked 'P' and 'B' fails to circulate.

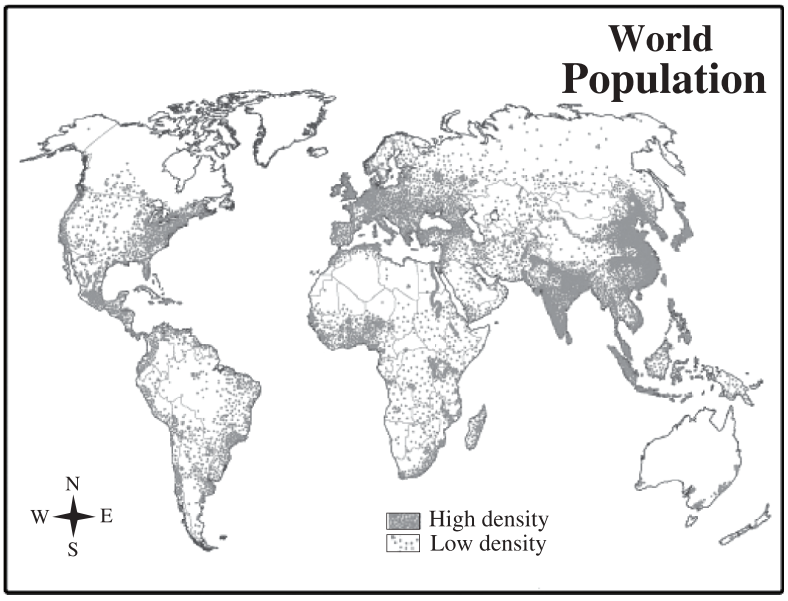
Short-answer questions

1. What is an oceanic plateau?
2. What is a deep-sea plain?
3. Why is the region near the Labrador Islands covered with ice year-round?
4. What is the hydrosphere?
5. Describe the effects of warm ocean currents.

Chapter Seven

Population

This world has seen a rapid growth of medical science, resistance against contagious diseases, invention of antibiotics, nutritious foods, healthy environments, use of safe drinking water and spread of education. As a result, neo-natal and child mortality rate has decreased. Life span of people has increased. Though birth rate slightly dropped in the developed countries, it has not decreased in the developing countries. For this, world population is rapidly increasing. Population has great impact on economic activities. Development is next to impossible without moderate labour power. On the other hand, overpopulation stands as a bar in economic flourishment. Natural, economic, political and geographical factors are responsible for turning different parts of the world populous or sparsely populated. Increase of population is a worldwide problem at present. This problem is deepening day by day.



Density of the world population

At the end of this chapter, we will be able to–

- explain the world population at present and its changing pattern;
- explain factors related to the change of population;
- explain factors, merits and demerits of migration;
- gather knowledge about the merits and demerits of migration and provide information to others about its;

- explain the relationship between rate of population and the natural resources;
- explain the density and distribution of population;
- discuss the factors of density and distribution of population;
- explain the growth of population of Bangladesh, its problems and its solution;
- provide solution to reduce the population growth.

Current population status and changing pattern

From the beginning of the Christian era till 1500 A.D. the world population increased very slowly and later increased gradually. Change of population through time is known as natural increase.

According to UN Convention, countries of the world has to conduct national census in every ten years. The modern census was first introduced in 1655 and gradually majority of the countries of the world have conducted national census. In 1650 total population of the world was 500 million, in 1850 it increased to 1.2 billion. After industrial revolution in the 1850's development of industries and improvement of agriculture led to the growth of population.Within one hundred years the population was double. In 1950 total population of the world was 2.53 billion which now increases to 8.06 billion in 2023. If this rate of increase continues, by 2030 the estimated population will be more than 8.60 billion (fig. 7.1).

World Population Change

Year	Population growth rate (Billion)
1950	2.53
1960	3.03
1970	3.69
1980	4.45
1990	5.32
2000	6.13
2010	6.92
2023	8.06

Source : UN, Dept. of Economic and Social Affairs, Population Division, 2023

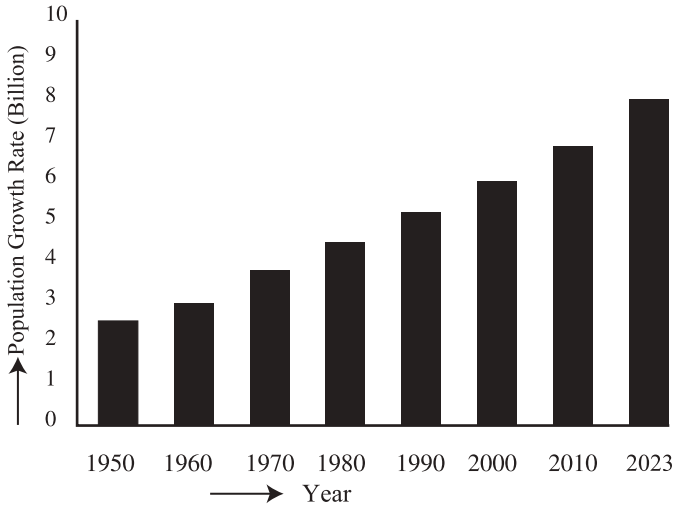


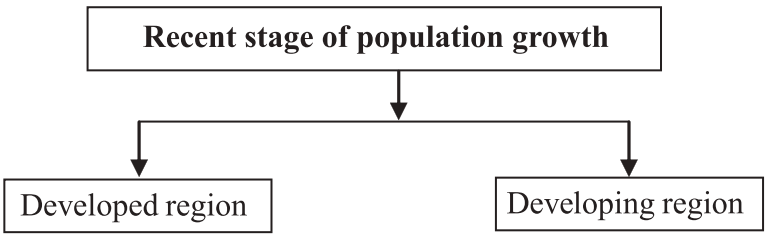
Fig. 7.1 : World Population growth trend 1950-2023

From the table and figure given above the population growth trend can be classified into three phases.

Initial stage : From the earliest times till 1650 A.D. is known as the initial stage. At this time total world population increase rate was very low, because both death rate and birth rate were very high.

Middle stage : The period between 1650 A.D. and 1950 A.D. is known as the middle stage of population growth. In the middle stage death rate declined but birth rate was high which resulted in very rapid increase of population. In Africa, Asia and South America population growth rate was low as the birth and death rate were very high. At the begining of this stage population growth was slow but at the end, it grow rapidly.

Recent stage : After 1950-2020 is the recent stage. In the last few decades the population has increased rapidly in the world, but on the basis of region two trends have been found.



Developed region or developed countries : In this region population is stable as population growth decreased due to low birth and death rate. Displayed population structure shows that the base of the structure is narrow, middle part is wide and the top is narrow (fig. 7.2). In developed region male/female population growth is nearly the same and dependent population is less than that. Number of active population is high and so the work force is high. Generally, population in the age group of 0-18 years and over 65 years are considered dependent population. The rest are known as active population.

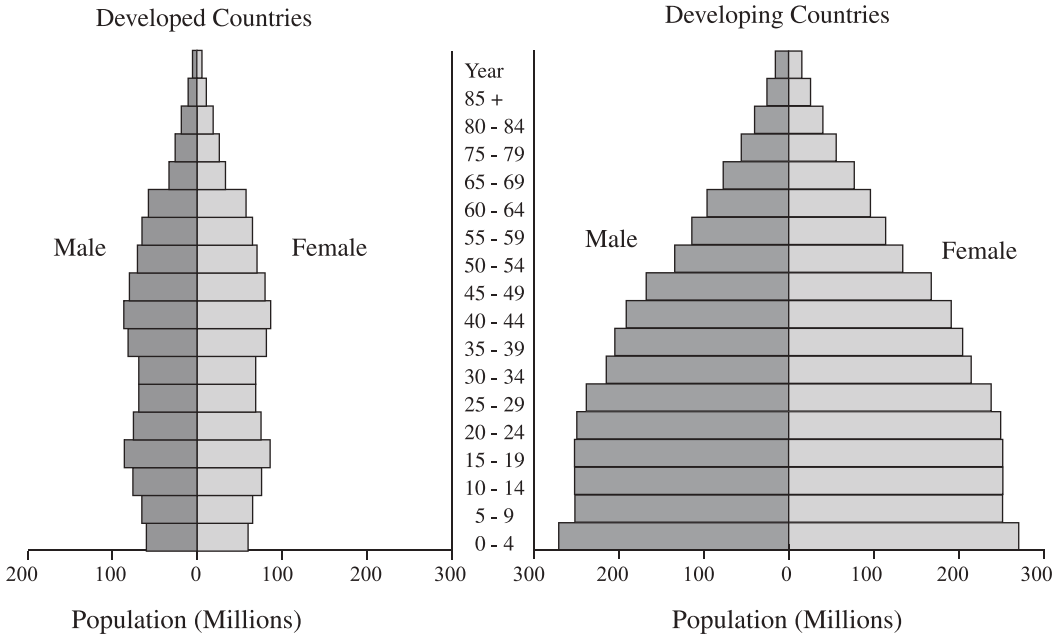


Fig. 7.2 : Population structure

Developing region or developing countries : In developing country of the world, population growth rate is still very high. In the last few decades in the developing world the death rate decreased but the birth rate did not decrease as such . The population structure of these countries has a very wide base and a narrow top (fig. 7.2).

Population structure : Age specific male/female distribution shown in a triangular shape graph is known as population structure. The left side of the vertical axis shows the male population and right side shows the female population. Graph that shows the population structure is known as population pyramid.

The number of children and aged population is very high in the total population and as a result the size of the dependent population is high. Active population is relatively low and so those countries' economies are poor.

Task : Write down the characteristics of population growth in the given table.

Initial stage	Middle stage	Recent stage

Factors of population change

If you observe in your family or in the neighbourhood, you will see that in the last few years some changes in the number of population has taken place. For example, some babies were born (birth), some died (death) and some went to other places due to job or marriage (migration).

The three factors of population change birth, death and migration are known as population dynamics. Population is a very dynamic factor. Birth, death and migration change population structure of a country which eventually has an impact on society and economy.

Birth rate

The birth rate in the number of live babies born in a year for every 1000 people in the total population. Child bearing capacity/fertility of women ranges between 15-45 or 15-49 years of age.

$$\text{Birth rate} = \frac{\text{Number of children born in a particular year}}{\text{Number of fertile women in a particular year}} \times 1000$$

Crude Birth rate

But crude birth rate is a more acceptable method. It is calculated by following formula.

$$\text{Crude birth rate} = \frac{\text{Total number of children born in a year}}{\text{Mid year total population}} \times 1000$$

Fertility of population differs from region to region in the world. Countries have different types of birth rate. Usually socio-economic condition is the main factor. Factors responsible for birth rate are given below :

1. **Marital characteristics :** Age of marriage, polygamy and divorce have influence on birth rate.
2. **Education :** General education decreases the fertility and lilliterary increases it
3. **Profession :** People like doctors, engineers, administrators and managers have low birth rate. On the other hand, farmers have high fertility rates.

4. **Rural-urban residence :** In rural areas birth rate is high and in urban area it is low.

Birth rate variation is a social matter. Society, societal status, geographical location, economic status, marriage, religious sentiment, education, culture are related to fertility and the birth rate.

Mortality : The death rate is the number of people in every 1000 who die each year.

Death rate

Crude death rate : The formula of CDR is given below :

$$\text{CDR} = \frac{\text{Total number of deaths per year}}{\text{Mid year total population}} \times 1000$$

Death rate is influenced by the following reasons :

1. **Natural disaster :** Storm, earthquake, flood, famine are the causes of unnatural death.

2. **War and social violence :** War, social violence and riots increase death rate. Afghanistan, Iraq and people of Palestine have higher death rates.

3. **Disease and accidents :** Epidemic, accidents increase death rate.

Death rate also varies from country to country. Developing nations have higher death rate, but it is low in developed countries. Death rate also varies from gender to gender. Usually women in child bearing age have higher mortality rates in the developing countries. The developing countries also suffer from high infant mortality rates.

Migration

Migration is the movement of people from one place to another to live or to work. Sometimes this movement may only be to the next town or only for a short period of time. Sometimes the movement may be to a different country and the move can be permanent. Migration can be classified into two on the basis of its nature- voluntary and forced migration. Migration are of two types depending on the destination international and internal. People who migrate are known as migrants.

1. Voluntary migration : Voluntary migration is when people choose to move. This is usually because of the 'pull' or attraction of a better quality of life elsewhere, or of a higher standard of living or greater personal freedom.

2. Forced migration : Forced migration is when people have no choice and are made to move. They can be 'pushed' out of a place because of natural disasters or to avoid religious and political persecutions. Those people who are forced to migrate and settle somewhere permanently are known as refugee and those forced migrants wait to return to their home country after sometime is known as emigre.

Task : Sadia's family, Shohag, Robin and many others migrated from Myanmar to Bangladesh in 2018. They are still staying in Bangladesh.

1. What type of migration is it?

2. Who are the refugees here?

3. Who are the asylum seekers here?

You will observe that migration is being occured within the terretory of the country rural to urban or urban to rural. Again, you will see that some people have migrated out of the country to another country. So, according to spatial view migration can be divided into two classes.

1. Internal
2. International

Task : Fill up the table (individual work).

Place of migration	Type of migration
Dhaka to Chittagong	
Dhaka to USA	
Mymensingh to Dhaka	
Bogra to Dhaka	

Factors of migration

Men continue migration for natural, economic, political and social grounds. Millions of people of Bangladesh have migrated to different countries of the world. Think why they have done this.

Pull factors are the causes for which people are inspired or instigated to settle in a new place. The reasons which compel people to leave their old habitation and settle in other places are called push factors. So, the reasons of migration are--

Pull factors

1. To live close to relatives and kin.
2. Employment opportunity and better economic prospect.
3. Education, health, housing and social security benefit.
4. Demand of skilled manpower in the market.
5. Personal benefit to get property from marriage.

Push factors

1. Natural disaster related destruction.
2. Population growth related problem.
3. Social and ethnic problem.
4. Economic recession.
5. Loss in Business and trade.

Merits and demerits of migration

When educated people voluntarily migrate for better quality of life or personal freedom the home country losses a good citizen who could contribute to the country's economy and development. When a less educated, unskilled or skilled labour migrates, he earns more than he earned in his own country. He can save money and send that back to his family. The family members have a better quality life than before. Labour class people bring in money for the country but the educated ones take away the education and money which he gained from the country. So, less educated temporary migrants are better citizens for the country.

Migration is important in the distribution of world population. Apart from location change, due to migration different regions have economic, societal and population

change which is discussed below :

1. Economic impact : People migrate for economic benefit. In the place of origin and destination property ownership, labour wages, unemployment, living standard, balance in trade, economic production and development may change. If a less literate person does not migrate in proper way, he may face economic loss. In the case of international migration people should have proper information about the destination. Information passed on from other people may not be authentic and migrants may face problem in destination and lead to deportation from foreign countries. In the home country the emigrant may have taken loan to go abroad but due to deportation he has to come back without earning which leads to more loss to the country and to the individual also.

2. Social impact : Exchange of social behaviour and pattern takes place for migration. Many types of disease are also spread by migration. Exchange of ideas, views with various types of people and the migration takes place. Migrants accept new culture and way of life which eventually leads to identity crisis of the migrants.

3. Impact on population : Due to migration, population decreases in the place of origin and increases in the place of destination. Educated young, and professional people's migration to the destination bring changes to the population structure. This leads to the imbalance of male female rates. Sometimes educated young migrants do not return to the home country which is a loss for the country. Many countries have low population so they import manpower to utilize their resources properly. These countries are Saudi Arabia, Malaysia and the United Arab Emirates. Developing countries send human resources to the labour market and earn foreign exchange.

Government policy on population : In 2012, a national policy was adopted for the improvement of health, family welfare, and better livelihood of mothers and children. For making small size family, population control, family planning programme were taken into consideration for the overall success of social and national development.

Population density and distribution: Population density refers to the ratio of total population to its total land area of a country. To determine the population density of the world and its various countries, one must know the total population and the area of each country.

$$\text{Density of population} = \frac{\text{Total population}}{\text{Total land area}}$$

Total population of Bangladesh is 16,98,28,911 and its area is 1,47,570 km².

$$\therefore \text{Density} = \frac{16,98,28,911}{1,47,570}$$

$$= 1,150 \text{ people/km}^2$$

From the above data, we learn that if the size of the country is large in relation to population, the density of population may be lower. Again, high density of population puts pressure on land (fig-7.3)

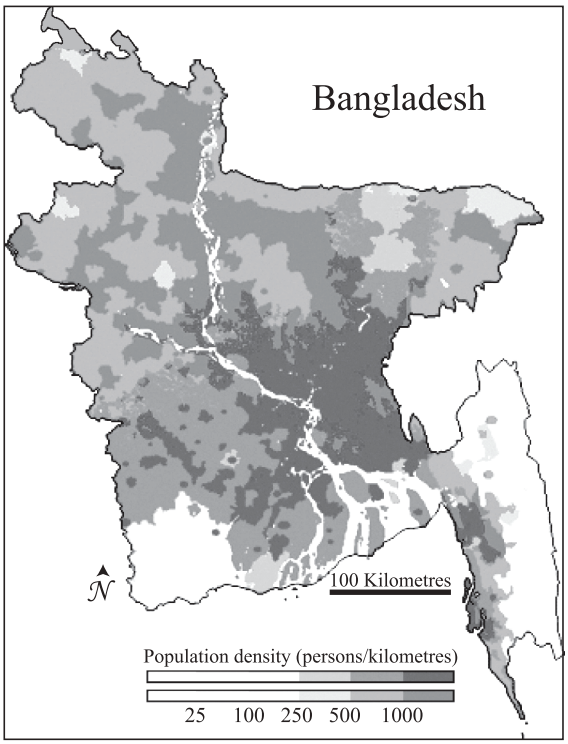


Fig. 7.3 : Population density of Bangladesh

Man-land ratio: Land that is useful to humans and capable of generating resources is called productive land. The man-land ratio refers to the proportion of production land available for human use.

$$\text{Man-land ratio} = \frac{\text{Total Population}}{\text{Arable land}}$$

Actually to understand the population pressure on a country's land, it is necessary to know the man-land ratio rather than just the population density.

Optimum population: A country's balance between total population and man-land ratio is known as the optimum population. As long as the natural resources and population of a country can support a certain number of population , it is the optimum population for that period. When the balance of man-land ratio of a country is unstable , it results in overpopulation somewhere or under population elsewhere.

Overpopulation: When the amount of productive land is low compared to the population , it is called overpopulation. As a result, the total amount of produced resources , as well as the per capita production, becomes low. And that reduces per capita production and consumption.

Under population: Even if the amount of productive land is greater than the population, production is hampered if resources and land are not adequately utilized due to low population. This condition is called under population. For example, countries like Australia and Argentina have fewer population compared to their land areas.

Population distribution: From the variations in population density and size, you can easily understand that the earth's surface is not evenly populated. The spatial distribution or arrangement of population across different places is called population distribution. In some places, there is a dense concentration of people , while in others, there is no human presence at all. Only about 5% of the world's population lives in approximately 50% to 60% of the earth's surface area. Nearly half of the world's population lives in only about 5% of the earth's land area.

Factors of population density and distribution

Population is not evenly distributed all over the country. There are some natural, social and economic reasons for the uneven distribution of population in a country. Factors that influence the distribution of population are divided into two : these are physical factors, non- physical factors.

Physical factors

Physical features : People are naturally attracted to flat low lying lands where soils are fertile, water supply is plentiful and transport linking to other places is good. Relief discourages settlement especially in areas which have high mountains. Dense tropical rain forest have few permanent settlements. In Chittagong Hill Tracts and Sunderbans area density of population is very low.

Climate : People are discouraged to settle down in areas of extreme climate which are very cold, very hot or very wet. People prefer to live in mild climate areas.

Soil : Fertile soil is good for agriculture so people are attracted to areas near the river where plains exist.

Water : Sweet drinking water attracts people. Places along the river is good for settlement and agriculture which is the reason for high density along the river.

Mineral : Population density also depends on the availability of mineral resources.

Non-physical factors

Social: Density of population is high on places where there are availability of food, clothing, housing and employments. Density of population is increasing in countries like Australia and The USA through migration despite having less natural opportunities.

Cultural: Education and culture have deeply influenced people in this age. People crowd in places where pursuit and spread of education and scientific knowledge are more.

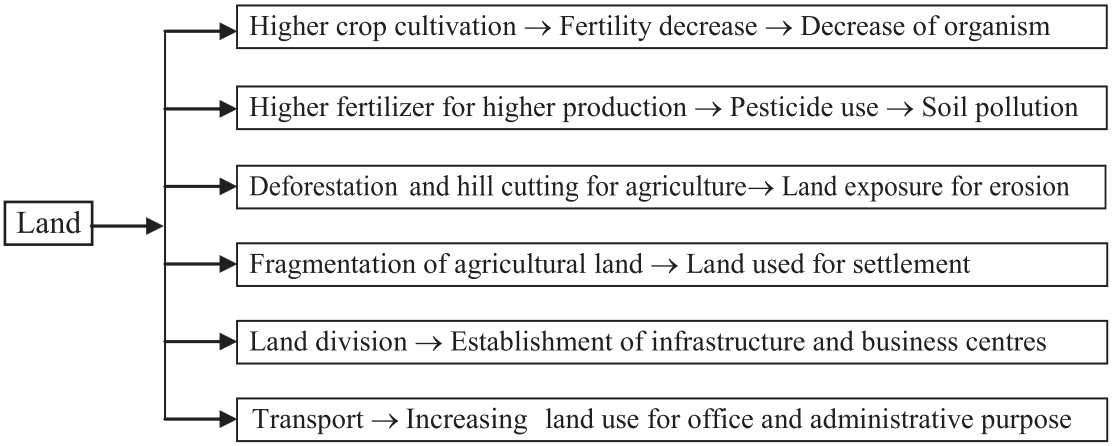
Economic: People tend to concentrate on those industrial areas where employment opportunity is higher and those places genomically advanced. For example, Osaka in Japan, Mumbai in India are the places where density of population is very high.

Impact of excessive population pressure on natural resources

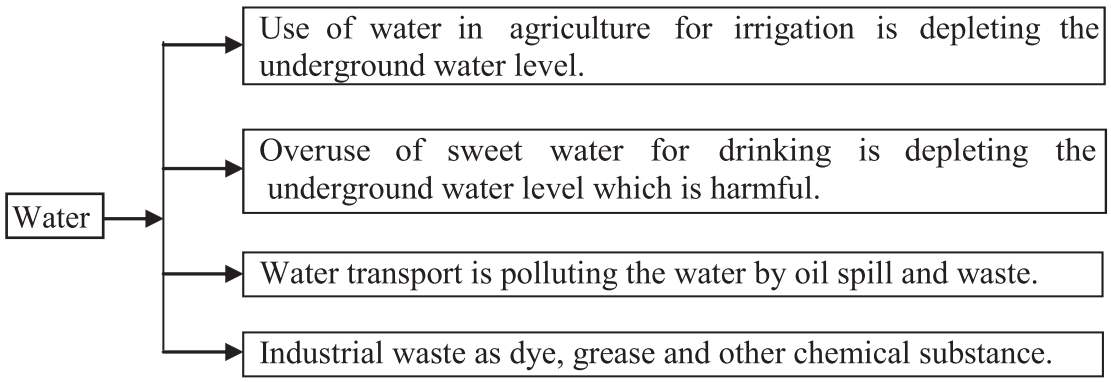
Increasing population raises pressure on land. When the population of a country increases in a limited area, more food is needed. For higher population more land is used for food. Land fragmentation and overuse of land are leading to the decrease of productive lands. Increase of settlement is decreasing open space and water bodies.

Micro-soil nutrients are destroyed. Vegetation does not grow in polluted soil which leads to desertification. So, proper land utilization is necessary to keep a balance between population increase and land resources.

A diagram showing the impact of over population on land resources



Water is essential for human survival. Population increase also affects the water resources. Over use of sweet water and its impact is shown below :



Due to the above mentioned resources marine plants, micro organism and plankton cannot survive and the food chain of small and big fishes is broken and so the marine life is decreasing gradually.

Environmental balance is decreasing due to increase of human settlement, industrial production, hill cutting and deforestation.

Task : Make a chart of your surrounding area by observing the land use, water and forest.

Balance between resources and population is very important for a country's development. Population and resources are the two factors for national development. So, population policy is made for proper utilization of resources for the development of a country.

Current population of Bangladesh problems and solutions

Bangladesh is one of the densely populated countries. According to Bangladesh Bureau of Statistics (BBS), 2019, total population of Bangladesh is 16 crore 55 lacs 70 thousand. Density of population is 1,116 persons per square kilometres. If the present growth rate continues, density of population will increase in future. Population characteristics of Bangladesh are given below :

Population characteristics of Bangladesh

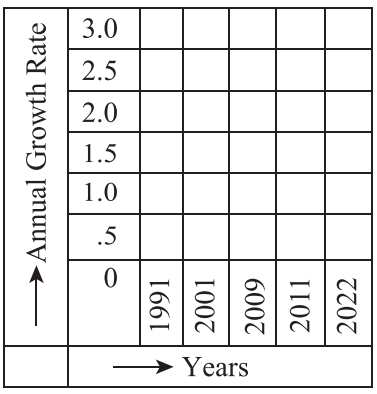
- Population is increasing but growth rate decreased.
- Population is high in comparison to land area and resources.
- Number of Male/Female is same.
- Half of the population is dependent.
- Death rate declined more than birth rate.
- Majority of the population lives in rural areas.
- Average longevity is less than developed countries.

Population growth rate : Population of Bangladesh is increasing rapidly. In 1991 population growth rate was 2.17 percent, in 2001 1.48 percent and in 2011 it was 1.37 percent and in 2022 1.22%. A graph showing the growth rate of population is given below :

Bangladesh Population growth rate

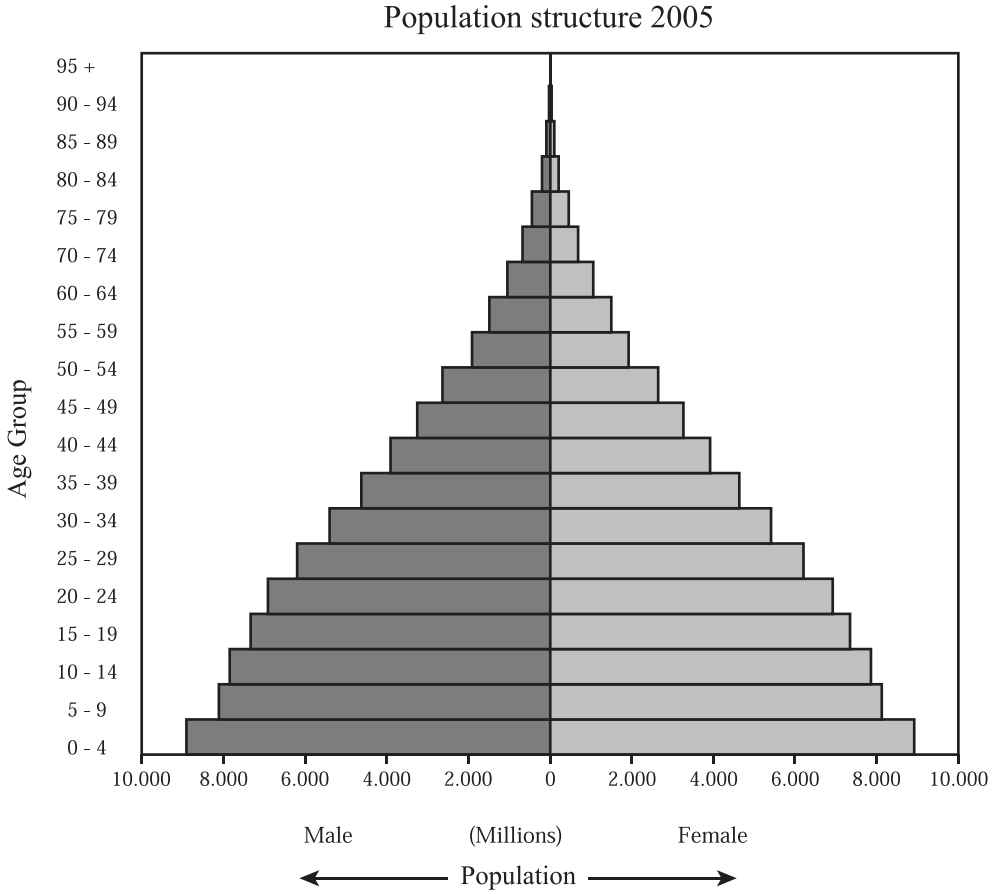
Year	Yearly growth rate in percentage
1991	2.17
2001	1.48
2009	1.5
2011	1.37
2022	1.22

Task



Population distribution according to age group

Population characteristic of Bangladesh is greater youthful population. Census records in different years show that the number of dependent population is high i.e., children, adolescent and aged population. Population structure of 2005 shows that in the aged population group between 60-90 years is less than 1.5 million and number of females is higher than males. Using the structure complete the task below :



Task : 1. Which age group has the highest population?

2. Which age group is active?

3. Find out the rate of active and dependent population.

Population problem of Bangladesh

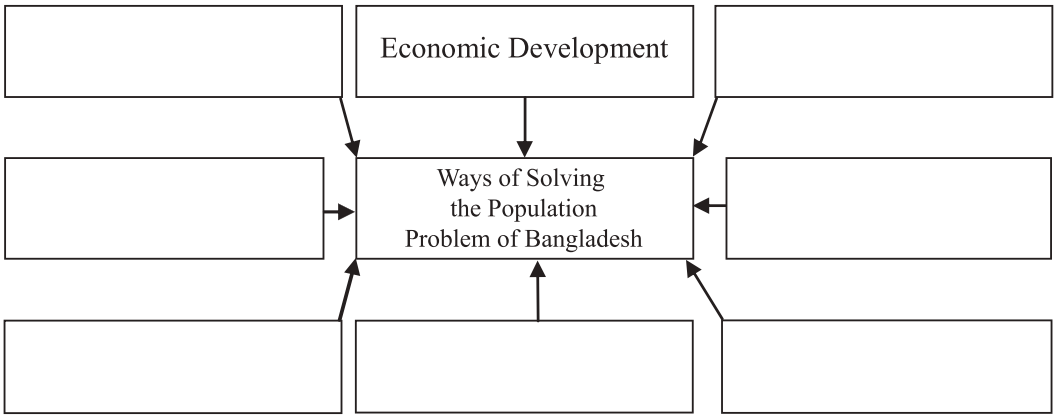
In any country, land and natural resource is limited. Population of Bangladesh is increasing rapidly. However, directly and indirectly population pressure is acting on land and resources.

- Fragmentation of land = Decrease Production
- Demand for housing, increasing use of land = Decrease of agricultural land
- Decrease of per capita income = Low standard of living
- Rapid population increase, less food production = Food shortage
- High population = Poor health care facilities
- Population increase = Health care facilities is less
- Deforestation, Hill cutting, Slum increase = Environmental pollution
- Low per capita income = low savings, low investment leads to unemployment = Unemployment increase
- Increase of food import = Decrease of foreign exchange
- Degradation of social values, increase of stealing, mugging for survival = Loss of security in social life
- Too many students in classes due to fewer schools, admission problem, harmful educational environment = low literacy rate

Solution of population problem of Bangladesh may lead to economic development. Modernization of agriculture, industrialization, development of transport and communication can speed up the economic development of the country. Population can be moved from high density area to low density area to solve the population problem. Extension of education and family planning can decrease the population growth.

Even distribution of national income may increase the standard of living. Skilled manpower development may decrease population growth. Agriculture, industry, business development may increase the per capita income which may reduce the population to some extent but solving population problem is not easy.

Task : Fill in the diagram by using information above.



Measures taken to control population in Bangladesh

Population is one of the major problems of Bangladesh. Government has taken many family planning programmes. Non-Government organizations are also trying to increase the awareness of the bad effects of too much population. A joint effort may lead the population from burden to human resource. Some of the measures to control population are :

* Ensure the effective implementation of contraceptive methods
* Introduce late marriage system.
* Stop early marriage and polygamy.
* Enhance female education and employment opportunities for women.
* Create multiple facilities for the recreations of people.
* Remove superstitions like fanaticism, dependency on son, lineage of the family.

Sample Questions

Multiple choice questions

1. Which of the following represents an unnatural influence on population distribution?

(a) Economic (b) Mineral
(c) Soil (d) Water

2. What is meant by a desirable population relationship?

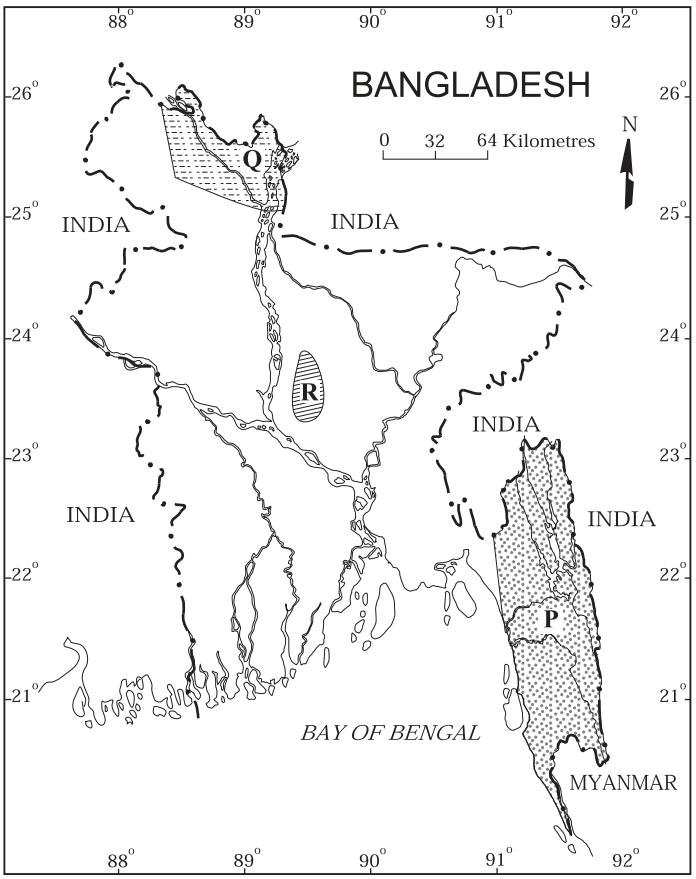
(a) A balance between people and forest resources

(b) A balance between people and land

(c) A balance between people and mineral resources

(d) A balance between people and industry

Answer questions 3 and 4 from the figure below :



3. The reasons for migration from the area labeled 'Q' to the area labeled 'R' on the map are as follows:

i. Lack of employment

ii. Climate impact

iii. Cultural discrimination

Which of the following is correct?

(a) i and ii (b) i and iii
(c) ii and iii (d) i, ii and iii

4. The reason for the low population density in the area marked 'P' on the map is:

i. Roughness of the land
ii. Underdeveloped communication system
iii. Underdeveloped agricultural system

Which of the following is correct?

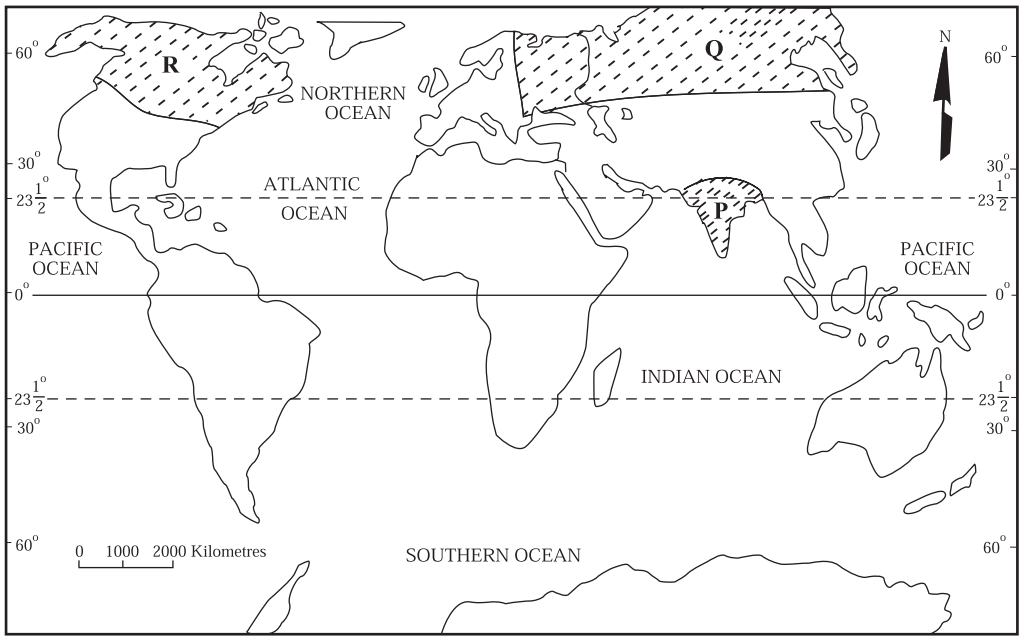
(a) i and ii (b) i and iii
(c) ii and iii (d) i, ii and iii

Creative questions

1. Recently, ethnic riots erupted between the Buddhist community and the minority Rohingya Muslims in neighboring Myanmar. As a result, Rohingya Muslims sought refuge in Ukhia, Cox's Bazar to save their lives.

a. What is migration?
b. What is meant by refugee?
c. What type of migration did the Rohingyas experience when seeking refuge in Ukhia, Cox's Bazar? Explain.
d. Analyze how the migration of Rohingyas will impact the overall environment of the region.

2.



a. What is the regular birth rate?
b. Explain overpopulation.
c. Describe the natural factors contributing to the population density in the area marked 'P' on the map.
d. Conduct a comparative analysis of the population density between the two areas labeled 'Q' and 'R'.

Short-answer questions

1. What is population structure?
2. What is meant by population pyramid?
3. What is usable land?
4. Write four attractive factors for migration.
5. How is gross mortality determined?

Chapter Eight

Human Settlements

A settlement is a place where people live permanently. It can be as small as an isolated farm or a hamlet. The location and growth of a settlement depend on its site and situation. The site is the actual place where people decide to locate their settlement. The growth of that settlement then depends on its situation in relation to natural resources and other settlements.

Settlement varies with the physical features of the region. for example, Eskimos live in icehouses in polar climates, while most rural people in Bangladesh live in homes with slanted roofs. in cities across the globe, tall buildings with modern designs and construction materials are now common. Human settlement is increasing with the growth of population in the world. Unplanned urbanization is the reason behind extensive environmental pollution.



Rural settlement



Urban settlement

At the end of this chapter, we will be able to—

- explain the factors of location settlement;
- discuss the pattern of urban and rural settlement;
- discuss the pattern and explain type of rural settlement;
- know about urbanization and types of cities;
- know the impact of urbanization;
- know problems due to unplanned urbanization;
- classify the type and pattern of settlement of our area;
- know the surrounding physical environment and take care of it.

Factors of settlement

The sites of settlement determined by the following physical factors.

1. **Topography:** Topography plays a major role in the formation of a settlement. It is easy to cultivate in plain land, but in hilly area, it is difficult. So, in a hilly area, for the sake of easy communication, the settlements are formed near the cultivable land. In Bangladesh, density of settlements in Chittagong hill tracts is less than that in plain land.

2. **Availability of water:** Human beings cannot live without pure water. Therefore, people build their settlements around water resources. In the desert and semi-desert regions, human beings build their settlements in a cluster around wells or natural waterfalls. This type of water-based settlement is called a Human Region Settlement.

3. **Soil :** Human settlements are established depending on the fertility of soil. Agglomerated settlements grow up in fertile land while scattered settlements grow up in infertile land.

4. **Defense:** In order to defend themselves human beings used to live in agglomerated settlements in ancient times. In that time, they had to fight with bare hands, so living together gave them safety.

5. **Grazing:** Scattered settlements are seen in grazing areas. Grazing needs vast area. Therefore, in some regions, people build Dispersed Settlements for their own advantage.

6. **Transport:** In ancient time, people built settlements where the physical features were convenient for transport and communication. For example, Agglomerated Settlements grew up on plain land and by the river sides for the availability of land and water transports. The Egyptian civilization and the Indus civilization developed beside the Nile river and the Indus river respectively due to convenience in communication.

Types of settlement

There are two types of settlement–rural settlement and urban settlement.



Fig. 8.1 : Rural settlement

Rural settlement : People whose livelihood is from primary activities (farming, fishing etc.) living in rural areas are the inhabitants of rural settlement. Rural settlements are classified into scattered and nucleated linear depending on topography of the land. Using the site and situation factors of the location of settlement, these rural settlements are at a corner of cropland higher than the located surrounding area so that the homestead is above flood level during normal flooding. Rural settlements have different types of characteristics on the basis of its design and construction material (fig. 8.1). Construction materials are usually tin, bamboo and bamboo mats etc. These dwellings are not strong. It is easily destroyed by a big storm or flood. In Bangladesh the rural settlements have a special design. There is an open space inside the dwelling for drying the rice crop. Bedroom, crop storage area and kitchen are all located around the open space. One open space is shared by two or three families. In the rural areas roads are few. Apart from agricultural activities some rural areas one specialized in producing hand woven clothes, pottery items and dairy product and these places are named according to the profession of the dwellers.

Urban settlement : The settlements where most of the people are engaged in secondary and tertiary economic activities (industrial productions, transportation, purchase and sell, administration, educational activities etc.) are known as urban settlements. In external consideration, there are numerous roads and streets; and in

some areas, there are skyscrapers (fig.8.2). Besides, there are different types of educational institutions, hospitals, stadiums, movie theatres, multistoried markets, parks etc. Different activities take place on different parts of large cities. Urban settlements are characterized by design, structure, construction material and well defined streets and urban facilities like electricity, water, gas, sewerage etc.



Fig. 8.2 : Urban settlement

Task : Find out the differences between the urban and rural settlement.

Patterns of rural settlements

On the basis of location rural settlement can be classified into three groups :

1. Nucleated settlement : Several dwellings grouped together for defensive purposes or for social and economic reasons are known as nucleated settlement. This type of settlement is found in the Hilly areas of Bangladesh in the north eastern and south eastern part. The dwellings of this type of settlement are close to one another. Physical features, soil fertility and source of water supply are some of the causes of nucleated settlement (fig. 8.3).

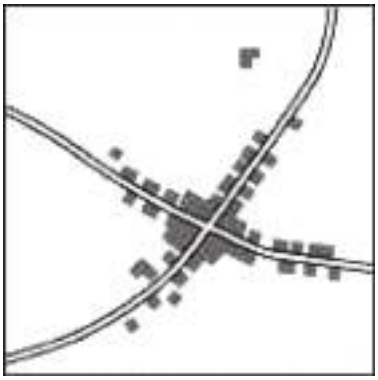


Fig. 8.3 : Nucleated settlement

2. Scattered settlement : Scattered settlement occurs in an area of adverse physical condition where natural resources are insufficient to support more than a few people. Scattered settlement is an isolated, individual dwelling, or a group of dwellings forming a hamlet/small village and separated from the next group by

two or three kilometres (fig. 8.4).

3. Linear settlement : A linear settlement is a small to medium sized settlement that is formed around a transport route, such as a road, river or canal (fig. 8.5).

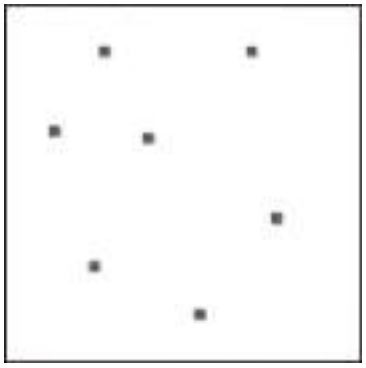


Fig. 8.4 : Dispersed settlement

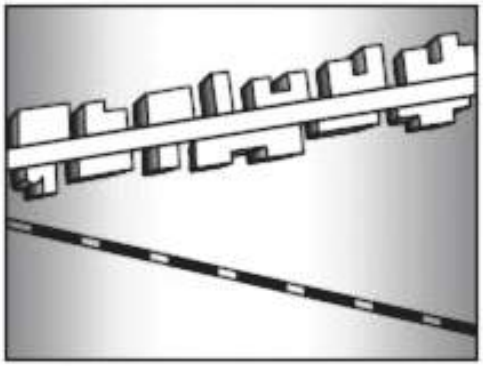


Fig. 8.5 : Linear settlement

Task : Write down the characteristics of rural settlement in a chart below (group wise task).		
Nucleated settlement	**Dispersed settlement**	**Linear settlement**
•	•	•
•	•	•
•	•	•

Urbanization

The term 'urbanization' means the increase of people living cities. The process of urbanization starts after certain conditions are met such as surplus production of food, specialization of labour etc. In 5000 BC, most people in the world lived by hunting and gathering their food. Over the next 3000 years a major transformation occurred due to the development of farming which allowed people to settle in a particular area. The first civilization started in Mesopotamia in 2500 BC in the fertile farmland between the Tigris and Euphrates rivers. The Valley of Nile was also a region of early civilization. By 1200 BC major civilizations have also emerged along the banks of Indus river in Mohenjodaro and Harappa in Pakistan, in China in the valleys of Yellow River and in Greece. Roman civilization spread 'city idea' throughout the Mediterranean and mainland Europe. The fall of Roman Empire in the late 5th century led to the decline of urban life.

Then followed the dark ages from 500-1000 A.D. when urban life and traditions all disappeared for over 500 years. In 715 A.D. the Muslim army conquered most of Spain, only the northern mountainous region remained independent. They established cities in Cordova, Toledo and Seville, which became the centres of learning at that time. The great urban growth started from 1000 A.D. During 1000-1400 A.D. urban expansion took place in western and central Europe and also in central Russia with a marked growth of population. By 1400 A.D. the western and central Europe had many towns and villages. The impact of technology during the period 1600-1800 A.D. gave great momentum to commerce and exploration. The people of northern Europe began to colonize parts of North America, Asia and Africa. New cities like New York, Philadelphia, Boston, Montreal, Goa, Kolkata, Singapore, Jakarta grew up. During the Industrial Revolution new mining towns developed near coal and iron are sources as those raw materials were used in the industries. Manufacturing towns developed on the basis of secondary activities for selling the manufactured goods within the country or exporting them outside the country. Tertiary activity oriented market towns or ports developed. According to the opinion of the experts, in near future majority of the population of the world will live in the cities. Urbanization is related with two types of process. (1) Rural Urban migration of people resulting in higher percentage of population living in the city. (2) Urban culture is spread easily through transport and communication routes as a result the culture gap of rural and urban people is greatly reduced.

Task : What is urbanization? Discuss in group and write down the points in a copy or chart paper.

Classification of cities

Geographers have classified the cities in different ways, cities differ in size, structure, population characteristics and functions. Even though there are various types of categories but the classification on the basis of functions is more important.

Types of cities on the basis of function are as follows:

1. Cities based on military activities : Army and navy establishments like garrisons or forts are located at strategic places of a country. Gradually cities grow up around

these locations. Agra in India, Gibraltar in Spain, Edinburgh in Scotland etc. are the examples of this type of cities.

2. Administrative cities : The centre of administrative and political activities becomes a city. For administrative purposes a central city is identified as the capital and then urban settlement expands in that city. Dhaka in Bangladesh, New Delhi in India, Islamabad in Pakistan and Canberra in Australia are such cities.

3. Industrial cities : Industrial activity is an important factor in urbanization. For the industrial use of coal, cities grew up in areas of coal mines and in this way many coal cities grew up around the world. Newcastle in UK, Raniganj in India, Pennsylvania in USA are mining cities.

4. Trading cities : Small service centres expanded and became urban settlements. Since the dawn of civilization the exchange of goods in a place starts a trading centre or a market. The local market grew up at the junction of roads. This factor is still very important in the growth of towns and cities. In ancient times many trading cities grew up on continental land routes such as Damascus in Syria, Alexandria in Egypt and the city of Fez in Morocco. Dhaka grew up along the banks of the Buriganga river and Chattogram along the Karnaphuli river.

5. Cities based on cultural activities: A city can develop for religious reasons. Birthplace of a renowned personality, his place of activity or his memorial can lead to the growth of cities. Mecca, Jerusalem, Goya are religious cities. Some world famous university or research institution can also play an important role in the growth of cities. Oxford and Cambridge in England, Nalanda in India are the university towns. Other cultural activities like fine arts and films also influence city development such as Paris for fine arts, Hollywood in USA and Mumbai in India for film industry.

6. Health resort and recreation centre : To get recreation from the routine activities of life, people spend time outside their home in seaside or hill resort. These types of resorts are Cox's Bazar in Bangladesh, Puri in India and Honolulu in USA where beach is a great attraction for everybody.

Task : Name five cities of Bangladesh and their origins.

Impact of urbanization

Processes that influence the urbanization and the urban structure are discussed below :

1. Size and density of the population : Usually cities are densely populated. In Bangladesh any settlement which has a minimum population of 5000 persons and density of 1500 persons per square kilometres is called a City. Fertility and mortality rates are less in the urban areas than the rural areas. But due to migration urban population is gradually increasing.

2. House types : Multistoried buildings made of bricks, wood, iron, cement are built in urban areas because large population live in a small area. Wide roads, parks, artificial lakes increase the beauty of the cities. All modern amenities like electricity, water supply and gas are available here.

3. Transport system : As there are well constructed roads in urban areas, people can move from one place to another using various types of transport. Cheap and easy transport is an added attraction of the cities.

4. Family size : Family is the oldest form of social institution. In urban areas nuclear family is more common. Average family size in the city ranges is between 4–6 persons. The city people with various types of occupation have little time for recreation So they cannot spend much time with their family.

5. Behaviour pattern : Mobility is very high in urban life. As there is scope to change one's occupation people easily change their professions from time to time. Here the social status is determined by the earning capacity. People of rural areas are conservative. They are more respectful towards traditional social values. In the rural areas, social status is determined by birthright.

6. Economy : People of the urban areas are engaged in secondary and tertiary economic activity. Urban profession is very diversified. They are usually engaged in non agricultural work like business, education, administration and service sectors.

7. Services : An urban area is provided with services like electricity, gas, water, sewerage and roads.

8. Education and health services : In the urban areas people get highest benefit from education and healthcare services.

9. Recreation : In urban areas people have recreation facilities to overcome their tiredness from very active life. Cinema, theatre and stadiums have profound influence on the life of the urban people.

10. Rise of crimes : In urban areas stealing, cheating mugging and brawling are regular incidents. These incidents are the negative impact of urban life.

11. Political and Social organization : Civil society organizations of the urban areas are very active. Different types of political activities and programmes are directed from the cities. Other social organizations arrange cultural and traditional folk festivals which add pleasure to the urban life.

Task : Write down the advantages and disadvantages related to urbanization that you have observed.

Problems of unplanned urbanization

Unplanned urbanization in different countries of the world created various types of environmental problems and Bangladesh is one of them. Bangladesh is not an industrialized nation, but it is in the initial stages of urbanization. Urbanization processes are growing rapidly. But all urban centres are not growing equally. Growth rate of large urban centres is high as industries, government administration and service sectors are rapidly expanding there.

About 40 percent of the population of the world live in urban areas. The size of the urban population in Bangladesh is small now but it is increasing gradually. Unplanned urbanization is directly related to environmental problem, such as loss of agricultural land, drinking water scarcity, drainage problem, waste management, transport and traffic jam problem, housing problem, increase of slum, pollution of water, air, land and noise, scarcity of open space and absence of recreational facilities.

In Bangladesh, each person on average has only 0.05 acre of agricultural land. Urban areas usually grow up in fertile agricultural land and gradually agricultural land is acquired for the expansion of urban areas. According to the World Health Organization for an urban area with 10 lakh population, 1,37,36,268 gallons of water is required per day. Only Dhaka city needs 28.5 crore gallons of water everyday. Wasa can supply only 18 crore gallons and about 3.5 crore gallons is wasted or misused. So, the deficit is 15 crore gallons. In dry season water scarcity in the city is high. According to the World Health Organization, a person requires 7 gallons of water a day for his survival but in our country urban people get less than its average daily.

Waste water and river water are collected at Chandighat and then refined and distributed again. In this case, the use of Meghna and Jamuna river water is important. Daily on an average 900 tons of waste is generated in Dhaka which is disposed in the lowlands and open areas. These wastes produce stink and bad smell in the surrounding areas, and the seepage into the soil pollutes the underground water level. People from slum areas use this water for their living. As a result they suffer from skin diseases, cholera, typhoid, malaria and other diseases. In other divisional cities such as Chittagong, Khulna, Rajshahi the situation is same.

The number of transport is increasing in almost all the cities. Fumes combined with harmful element like sulphur dioxide, nitrous oxide, nickel, etc. are in the air. This pollution causes asthma and various types of allergies.

In unplanned city there is a scarcity of housing. The poorest people and the migrants from the rural areas live in the densely populated slums are the causes of environmental pollution. Roads and highways, educational institutions, health centres, recreation centres, easily available fuel, trade centre and markets are essential part of urbanization. Due to steady increase of urban population it is difficult to provide all these services. Due to this unplanned urbanization building a planned city is really diffcult.

Task : Make a list of negative impact of unplanned urbanization

Sample Questions

Multiple choice questions

1. What is the first step in human adaptation to the environment?

(a) Settlement (b) Family formation
(c) Choice of profession (d) Education

Read the following passage below and answer questions 2 and 3.

Sadia lives in an area that allows easy travel to all parts of Bangladesh. The region has developed into a series of settlements, resulting in wide roads, electricity, gas, water, and sewage systems.

2. What is the natural feature of Sadia's area?

(a) Hilly (b) Plain
(c) River bank (d) Forest

3. What types of facilities are available in Sadia's area?

i. Civic facilities
ii. Education and health facilities
iii. Activity facilities

Which of the following is correct?

(a) i and ii (b) i and iii
(c) ii and iii (d) i, ii and iii

Creative questions

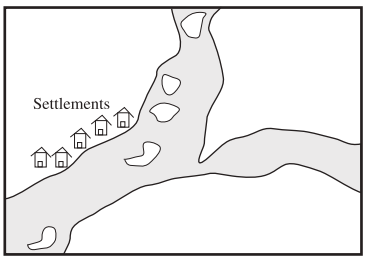


Fig.1

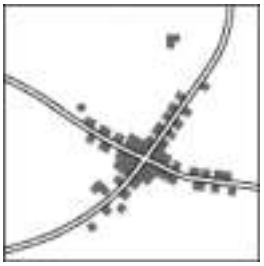


Fig. 2



Fig. 3

a. What is rural settlement?
b. How is settlement formed?
c. Explain the reasons behind the settlement formation shown in Figure 1.
d. Do you think dispersed settlement and the type of settlement in Figure 2 are the same? Analyse.

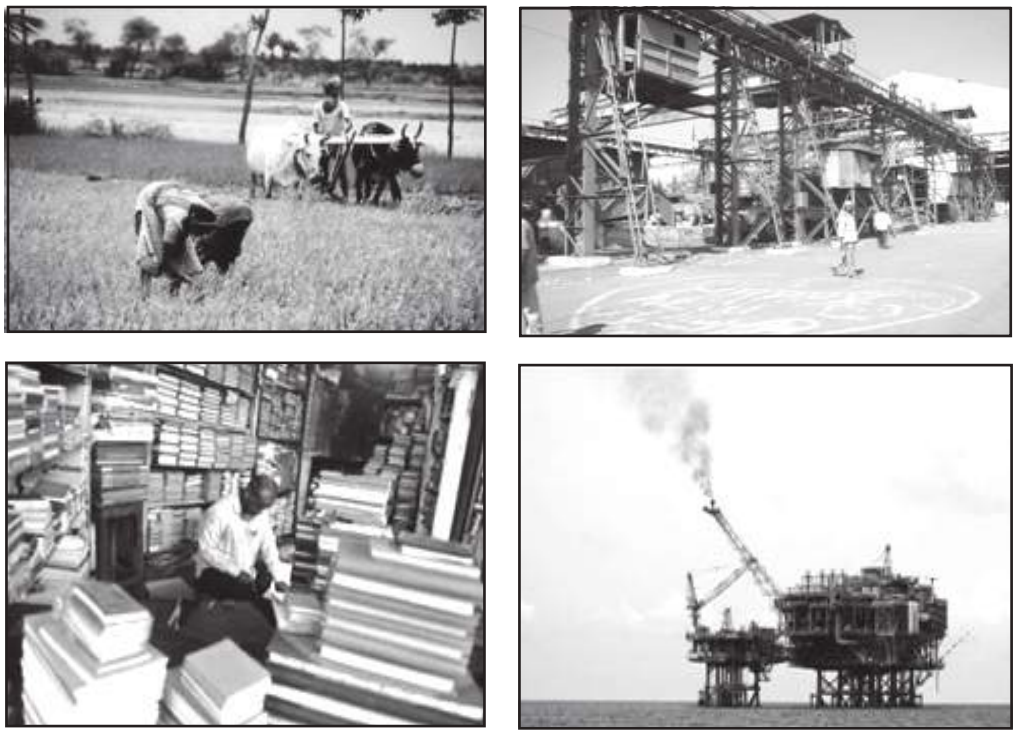
Short-answer questions

1. Why is defense a crucial element in creating agglomerated settlements?
2. What is meant by a consolidated settlement?
3. What type of city did painting help to establish at Paris in France?
4. Discuss how urbanization affects family dynamics.
5. Why is improving the sewage system necessary for planned urbanization?

Chapter Nine

Resources and Economic Activities

Human beings need resources to maintain the daily necessities of life and these are important for an economy. By studing how resources are used, we will be able to answer the following questions. What types of economic activities are performed by the people of different countries of the world based on the use of resources? What are the factors behind the industrial development? Why does the imbalance of export and import happen?



Economic activities

At the end of this chapter, we will be able to–

- describe the concept of resources and classify them;
- explain the ways of conservation of resources;
- raise awareness among people about conserving resources;
- explain the economic activities;
- explain the economic activities of underdeveloped, developing and developed countries;

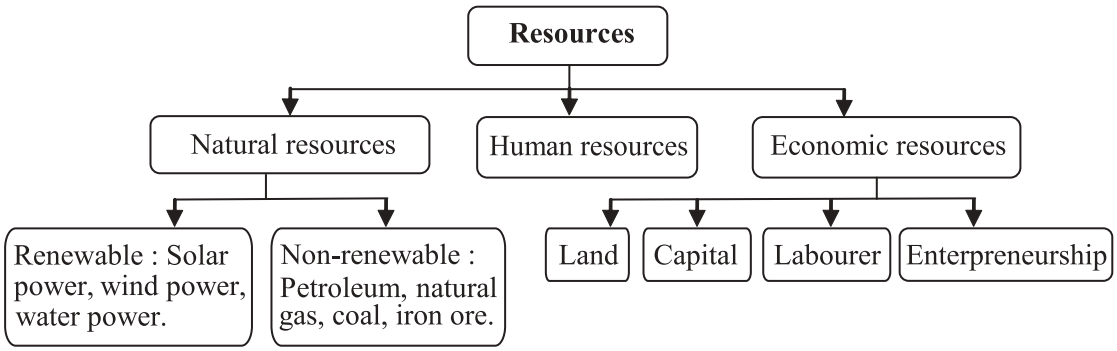
- explain the factors of industrial development;
- explain the classification and analyze the location of industries;
- explain the export and import trade;
- analyze the relationship between the balance of trade and development.

Concept of resources

Anything that can be used within a specific technological, economic, and social context is called resource. For example, petroleum (crude oil) became a valuable national resource only after people learned how to extract and use it. The value of land can go up or down depending on its location. Similarly, things that were once considered useless become important after people discover how to use them. In short, it is the usefulness of a thing that makes it a resource.

Classification of resources

Resources are classified into three categories. These are- (1) natural resources, (2) human resources and (3) economic resources. According to the scientists, the process of creation of non-renewable resources is very slow and their supply is limited. There are many resources which are exhausted with the passage of time such as natural gas, iron ore, coal and petroleum is decreased due to extraction. All these minerals are known as non-renewable resources as once extracted is no longer recycled. The renewable resources mean those kinds of resources which are continuously produced but changeable. Hydroelectricity is an excellent example of renewable resources. Human resources are the human beings with proper education and training.



Task : Give at least two example of various types of resources (individual work).

Conservation of resources

Conservation of resources means using of natural resources in such a way so that the can be used for a long time for the benefit of many people. The other names of conservation are education, truthfulness, justice, devotion or love for nature. According to the economists the resources are not unlimited. Proper management for utilizing the resources is very essential.

Increasing renewable resources is possible only through proper management. Environment friendly management is desirable. Non-renewable resources can be destroyed by burning oil or gas. But the environment is not polluted if the solar electricity is generated by using renewable solar energy and the hydroelectricity is generated by using water resources. Various usable things can be turned into resources by recycling minimizing wastage of resources.

Use of chemical fertilizer increases production in the beginning, but later on, it decreases the land's fertility. In this regard the idea of using organic fertilizer can be brought under consideration. The different soil conservation methods can be used for protecting the cropping soil such as the terrace farming and crop rotation. Besides the soil of fallow land can be conserved through afforestation. Used materials can be recycled and produced as a useful resource. All of us should be careful about protecting the land, water, mineral resources and natural environment and stop the wastage which will increase the usage of these resources for a longer period. Conservation of resources through 3R method is necessary. 3R stands for Reduce, Reuse and Recycle.

Task : How to prevent the wastage of resources (group work)?

Economic activities

Any sort of human behaviour related to the production and exchange is called Economic activities. Economic activities are classified into three categories.

(1) Primary economic activities

(2) Secondary economic activities

(3) Tertiary economic activities

Primary economic activities : Primary economic activities are those activities where natural resources are extracted from the earth. Examples of primary activities are mining, farming and fishing. Natural resources are those resources which are found in nature and are of benefit to mankind.

Secondary economic activities : The secondary economic sector deals with the processing of raw materials into finished goods. Builders and potters are examples of secondary economic sector workers. Lumber from trees is used to build houses and clay from earth is used to make pottery.

In the secondary economic activities products that are collected in primary economic activity are processed by changing their forms and increasing their value. The extracted iron ore from mines is changed into steel and iron products. Manufacturing all types of mechanical equipment to cooking all come under secondary economic activities.

Tertiary economic activities : The tertiary economic sector has to do with services to businesses and consumers. The activities of wholesalers, hawkers, bankers, teachers, doctors, nurses, lawyers, barbers and rickshaw pullers fall into the category of tertiary economic sector workers. Transportation, banking, tourism and retail stores are all part of the tertiary economic sector.

Task : Write down the economic activities of shop keeper, iron monger, teacher, farmer, business person and nurse in the table below (group work).		
Primary activities	**Secondary activities**	**Tertiary activities**

The economic activities of undeveloped, developing and developed countries

The different countries of the world are classified into undeveloped, developing and developed on the basis of economic power. Around 50%–80% people of undeveloped and developing countries are engaged in primary economic activities, such as, Bangladesh, Myanmar, Bhutan, Nepal, Cambodia, Ethiopia, Kenya and Zambia. People of these countries are engaged in animal rearing, fishing, wood collecting and in physical labour. More than 80 percent people of developed countries like USA, UK, Canada, Japan, China, Italy, Germany, France, Spain, Australia and New Zealand are involved in the secondary and tertiary economic activities. People of these countries are engaged more as industrial labour, teacher, doctor, engineer, nurse, business, cultural activity, politics, research and social work. In these countries literacy rate, standard of living and per capita income are higher than undeveloped and developing countries.

The factors of industrial development

Industries develop based on natural and economic factors. The natural factors are : (1) Climate, (2) proximity to energy resources, (3) availability of raw materials. Economic factors are : (4) Capital, (5) supply of labour, (6) proximity to the market, (7) use of modern technology, (8) good transport system, (9) government investment policies and (10) political stability.

Natural factors

(1) Climate : Climate means the average temperature, rainfall, water vapours and humidity of an area over a long period of time. It is difficult to develop industries in tropical countries where the workers get tired easily due to high temperature. So, the temperature is controlled by air conditioner. It increases the cost of production. But in temperate and cold countries industrial workers can work over a longer period of time without being tired.

In an indirect way the location of industries depends on the climate. In different types of climate different types of raw material is produced. For example, Jute grows well in the tropical climate of our country. So a large number of jute industries have developed in our country. Similarly Khulna newsprint mill has been established to use the Sundari tree as raw material from Sunderbans.

(2) Proximity to energy resources : The location of industries depends on the proximity to energy resources. As energy resources are needed to run the industries.

Large industries need energy to run which is produced from coal, petroleum, natural gas, and hydroelectricity. Basically Industries are developed in those areas where there is an abundant supply of energy resources.

(3) Availability of raw materials : Raw materials are required for industries. So, the industries develop in areas where raw materials are abundant and cheap. In Bangladesh there is an abundant supply of bamboo and cane in Chandraghona area, in Rangamati and so Karnaphuli paper mill has been established there.

Economic factors

(4) Capital : Capital is required to establish an industry. A large amount of money is necessary for purchasing land, equipment for industries, payment of labourers and for transportation. The industries are developed in areas where capital is available.

(5) Supply of labour : Supply of labour is an important factor for the development of industries. A large number of industries are developed in more heavily populated countries due to availability of cheap and abundant labour.

(6) Proximity to the market : A proper market is needed to meet the demand for industrial products. If suitable market is not available, the possibility of the industry to survive is difficult. So, industries are usually established near the market. Usually there is a heavy demand for industrial products in a densely populated area.

(7) Good transport system : A good transport system plays an important role for setting up the industries. In developed countries as there are good roads, railways, waterways and airways, there are more industries. Dhaka, Chittagong and Narayanganj have good transport system than the rest of the country which leads to the location of more industries than other areas of Bangladesh.

(8) Use of modern technology : It is not possible to exist in the free market economy without using the modern technologies in industries. For this reason, the commodities produced by Japan, China, Germany, USA, England etc. using the modern technologies are in demand in the world.

(9) Government investment policies : The government introduces some policies to encourage investment by the local and international investors to establish industries in this country. If the policies are favourable to the investors then more industries will be established in the country.

(10) Political stability : Political stability is essential for developing industries by the local and international investors. Countries where there are democratic system of government, the number of industries increases and the economy becomes strong.

Classification of industries

Based on natural resources like petroleum, agriculture, animals and forest resources different kinds of industries grow up. Generally, industries are classified into three categories. Such as :

(1) Small scale industry

(2) Medium scale industry

(3) Large scale industry

(1) Small scale industry : The industry which needs few labourers and little capital is called small scale industry. The workers produce with small machineries and equipments. These industries develop in the village and urban areas as private enterprise such as dairy farm, handloom industry and bakery.

(2) Medium scale industry : A private enterprise starts functioning with the funding from a financial institution of 2 crore taka and employs more than 100 workers is known as the medium scale industry. These industries are : Ready-made garments and leather processing industries.

(3) Large scale industry : Massive infrastructure, a large number of laborers and a large quantity of capital are essential for developing these types of industry. Such as : iron and steel industry, textile industry, motor car industry, shipbuilding industry etc. These industries contribute to the economic growth, foreign exchange earnings where thousands of labourers are employed and the unemployment problem is reduced. These industries are located near the cities.

Import and export trade

No country in the world is self-sufficient with all sorts of resources. Many countries import products based on demand and export surplus goods to other countries following international trade protocols. It is called Import and Export trade.

For example, Japan exports the heavy machineries made by iron and steel, electronic

products, motor car, shipbuilding and various industrial products and Japan imports iron and coal from other countries. Bangladesh imports rice, wheat, edible oil, thread, petroleum goods, electronic machinery and exports garments, agricultural products, tea, leather, ceramic products, frozen food, raw jute and jute products etc. In this way a trade relationship is maintained through export and imports.

Trade balance and development of relationship

Trade balance among different countries in the world are not equal, as there are significant differences between import and export trades. The trade balance of any country in the world depends on economic strength of a country. The trade imbalance is often seen among the economically developed countries and the less developed and developing countries of the world. Bangladesh has trading imbalance relationship with India and China. Bangladesh imports more from these countries than it exports. This is called trade deficit. Number of export items are: ready-made garments, shrimp, leather, jute products and tea. Balance of trade between Bangladesh and USA is positive and so Bangladesh is in a better position Bangladesh also has a trade surplus with Germany, France and United Kingdom also.

Table 1 : Trading imbalance report of last Five years of Bangladesh

Financial Years	Import (In million US dollar)	Export (In million US dollar)	Proportion to export and import imbalance
2019-2020	62,885	37,130	25,755
2020-2021	65,595	38,758	26,837
2021-2022	89,162	52,083	37,079
2022-2023	75,062	46,495	28,567
2023-2024	66,725	44,475	22,250

Source : Bangaladesh Bank, Annual Report, 2019-2024.

Sample Questions

Multiple choice questions

1. Which one of the following is an export product of Bangladesh?

(a) Edible oil
(b) Clothing
(c) Petroleum products
(d) Electronic equipment

2. How can renewable resources be increased?

(a) Through good management
(b) Through conservation
(c) By being dutiful
(d) Through lifestyle

Read the following stimulus and answer questions 3 and 4.

Piyal works in an industrial establishment. The establishment has a large number of workers, a large amount of capital, and extensive infrastructure.

3. In which industrial establishment does Piyal work?

(a) Weaving industry
(b) Textile industry
(c) Leather industry
(d) Ready-made garment industry

4. Where are these industries usually established?

(a) Near the city
(b) On the banks of the river
(c) In sparsely populated areas
(d) Far from the market

Creative questions

1. Scenario: 1 - Faisal cultivates land, while Mahmud makes a living by raising cattle and goats.

Scenario 2: The factory where Adiba works produces biscuits, cakes, and bread. In contrast, the factory where Rakib works produces various construction materials made from iron and steel.

a. What is wealth?
b. Why is capital important for starting an industry?
c. To which level of economic activity do the works of Faisal and Mahmud belong? Explain.
d. Among the industries where Adiba and Rakib work, which one do you believe plays a more significant role in economic development? Analyze it logically.

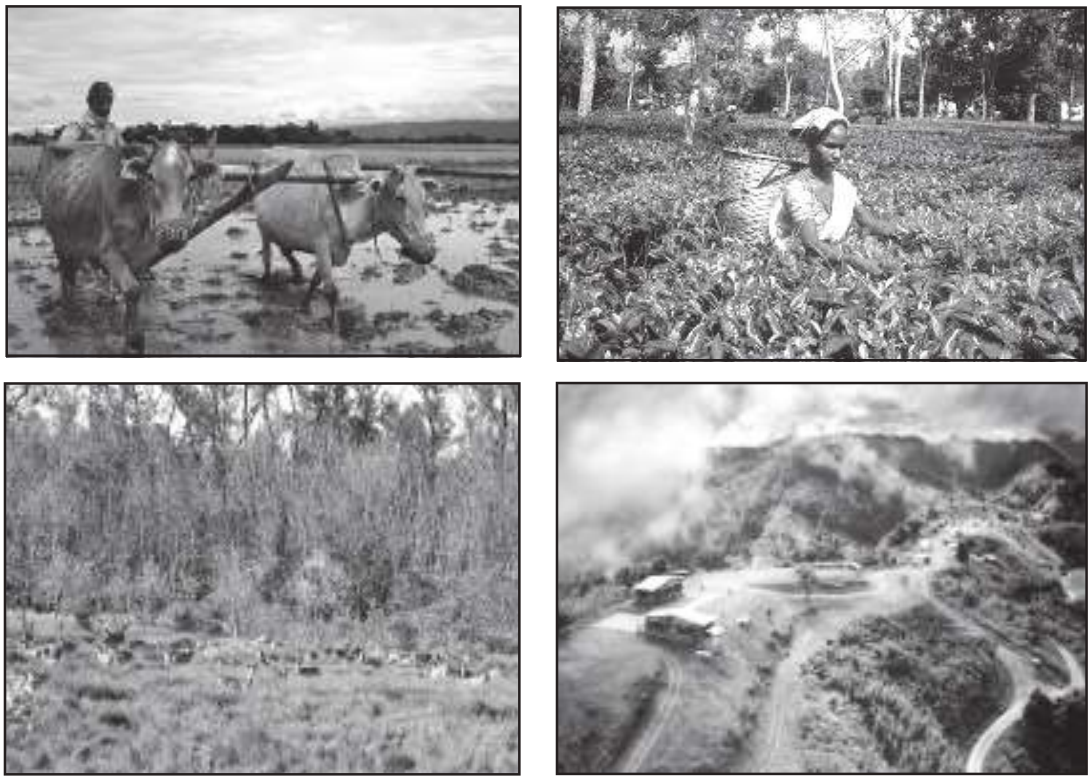
Short- answer question

1. Explain the importance of climate in setting up industries.
2. What is resource conservation?
3. What is economic activity?
4. What is meant by import and export trade?
5. Why is hydropower called a renewable resource?

Chapter Ten

Geographical Description of Bangladesh

Bangladesh is an independent country in South Asia. The Tropic of Cancer passes through the middle of the country due to its geographical location. There are various types of physiographic characteristics: rivers, location of the Bay of Bengal, hilly areas and seasonal climate change bring a diversity in this country.



Some renowned landscapes of Bangladesh

At the end of this chapter, we will be able to–

- describe geographical location and physiography of Bangladesh;
- describe the main rivers, tributaries and distributaries;
- describe reasons of filling up the rivers and wetland caused by human; their influence and ways of prevention;
- raise awareness about the harmful influence of filling up the rivers and wetlands;
- describe the characteristics of climate, seasonal temperatures, wind and rainfall;

- describe the characteristics of monsoon climate and norwester;
- take precautionary and safety measures against nor'wester storms and lightning, and raise awareness among others.

Location : Bangladesh is located in South Asia in the southern part of the continent of Asia. Bangladesh is an independent country. This country is situated between 20°34′ North latitude and 26°38′ North latitude and between 88° 01′ East longitude and 92°41′ East longitude. The Tropic of Cancer passes through the central part of Bangladesh.

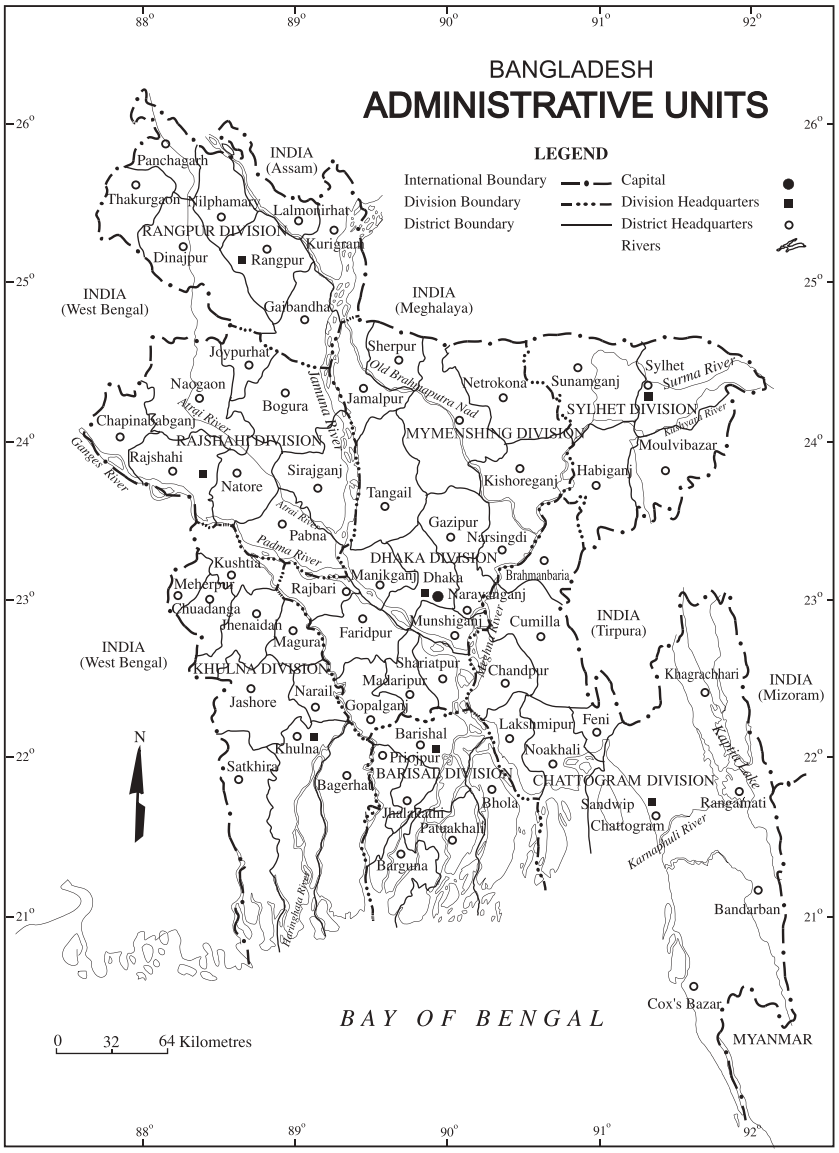


Fig. 10.1 : Administrative units of Bangladesh

Area : The total area of Bangladesh is 1,47,570 square kilometres. According to Bangladesh Bureau of Statistics 1996-97, the area under rivers is 9,405 square kilometres and that of the forest is 21,657 square kilometres. Territorial waters is 12 nautical miles and exclusive economic zone is 200 nautical miles and the oceanic boundary is till the end of the continental shelf.

The ocean boundary of Bangladesh was limited within 130 nautical miles due to the claim of equidistant method by Myanmar and India. In this way, Bangladesh would get 50,000 square kilometres less. To establish the sea boundary and to have rights on the sea resources, Bangladesh lodged a case against Myanmar on 14th December 2009 in Sea Law tribunal in Hamburg in Germany and against India in an arbitration tribunal at Hague in Netherlands. Bangladesh received the historical verdict on 14th March, 2012 against Myanmar and 7th july, 2014 against India from the International Court. Due to this verdict Bangladesh gained more than 1,00,000 square kilometres of sea boundary. Through this verdict St Martin's Island has been made the coastal baseline and from there 12 nautical miles have been selected as the Territorial sea and 200 nautical miles as the Exclusive economic zone. Area under the sea is the continental shelf, beyond is in the possession of Bangladesh and sovereign right to all natural resources has been established. According to this estimate 350 nautical miles from the coast of Bangladesh in the continental shelf under the sea is the territory of Bangladesh.The ocean boundary of Bangladesh was limited within 130 nautical miles due to the claim of equidistant method by Myanmar and India. In this way, Bangladesh would get 50,000 square kilometres less. To establish the sea boundary and to have rights on the sea resources, Bangladesh lodged a case against Myanmar on 14th December 2009 in Sea Law tribunal in Hamburg in Germany and against India in an arbitration tribunal at Hague in Netherlands. Bangladesh received the historical verdict on 14th March, 2012 against Myanmar from the International Court. Due to this verdict Bangladesh gained more than 1,00,000 square kilometres of sea boundary. Through this verdict St Martin's Island has been made the coastal baseline and from there 12 nautical miles have been selected as the Territorial sea and 200 nautical miles as the Exclusive economic zone. Area under the sea is the continental shelf, beyond is in the possession of Bangladesh and sovereign right to all natural resources has been established. According to this estimate 350 nautical miles from the coast of Bangladesh in the continental shelf under the sea is the territory of Bangladesh.

Boundary : Bangladesh is surrounded by India in three sides. In the north there is West Bengal, Meghalaya and Assam; to the east is Assam, Tripura, Mizoram and Myanmar (Burma); and to the south is the Bay of Bengal and to the west is the State of West Bengal. The total length of the boundary of Bangladesh is about 4,711 kilometres of which about 3,715 kilometres exist between Bangladesh and India, and the boundary between Myanmar and Bangladesh is only 280 kilometres and the coastal boundary extends to the south of 716 kilometres (fig.10.1). In the south-west, the Hariabhanga River marks boundary with India, and in the south-east, the Naf River marks the boundary with Myanmar.

Task : Complete the table in a group.

What is the location of Bangladesh in Latitude and Longitude?	What is the area of Bangladesh?	What is the extent of exclusive economic zone?	What is the extent of the territorial waters?	What is the length of coastal boundary between Bangladesh and the Bay of Bengal?	Up to how much depth is the sea rights on the continental shelf ?

Physiography of Bangladesh

The physiography of a country influences agriculture, industry, trade and commerce, transport and communication system. The influence of physiography on the economic development of Bangladesh is enormous.

Bangladesh is one of the largest deltas in the world. The Ganges, the Brahmaputra, and the Meghna flowing from the west, north and south-east respectively have together formed this vast delta.

Plains are ideal for permanent settlement. A greater part of Bangladesh is an extensive plain. On the basis of natural features Bangladesh can be classified into three physiographic divisions. These are :

1. The Hills of the Tertiary period.
2. The Terraces of Pleistocene period, and
3. The Recent Flood Plains.

Description of the natural features are given below in detail (fig. 10.2).

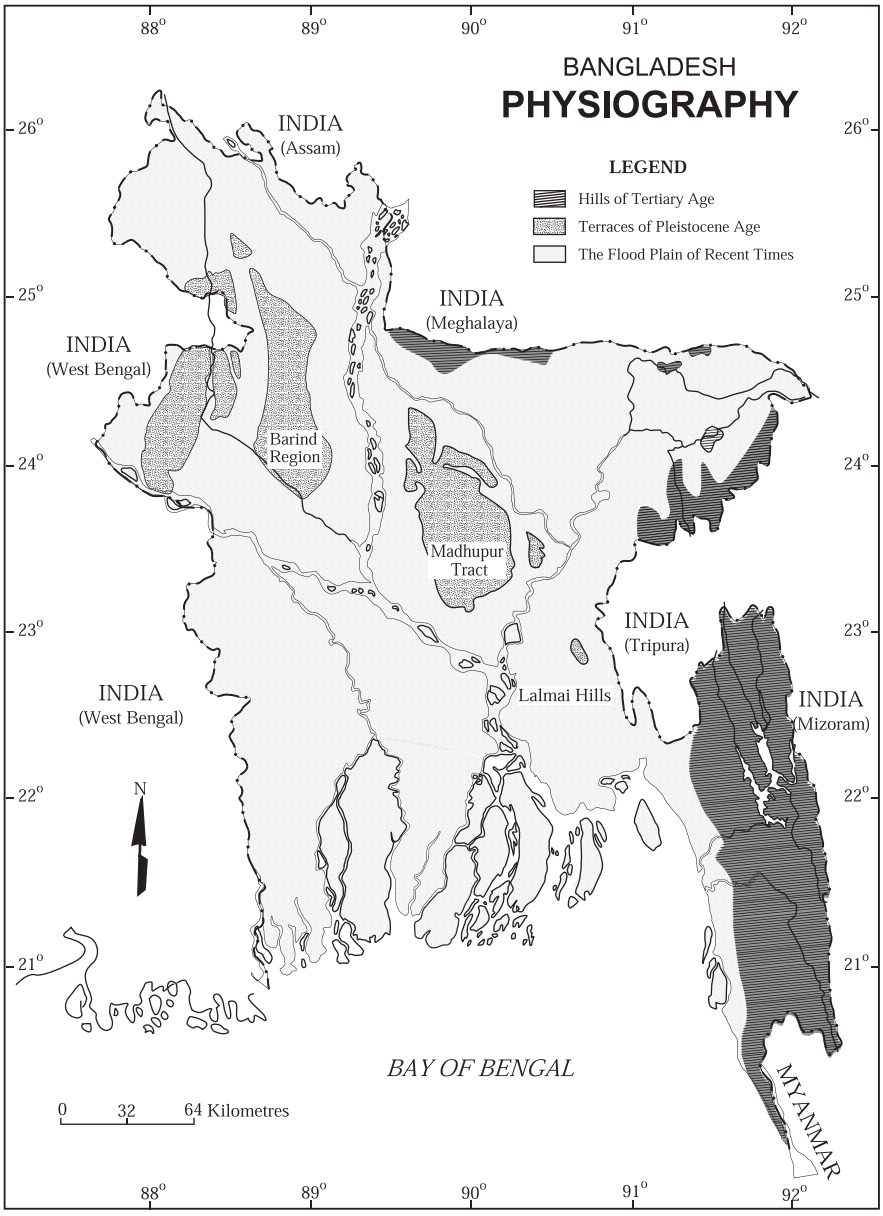


Fig. 10.2 : Physiography of Bangladesh

1. The Hills of the tertiary period : This region covers the hills of the south-east and north-eastern parts of Bangladesh. These Hills were formed along with the formation of the Himalayan Mountains, and so, these are called the Hills of Tertiary period. It is assumed that Lusai Hills of Assam and the Arakan Hills of Myanmar (Burma) are considered to be of the same age. These hills are formed of the sandstone, shale and mud. The hills of this region are divided into two, such as : (a) Hills of the South-East, (b) Hills of the North and North-East.

(a) Hills of the south-east : Rangamati, Bandarban, Khagrachhari, Cox's Bazar and the eastern part of Chattogram cover this region. The average height of these hills is 610 metres. The highest peak of Bangladesh is Tajingdong (1,280 metres) located in the south-eastern part of this region in Bandarban district.

(b) Hills of the north and north-east : The hills in the north of Mymensingh and Netrokona districts, in the north-east of Sylhet district and the hills of the south of Moulvibazar and Habiganj are not more than 244 metres in height. The hills of the north are locally known as Tila. The height of these Tilas varies from 30 to 90 metres.

2. The terraces of pleistocene period : The Pleistocene period is over 25,000 years old. The Barind of the north-west, Madhupur and Bhawal Garh of the central part and the Lalmai hills or highland of Cumilla district cover this region. It is thought that these terraces were formed during the Pleistocene period. The descriptions of these highlands are given below.

(a) The Barind : The Barind covers an area of 9,320 square kilometres in the north-western region of the country. The height of this region above the flood plain is about 6 to 12 metres. The colour of the soil is grey and red.

(b) The Madhupur and Bhawal Garh : The Madhupur is situated in Tangail and Mymensingh districts and the Bhawal Garh is in Gazipur district. The area is about 4,103 square kilometres. The height of this region above the plain land is about 30 metres. The colour of the soil is grey and red.

(c) Lalmai hills : The Lalmai Hills stretch from Lalmai, 8 kilometres to the west of Cumilla town to Mynamati. This region covers an area of 34 square kilometres and the average height is 21 metres.

3. The recent flood plains : Excepting the hills and the Terraces, the whole of Bangladesh is a plain land drained by rivers. Innumerable small and big rivers are found everywhere in Bangladesh. These rivers flow through the plain land and cause floods during rainy seasons. This flood plain has been formed due to the deposition of the sediments brought down by the rivers for years together. The total area of this flood plain is 1,24,266 square kilometres.

This plain land slopes towards the coast from the north of Bangladesh. The Sundarban region stands almost at sea level. The other regions such as Dinajpur stands at a height of 37.50 metres, Bogura at 20.00 metres, Mymensingh at 18.00 metres, Narayanganj and Jashore at 8 metres. Innumerable marshy and lowlands are scattered throughout this region. Some of these are abandoned Ox-bow lakes. Locally, these are known as beel, jheel or haor. Of these, the Chalan Beel and the haors of Madaripur and Sylhet are remarkable.These are submerged during the rainy season and turn into lakes. The layer of the soil of the whole flood plain is very deep and very fertile. The recent flood plain can be divided into several divisions, viz.

(a) Piedmont Plain of Rangpur and Dinajpur,

(b) The Flood Plain of Dhaka, Tangail, Mymensingh, Jamalpur, Pabna, Cumilla, Noakhali and Sylhet,

(c) The Deltaic Plain comprising of some parts of Dhaka, Khulna, Faridpur, Kushtia and Jashore,

(d) The Flat Coastal Plain of Chattogram extending from the lower part of Noakhali and Feni rivers to Cox's Bazar,

(e) The Tidal Plain or the Mangrove Forest comprising of some parts of Khulna, Patuakhali region and Barguna district.

These regions are very fertile and remarkable for their agricultural production.

Task : Find out the different physical features in different districts of Bangladesh in an Atlas and write it down in a copy in a group.

Main rivers of Bangladesh

Bangladesh has about 1008 rivers. Due to the presence of a large number of rivers, Bangladesh is called a riverine country. The Rivers influence the life style of the people of Bangladesh. The Padma, the Brahmaputra, the Jamuna, the Meghna and the Karnaphuli are the major rivers of Bangladesh. These rivers also have their tributaries and distributaries. The total length of all the rivers including tributaries and distributaries is about 22,155 kilometres. The description of the rivers of Bangladesh is given below (fig. 10.3).

The Padma : The Padma is one of the major rivers of Bangladesh. It originates from the Gongotri, glacier. Then it flows to the south-west and then to the south-east taking the name of the Ganges at Haridwar and enters into the plane lands. From this point, the Ganges flows through Uttar Pradesh and Bihar State leaving a distributary named Bhagirathi (Hooghly) river at Dhulian of Murshidabad district in West Bengal.

The Bhagirathi falls into the Bay of Bengal. The main flow of the Ganges takes the name of Padma at the south-western point of Rajshahi district and flows for about 145 kilometres through West Bengal and along the border of Bangladesh. It enters into Bangladesh through the north-western point of Kushtia district. Then it meets the Jamuna river at Daulatdia. This combined stream flows towards the south-east as the Padma and meets the Meghna at Chandpur. Afterwards, the combined flow of these three rivers fall into the Bay of Bengal as the Meghna. The Padma drains an area of 34,188 square kilometres. The Kumar, Mathabhanga, Bhairab, Gorai, Madhumati, Arial Khan etc. are the distributaries of the Padma river and the Mahananda is the main tributary. Punarbhava, Nagor, Pagla, Kulik and Tangan are the tributaries of Mahananda.

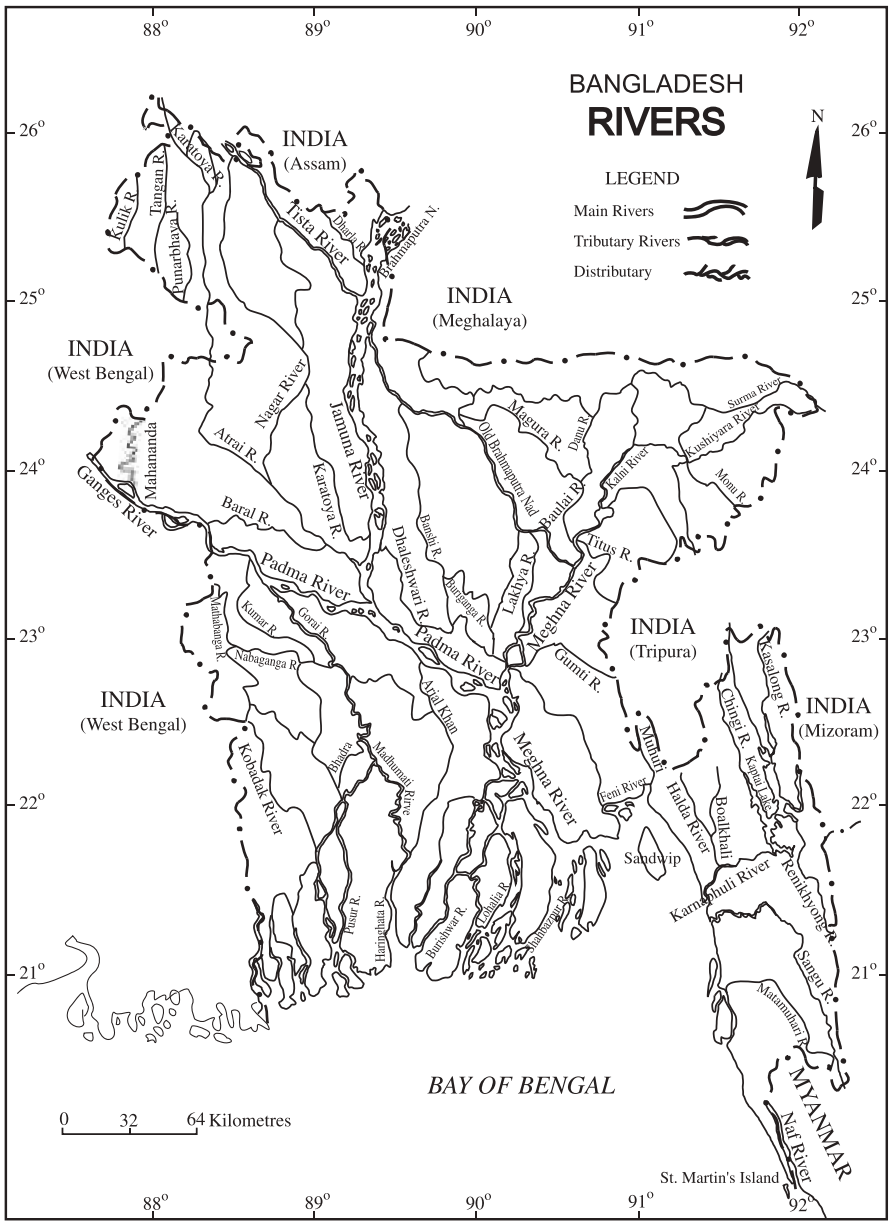


Fig. 10.3 : Rivers of Bangladesh

The Brahmaputra : The Brahmaputra river originates from Manas Sarovar near Kailash peak of the Himalayas and then flows to the east over Tibet and finally passes through Assam to the west. Thereafter, the Brahmaputra river enters into Bangladesh near Kurigram. This river takes a turn towards south-east near Dewanganj and then flowing through the district of Mymensingh falls at Meghna to the south of Bhairab

Bazar. Dharla and Tista are the main tributaries and Bangshi and Sitalakhya are the major distributaries of the Brahmaputra river.

The Jamuna : The main branch of the Brahmaputra near Dewanganj of Mymensingh district flows towards south as Jamuna to meet the Ganges river near Daulatdia and flows as Padma. Karotoa and Atrai are the major tributaries of the Jamuna and Dhaleshwari is its distributary. Whereas Buriganga is the distributary of Dhaleshwari.

The Meghna : The Barak river of Assam originates from Naga-Manipur region and being divided into two branches as Surma and Kushiyara, enters into Sylhet district of Bangladesh. Surma, the northern branch, flows towards west by the side of Sylhet, Chhatak and Sunamganj. The Surma of north Sylhet, the Kushiyara of south Sylhet, the Kalni of Habiganj meet together near Ajmiriganj. Then the combined stream of Kalni, the Surma and the Kushiyara after flowing some distance to the south as Meghna, joins the old Brahmaputra in the south of Bhairab Bazar and after flowing to the south-west it meets the Padma near Chandpur and ultimately falls into the Bay of Bengal as Meghna. The Meghna drains an area of about 29,785 square kilometres. Monu, Baulai, Titas, Gumti, are the tributaries of the Meghna.

The Karnaphuli : Two hundred and seventy four kilometres long Karnaphuli river originates from the Lusai Hills in Assam and flowing through Rangamati and Chattogram falls into the Bay of Bengal. This is the main river of Chattogram and Rangamati. The major tributaries of Karnaphuli river are Kassalong, Halda, and Boalkhali. A hydroelectric project has been constructed at Kaptai on Karnaphuli. The main sea port of Bangladesh is located on the south of the Karnaphuli river.

Task : Fill in the table in a group (time–15 minutes).					
Name of main river	**Origin**	**Location of the falls**	**Course**	**Distributary**	**Tributary**
Padma					
Brahmputra					
Jamuna					
Meghna					

Causes of river and wetlands fillings: its impact and prevention

In Bangladesh the filling of rivers and wetleands has many natural and man-made causes. A major portion of Bangladesh is made up of alluvial deposits. One characteristic of alluvium is that it mixes easily with water as it is a soluble matter. During the rainy season, the northeastern side of Bangladesh and neighbouring countries like China, Nepal, Myanmar, and the Indian states of Assam and Meghalaya experience heavy rainfall. In the rainy season high velocity mountainous rivers in the upstream bring down alluvium and cause river bank erosion. In the downstream the velocity of the river decreases and the alluvium is deposited on the river bed and eventually the depth of the river is reduced and the navigability. Within the country, on the banks of the rivers and wetlands, unplanned dams, roads, industries, residential construction, encroachment and filling up are leading to the destruction of the rivers and wetlands. Water dispute with the neighbouring country is the cause of withdrawal of water from the major rivers during dry season, decreasing the velocity of river causing deposition at the mouth of the river.

In rainy season due to filling up of rivers and wetlands water flow is obstructed and it over flows the banks causing floods. During the dry season, reduced water levels in rivers and wetlands decrease navigability and hinder fish farming and irrigation. Conservation of water in the reservoir through natural process is gradually declining and supply of sweet water in the cities is declining resulting in environmental degradation. To overcome these problems regular dredging to maintain the navigability of the rivers during rainy season and winter, planned and environment-friendly dam construction and other development projects should be undertaken. We should stop encroachment of rivers and hill cutting, rescue wetlands from grabbers, make mandatory effluent treatment plants for the industries. We should resolve water dispute with India, Nepal and China and get the proper amount of water for the rivers Ganges, Tista, Brahmaputra and Feni. Environmental laws should be enforced and revised according to the need of the time so that greater environmental disaster can be avoided. Use of underground water should be reduced and the use of river water should be encouraged.

Task : How to prevent filling up of rivers and wetlands? Discuss in group and write it down in a copy or poster paper.

Climate

The climate of Bangladesh is moderate. As the Tropic of Cancer passes through the centre of the country, the prevailing climate is tropical. The influence of the Monsoon wind on the climate of this country is so strong that as a whole, the climate of Bangladesh is known as tropical monsoon climate. In a monsoon climate, there are different seasons in a year.

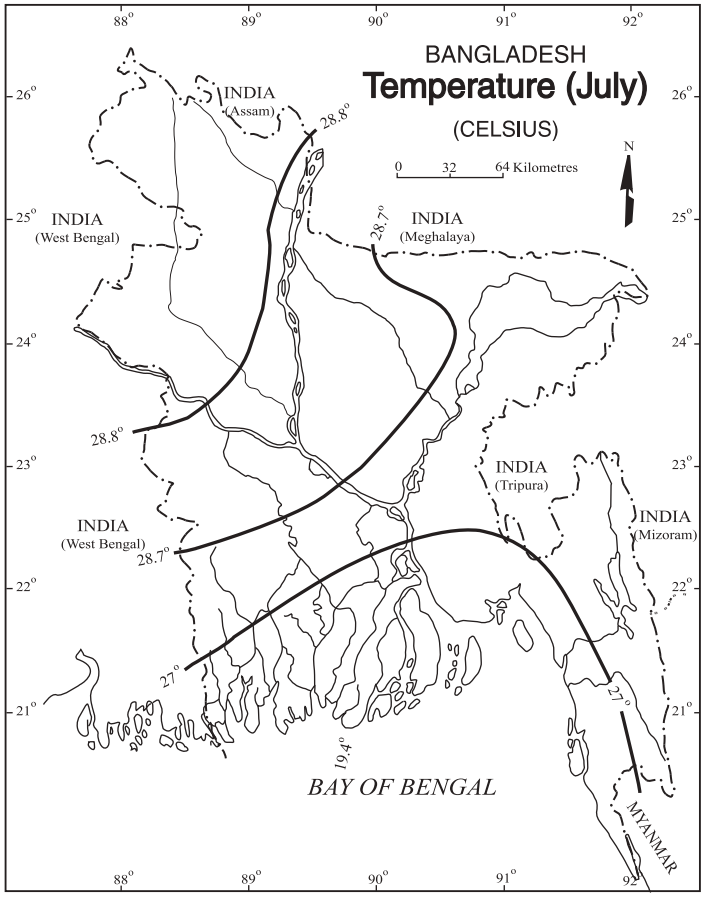


Fig. 10.4 : Temperature of Bangladesh (July)

But Bangladesh never experiences extreme cold and warm climate. In fact, hot and humid summer and dry and comfortable winter are the remarkable characteristics of the climate of Bangladesh. The average annual temperature is 26.01° Celsius and the average rainfall is about 203 centimetres. Due to monsoon, rainy season extends from June to October in this country (fig. 10.4). The highest rainfall in Bangladesh occurs at Sylhet.

On the basis of monsoon, rainfall and annual temperature, the climate of Bangladesh is divided into three seasons, viz. (a) Summer season, (b) Rainy season and (c) Winter season.

(a) Summer season : The summer season in Bangladesh extends from March to May (Falgun to Jaishtha). The temperature starts increasing in this season, as the sun shines vertically rays over the tropic of cancer during this period. The temperature, wind direction and the rainfall of this season are discussed below :

Temperature: The summer is the hottest season in Bangladesh. During this season, the maximum temperature of 34° Celsius and the lowest of 21° Celsius are recorded. The average temperature of 28° Celsius prevails in the month of April. April is the hottest month. The temperature increases gradually from the coastal region to the interior of the country.

Rainfall: The thunderstorm or the Norwester is one of the important characteristics of summer weather. Kalbaishakhi is a local name of thunderstorm or Nor'wester which occurs with thunder, lightning and hail storm during the months of March and April in the afternoon. About 20 percent of the annual rainfall of Bangladesh occurs in summer due to Kalbaishakhi storms. During this time the average rainfall recorded is about 51 centimetres (fig. 10.5).

Wind : A change in air pressure takes place due to the northward movement of the sun in the northern hemisphere. The hot and humid air coming from the south rises upward due to high temperature and comes in contact with the cold and dry air coming from the north causing rainfall with thunderstorms.

(b) Rainy season : The rainy season extends from June to October (Jaishtha to Kartik) in Bangladesh. The period between summer and winter with rain is known as the rainy season. During the first half of June, the rainy season begins with the advent of monsoon wind. The characteristics of rainy season are discussed below :

Temperature : The sun shines vertically during rainy season in Bangladesh. As a result, the temperature increases. But due to cloud cover and heavy downpour, the high temperature is not very uncomfortable. The average temperature is 27° Celsius.

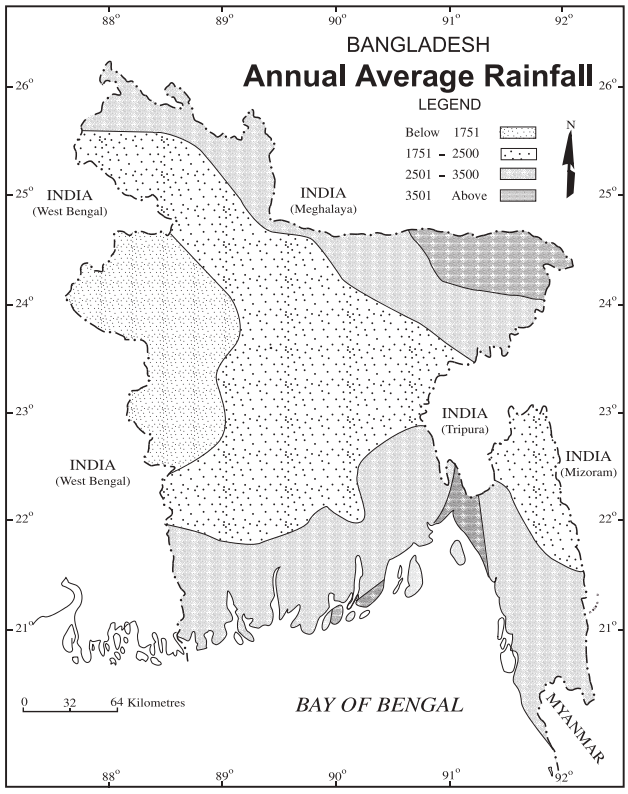


Fig. 10.5 : Annual average rainfall of Bangladesh

Rainfall: During the rainy season, the south-west moonsoon wind that blows over Bangladesh brings heavy moisture from the Indian Ocean and the Bay of Bengal. This moisture causes heavy convectional rainfall. Eighty percent of the total annual rainfall occurs during this period.

Wind: There is a change in air pressure due to the location of the sun over Bangladesh in the month of June. The rainy season begins when the south-west trade wind starts blowing from the Bay of Bengal. During this time, after crossing the equator, it deflects to the right as per Ferrel's law and it becomes south-west monsoon wind. This water vapour filled air is abstracted by the Himalayas in the north of Bangladesh which causes heavy rainfall. This is the beginning of rainy season. After the rainy season is over, cyclones hit Bangladesh occasionally.

(c) Winter season : The period from the end of November to February (Kartik to Falgun) is known as winter. The temperature starts declining after September and October. The lowest temperature is recorded in January (fig. 10.6).

Temperature : The lowest temperature is found in winter in our country. During this season, the maximum temperature of 29° Celsius and the minimum of 11° Celsius is recorded. The coldest month is January and the average temperature recorded is 17.7° Celsius. During winter, the temperature decreases from the coast to the north. In the history of Bangladesh, the lowest temperature recorded was 1° Celsius in 1905 in Dinajpur district, located in northern Bangladesh.

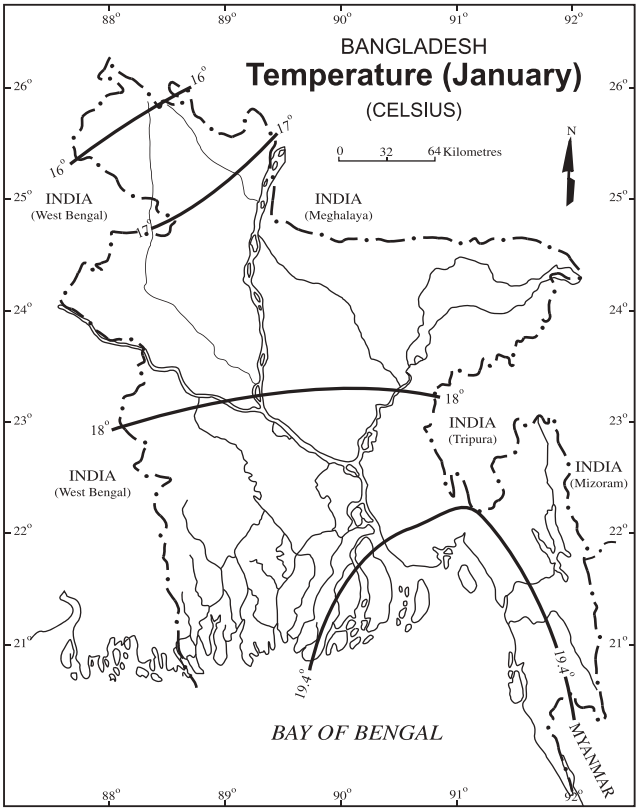


Fig. 10.6 : Temperature of Bangladesh (January)

Rainfall : During winter, Bangladesh does not normally experience any rainfall. At this time, the north-east cold monsoon wind blows over Bangladesh. A little amount of rainfall occurs in the coastal and in the mountainous regions during winter. The rainfall accounts for not more than 10 centimetres.

Wind : During winter season, the humidity in the air is less as the cold Monsoon wind blows from the north-east over Bangladesh. The lowest humidity recorded during this time is 36 percent. Sometimes, very cold wind blows over the northern region and as a result, it experiences very cold weather.

Monsoon wind: In the beginning of June warm and humid south-west monsoon wind blowing from the Bay of Bengal is obstructed in the hilly areas of eastern and northern region of Bangladesh causing rainfall. From June to October rainfall occurs all over Bangladesh due to monsoon wind and that is the rainy season. Four-fifths of the annual rainfall takes place during rainy season. Cloudy sky and heavy rainfall lower the temperature more than in the summer season. Summer extends from March to May. April is the hottest month. But the temperature does not vary much till September. The two seasons can be differentiated on the basis of humidity but not on temperature. In summer season the temperature of the air increases from the coastal area towards north in the interior of the country. Norwester or Kalbaishakhi is a characteristic feature of summer. This storm occurs in great intensity with thunder and lightning from north western direction during March-April. With high wind velocity, this storm causes severe damage. Summer rainfall is good for crop production. Rainfall, especially in summer, is very much useful for growing paddy, jute

and sugercane. On the other hand, in winter, south-east monsoon causes chill which is very useful for the growth of wheat and cereals (green crops). These type of crops are very profitable for the farmers.

Task : Mention the cultivation of crops on the basis of season and environment.		
Summer season	**Rainy season**	**Winter season**
• • • •	• • • •	• • • •

Task : What type of safety and security measures should be taken in case of thunderstorm and lightning?	
Security measures	**Safety measures**
• • • •	• • • •

Sample Questions

Multiple choices questions

1. In which district is Lalmai Pahar located?

(a) Gazipur
(b) Tangail
(c) Mymensingh
(d) Comilla

2. Causes of river sedimentation in Bangladesh-

i. Sedimentation of soil mixed with water.
ii. Deforestation occurring upstream of the river
iii. Planned construction of dams along the river.

Which of the following is correct?

(a) i and ii
(b) i and iii
(c) ii and iii
(d) i, ii and iii

Read the following stimulus and answer questions 3 and 4.

A river flows very close to Samina's house. It makes its way into Bangladesh through the heart of Kurigram district.

3. Where is the source of the river mentioned in the stimulus?

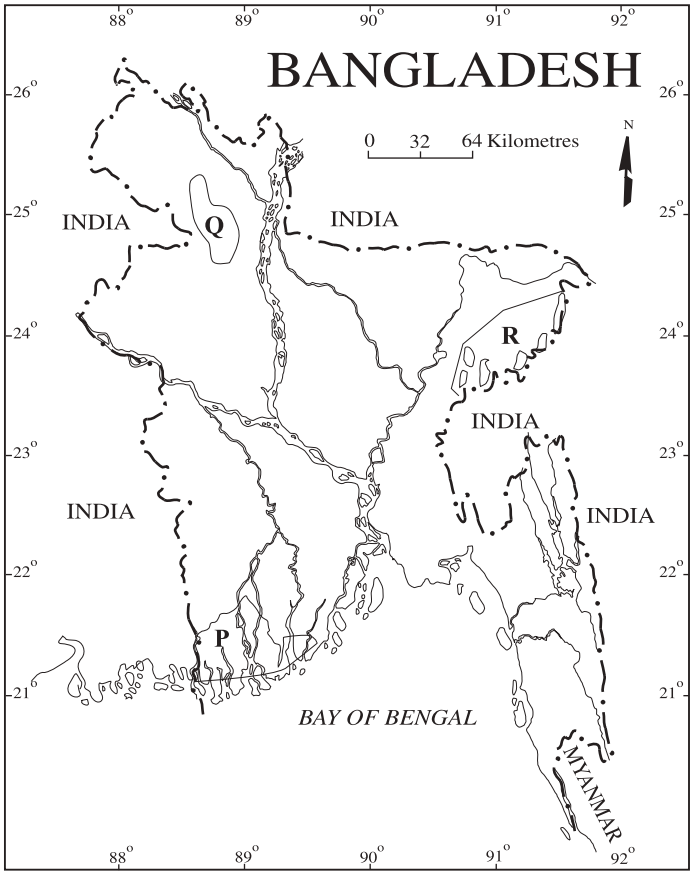
a. In the Lusai Hills
b. In Manas Sarovar
c. In the Gangotri Glacier
d. In the Naga-Manipur region

4. Which is the tributary of the mentioned river?

a. Banshi
b. Buriganga
c. Kumar
d. Madhumati

Creative questions

1.



a. Which storm is characteristic of the summer weather in Bangladesh?

b. Why is the climate of Bangladesh known as a tropical monsoon climate? Explain.

c. Describe the topography of the location marked `P' on the map.

d. Is there any similarity in the topography between the locations marked `Q' and `R' on the map? Analyze logically.

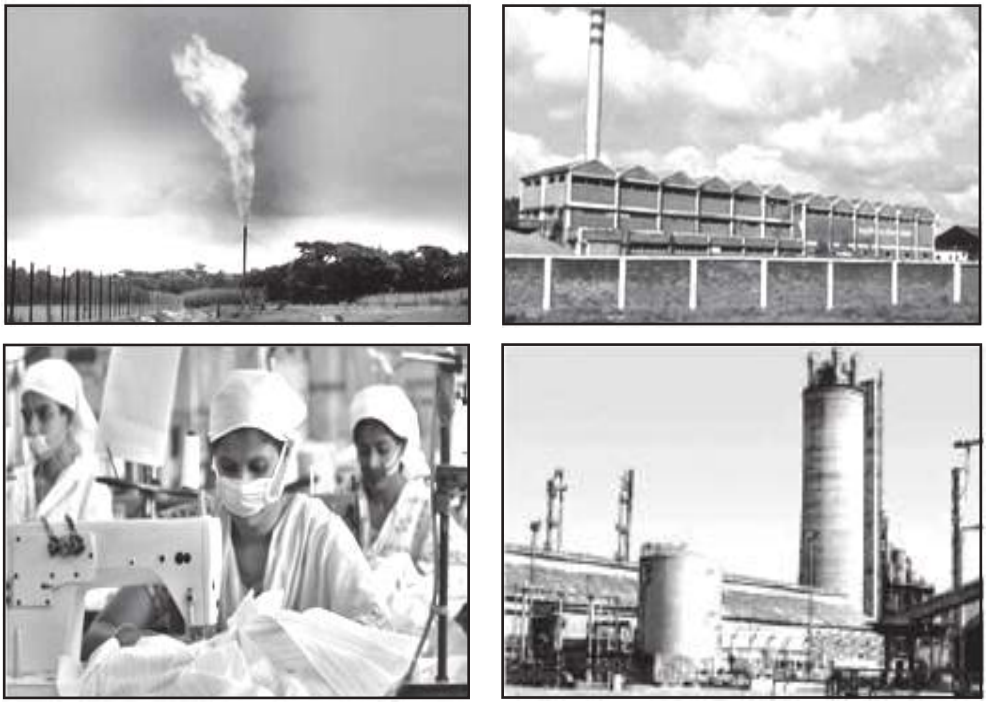
Short-answer questions

1. Describe the course of the Jamuna River.
2. Describe the wind currents in Bangladesh during the monsoon season.
3. Discuss the mountains in the southeastern region of Bangladesh.
4. Describe the geographical location of Bangladesh.
5. Describe the boundaries of Bangladesh.

Chapter Eleven

Resources and Industries of Bangladesh

The economic and the social development of a country depend on resources and industries. We use the essential products produced by the natural resources directly or using the resources. The important resources of Bangladesh are Agricultural and Forest resources, Mineral oil, Natural gas and Coal. The importance of industries of this country is limitless as a developing country. The garments sectors are contributing much in development of the economy of Bangladesh.



Some industry related photos of Bangladesh

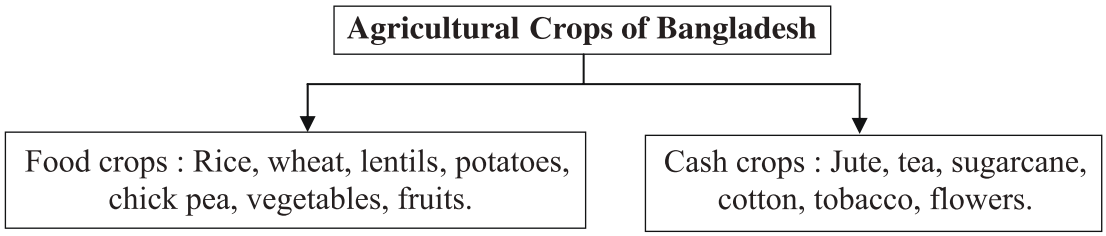
At the end of this chapter, we will be able to –

- explain the main agricultural products of Bangladesh and their distribution;
- explain the importance of different forest regions/areas of Bangladesh;
- create awareness of preserving the forest resources everywhere;
- explain the position of petroleum, natural gas, coal and limestone displayed on the map;
- explain the importance of Petroleum, Natural gas, Coal on the economy of Bangladesh;

- explain/describe the main industries of Bangladesh and represent them in map;
- analyze the contribution of Garment Industries to the economy of Bangladesh;
- explain the main tourist places of Bangladesh and display them on map;
- explain the importance and prospect of Tourism Industry of Bangladesh;
- follow the duty of citizen in preserving the favourable environment of tourism places as tourist.

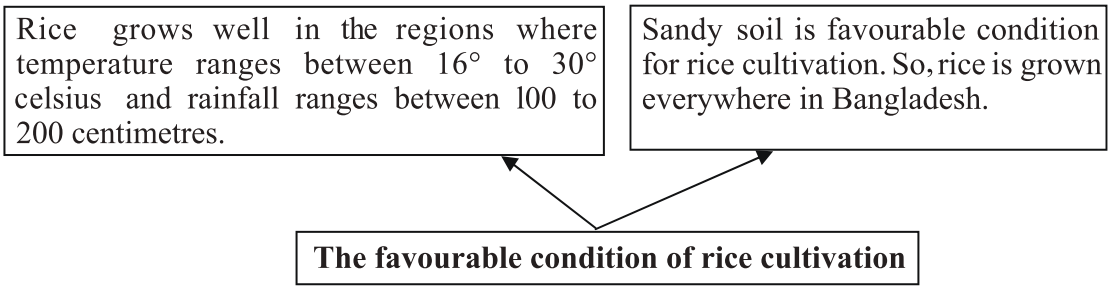
Agricultural products

Agriculture plays an important role in the economy of Bangladesh. Profitable, sustainable and environmentally friendly agricultural systems are important for the development of a country. The contribution of total agricultural sectors to G.D.P in the fiscal year of 2023-2024 is 11.02 percent (Source: Ministry of Agriculture of Bangladesh Report, 2024). About 40.6 percent of total man power of this country is engaged in agriculture. The main exporting products in agricultural sectors are frozen food, raw jute, jute goods, tea etc.



Food crops

Rice : Rice is the staple food crop of Bangladesh. Aus, Aman, Boro are the varieties of rice cultivated in this country. Rice is produced in all the districts of Bangladesh. Rice is mostly cultivated in Rangpur, Cumilla, Sylhet, Jashore, Kishoreganj, Rajshahi, Barishal, Mymensingh, Bogura, Dinajpur, Dhaka and Noakhali. But Aman and Boro are produced more in Rangpur and Sylhet (fig. 11.1) respectively.



Wheat : At present wheat cultivation is done in almost all the areas in Bangladesh where rice is grown due to the demand for food crops. But the northern districts of Bangladesh are more favourable for cultivating wheat. Wheat growing areas are Dinajpur, Rangpur, Pabna, Rajshahi, Kushtia, Jashore, Bogura (fig. 11.1).

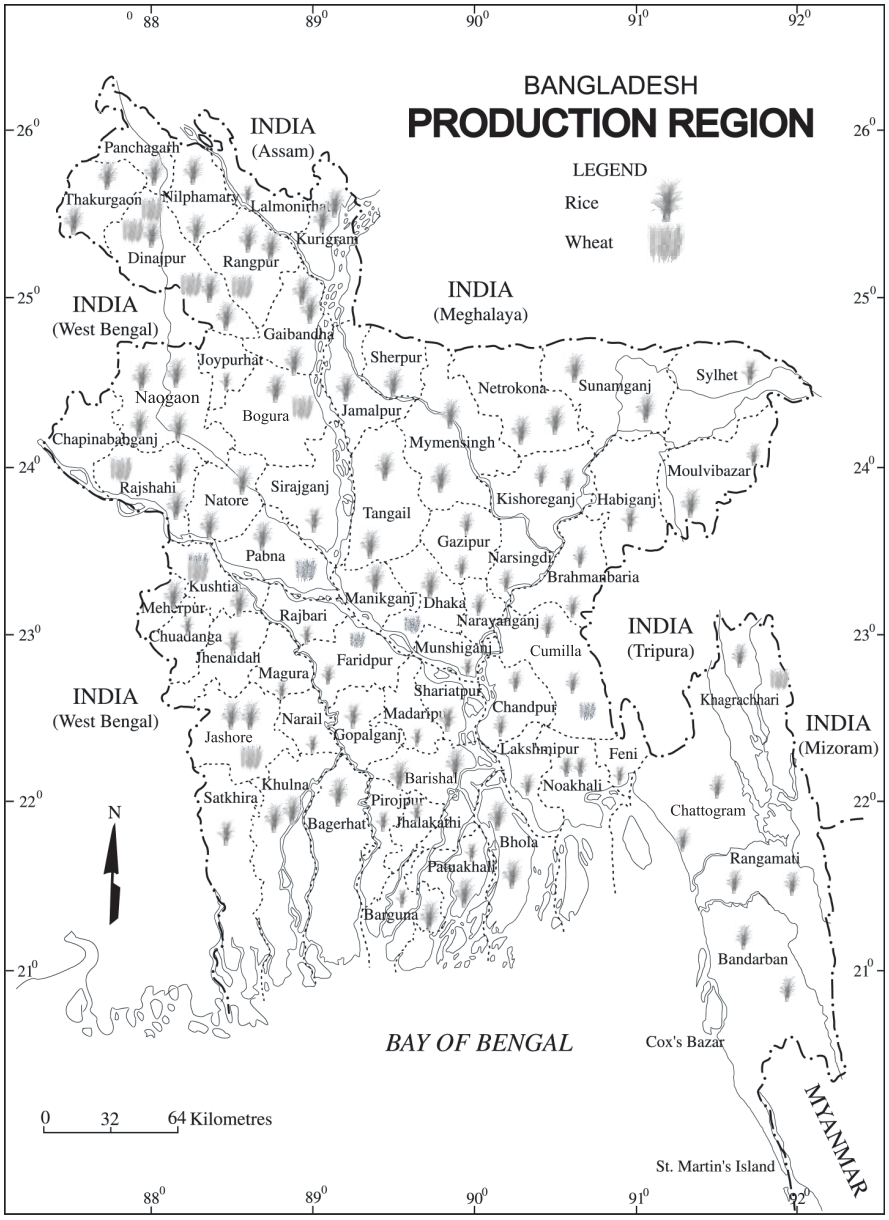
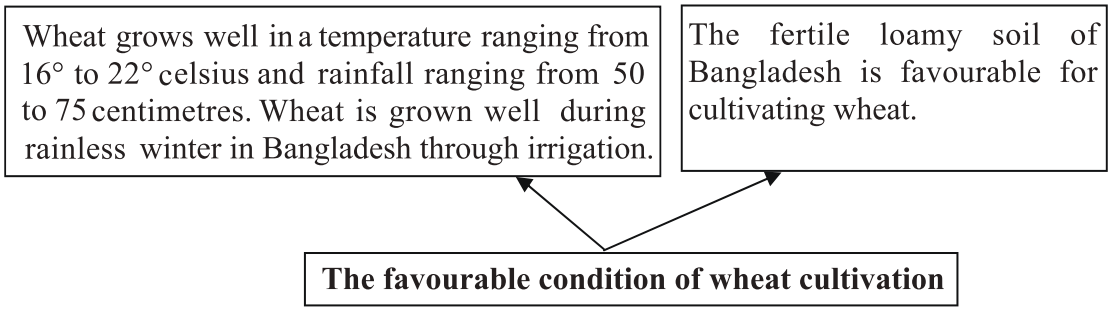


Fig. 11.1 : Rice and Wheat production regions of Bangladesh

The other important crops are oil-seeds like sesame, mustard, peanut, lentil, mungbean, gram, garlic, potatoes, fruits and vegetables.

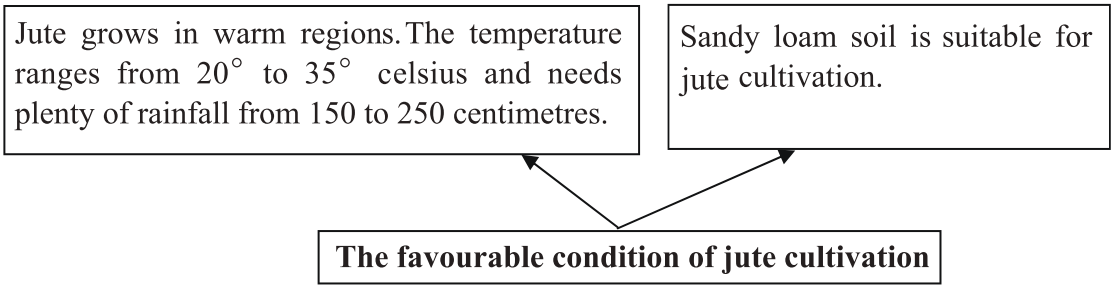


Cash or commercial crops

The crops which are cultivated for direct selling are called Cash or Commercial crops.

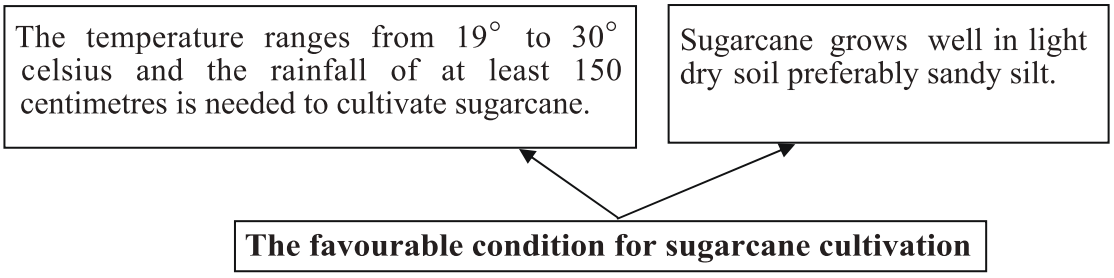
Jute

Jute is the main cash crop of Bangladesh. There are two kinds of jute cultivated in Bangladesh named: Deshi and Tosha. Jute is grown well in the districts of Rangpur, Mymensingh, Faridpur, Cumilla, Jashore, Dhaka, Kushtia, Jamalpur, Tangail and Pabna (fig. 11.2).



Sugarcane

Sugarcane is an important crop for producing sugar and molasses (gurh). Plain land is required to cultivate sugarcane. The main regions for cultivating sugarcane are Rajshahi, Rangpur, Dinajpur, Pabna, Kushtia, Faridpur, Dhaka, Jashore, Mymensingh etc. (fig. 11.2).



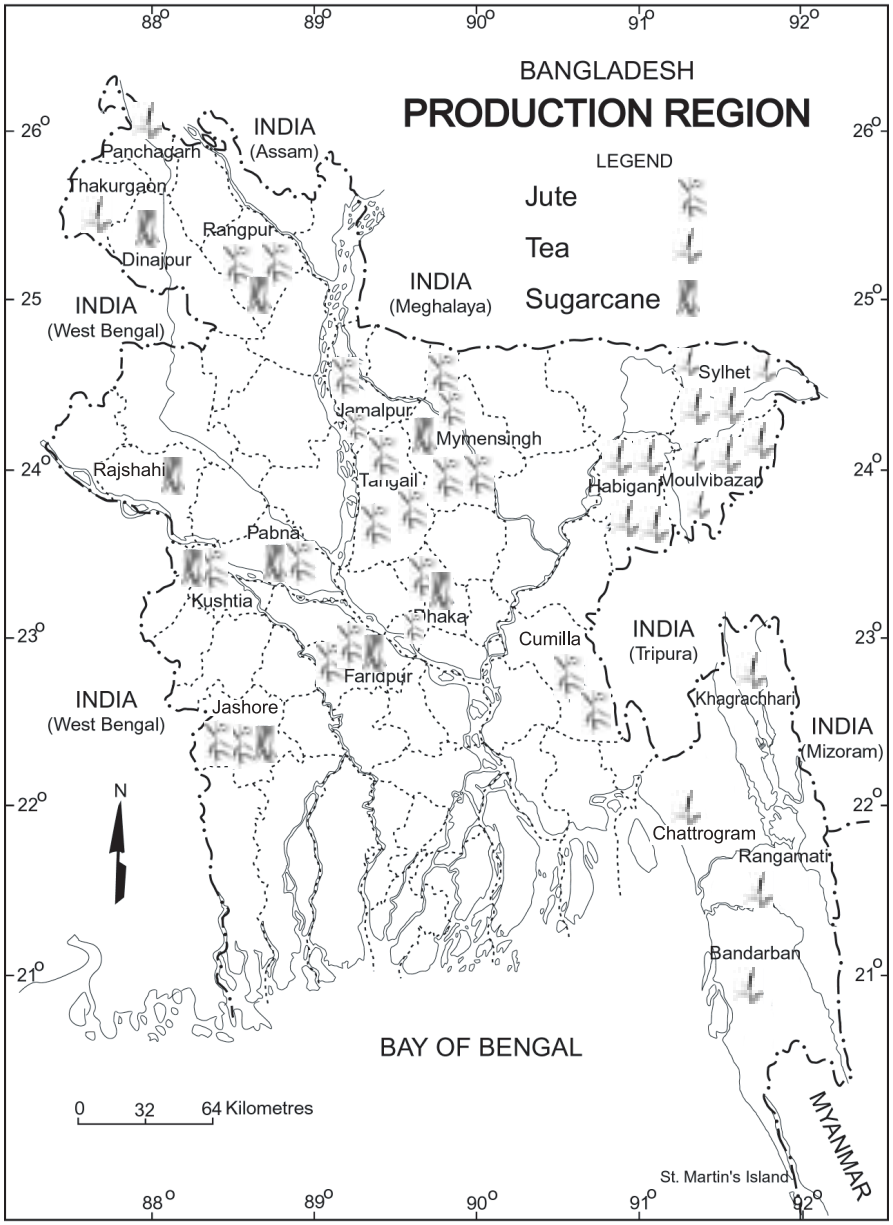
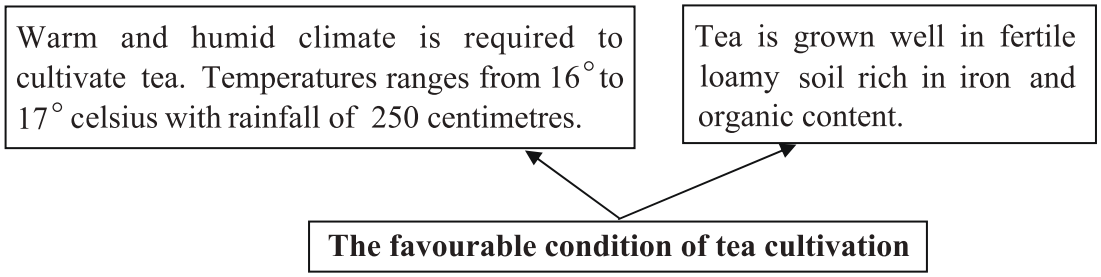


Fig. 11.2 : Jute, Sugarcane and Tea production regions of Bangladesh

Tea

Tea is one of the main cash crops in Bangladesh. Most of the produced tea of the country is exported abroad. Tea is grown in well drained soils on the slopes of the hills. Most of the tea gardens are in Moulvibazar, Habiganj, Sylhet. Besides

these, there are tea gardens in Chattogram, Rangamati, Khagrachhari, Bandarban, Thakurgaon and Panchagarh (fig. 11.2).



Besides the natural indicators of agricultural crops, the indicators such as capital, labour, transportation, market i.e also influence on extension and production. The agricultural extension is possible combining with the government assistance and natural environment.

Crop diversification

In Bangladesh, winter is good for the cultivation of cereals and vegetables. In this period, cereal crops are cultivated in different areas. As a result, the farmers receive lower prices. If same kinds of crops are cultivated year after year in the same soil, nutrition of soil decreases. At the same time, cultivation of various types of crops helps the farmers to receive higher prices.Various parts of plants mixed with fertilizer increase the fertility of the soil and check the soil degradation. As a result, much fertilizer is not required to use. In this way, by cultivating various types of crops; farmers can benefit themselves and the environment.

Forest of Bangladesh

The resources which are produced or available from the forest are known as forest resources. Ideally 25 percent of total land area of a country should remain under as cover to maintain environmental balance and the economic development. But according to the statistics of Forest Department of Bangladesh 2024, the total forest area until December 2023 is only about 15.58 percent in Bangladesh at present. The forests of Bangladesh are classified into three categories due to the variation of soil and climate (fig. 11.3).

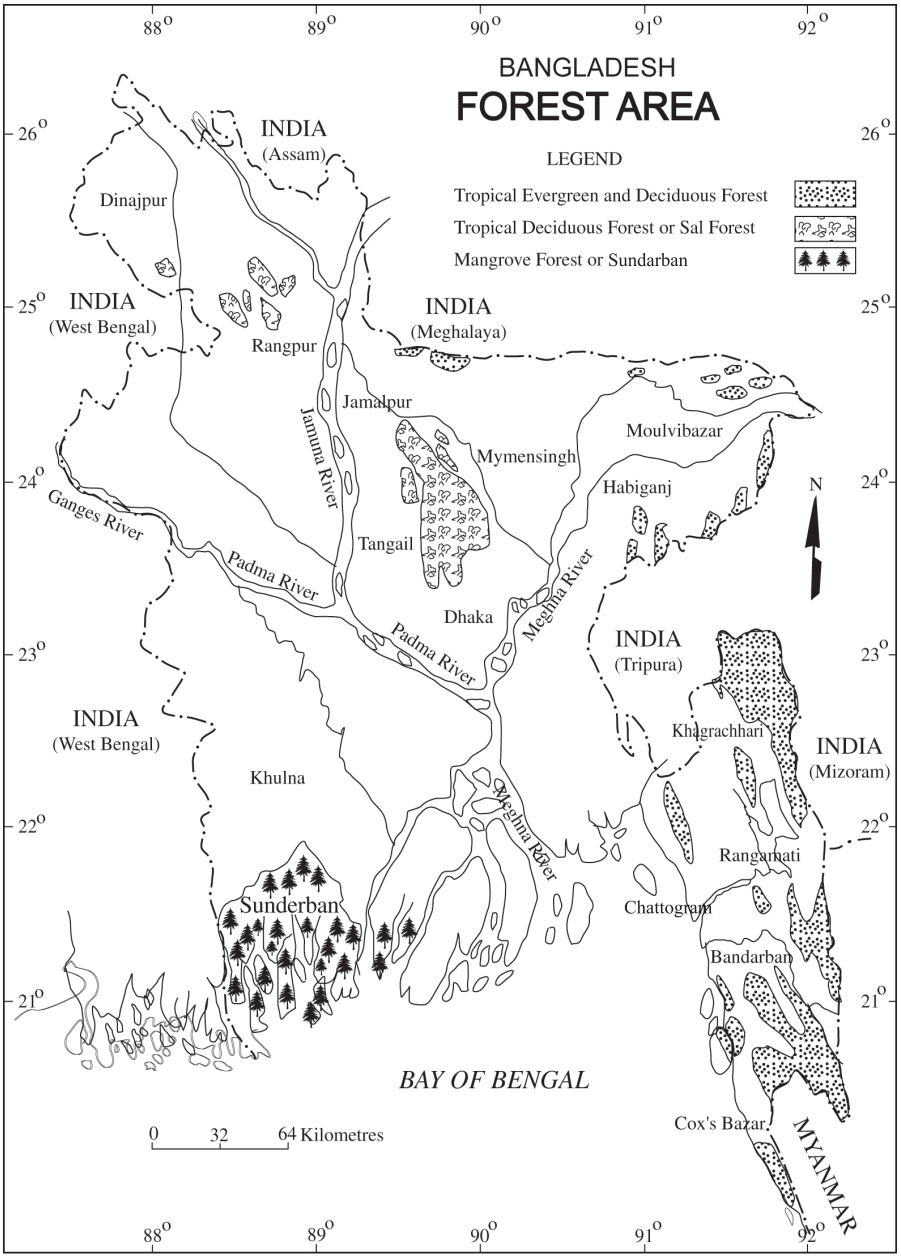


Fig. 11.3 : Forest area of Bangladesh

Tropical Evergreen and Deciduous Forests : These forests cover the major parts of Khagrachhari, Rangamati, and Bandarban and a considerable part of Chattogram and Sylhet regions. Evergreen trees have widespread coverage in the hills due to heavy rainfall.

Tropical Deciduous Forests: The tropical deciduous forest is found in less rainfall areas in the Pleistocene terraces of Bangladesh. This forest region is divided into two parts. (a) Forest of Mymensingh, Madhupur and Bhawal Garh of Tangail and Gazipur. (b) The forest cover of Barind region in Dinajpur and Rangpur districts. The leaves of deciduous forests fall during winter and new leaves sprout again during summer.

The Forest of Bangladesh

Mangrove Forest or the Sundarbans : This forest covers the districts of Khulna, Satkhira, and Bagerhat in the north, Bay of Bengal in the south, Haringhata river, Pirojpur and Barishal district in the east and Raimangal and Hariabhanga river which partially form the boundary with West Bengal, India. This forest occupies an area of 6,000 square kilometres in Khulna division. This region is enriched with the trees because of tides from the sea and salty water and heavy rainfall.

Task : The characteristics of different plants and names are given. Write the names of the relevant forest on the right hand column.

Plants and Nature	The name of forest
1. Sundari, Garan, Gewa, Dhundal, Keora and Golpata are usually grown in the tidal confluence of sweet and salty water. 2. Sal, Gajari, Koroi, Hizal shed their leaves annually. 3. Chapalish, Moyna, Telsur and Bamboo never shed their leaves any time.	

Importance of forest: Forests play an important role in the economy of the country. The forest resources of Bangladesh are limited and are diminishing day by day. Forests are extremely important for maintaining the balance of natural environment and the economic development.

1. Natural importance : The forest plays a significant role in preserving biodiversity, reducing land degradation, decreasing landslides, increasing the amount of rainfall, keeping the humid weather and controlling the flood.

2. Prospect of tourism industry : Sundarbans and Chattogram Hill Tracts are the potential places of tourism industry. The diversity of these places can attract the tourists which can contribute to the economy of the country.

3. Collection of consumable goods : To meet the daily needs, people collect wood, bamboo, cane, honey, wax etc. from the forest. The animal hide and skins and the medicinal herbs are also collected from forests.

4. Construction material : The people collect wood, bamboo, cane etc. from the forest so that they can construct their houses and make furniture.

5. Development of industry : The forest resources are used for the production of paper, rayon, match, fiber board and the accessories for toys. They have thus accelerated the development of industries. The Karnaphuli Paper Mill and the Newsprint Mill of Khulna have been established on the availability of forest resources.

6. Disaster risks minimisation : The forests of coastal region play an important role in reducing the destruction from tidal waves during hurricane or storms.

7. Transport and communication system : The wood collected from the forest is used to make railway sleepers, boats, launches, ships, electricity poles, bridges etc.

8. Source of government revenue : The forest resource is a source of government revenue. For example the government increases its revenue by selling and by imposing taxes on such resources.

9. The development of agriculture : Forests keep the climate humid as a result it causes heavy rainfall which helps to develop agriculture.

10. Foreign currency earnings : Bangladesh earns a huge amount of foreign currency by exporting the hide and skins of animals, teeth, horns, feathers of different types of animals.

Petroleum, natural gas, coal and hard rock of Bangladesh

Petroleum, natural gas, coal and hard rock are important mineral resources (fig. 11.4). The economic development is possible if a coordination of research, production and distribution is done.

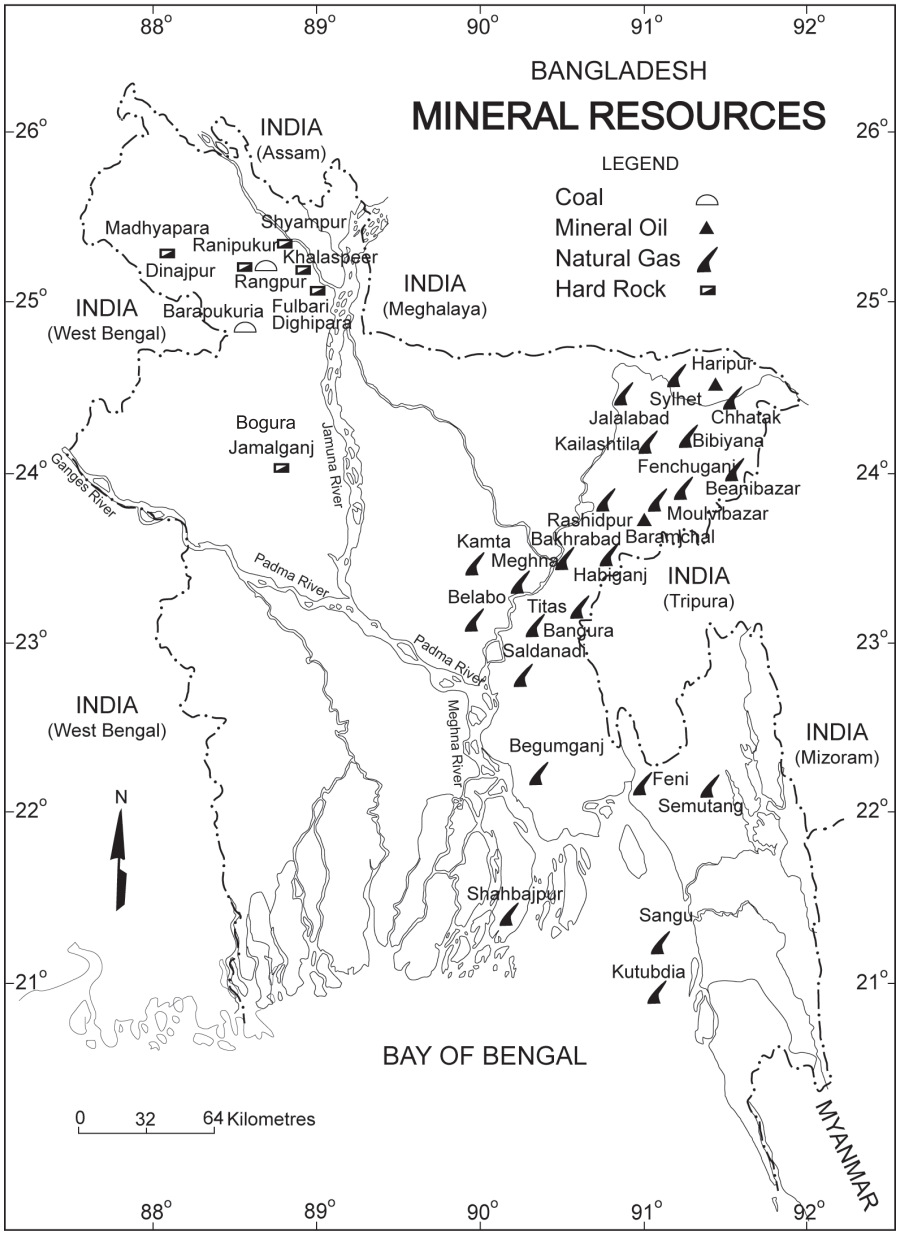


Fig. 11.4 : Mineral resources of Bangladesh

Petroleum : The experts think that there is petroleum in the coastal regions of Bangladesh. Oil was found in the seventh well of natural gas in Haripur of Sylhet district in 1986. Around 600 barrels of crude oil from this well is extracted everyday. This crude oil is sent to Chattogram refinery for processing.

Apart from petrol, kerosene, bitumen etc. are produced as by product from this crude oil. The second oil field of Bangladesh is located at Bramchal in Moulvibazar district. Around 1,200 barrels of oil produced everyday from this field.

Natural gas: Natural gas is an important fuel resource in Bangladesh. It meets about 54-59 percent of commercial consumption of the country. The total number of gas fields so far discovered is 29. These gas fields have approximately 28.89 trillion cft gas for extraction. From 1960 to June, 2023, 20.72 trillion cft gas has been extracted and 8.17 trillion cft gas was left to be extracted. At present gas is being tapped from 111 wells of 20 gas fields. In the year of 2022-2023 extracted 804 billion cft gas. (Source: Bangladesh Economic Survey, 2024).

Gas Fields			
On production	**Production not yet started**	**Production postponed**	**New gas field discovered**
Bakhrabad, Habiganj, Sylhet, Kailashtila, Rashidpur, Titas, Narsingdi, Meghna, Saldanadi, Jalalabad, Beanibazar, Fenchuganj, Moulvibazar, Bibiyana, Bangura, Shahbajpur, Semutang, Shrikail, Sundalpur, Begumganj.	Kutubdia, Bhola North, Jokigonj, Ilisha.	Chhatak, Kamta, Sangu, Feni, Rophgonj.	

Coal: Coal is one of the sources of energy. It is used to run the machineries, railways and ships etc. Coal is also used as fuel. Bangladesh is not rich in coal resources. A total of 5 coalfields have been discovered in the northwestern region of the country. These are Barapukuria, Phulbari, and Dighipara in Dinajpur; Khalashpur in Rangpur; and Jamalganj in Bogura. The total reserve of these coalfields is 3,426.9 million tons. Among these coalfields, the Barapukuria coalfield is currently active. Around 2500-3,000 metric tons of coal are being tapped everyday from the coal field of Barapukuria of Dinajpur district. (Source: Energy and Mineral Resources Division, Quarterly Report, December, 2024)

A good amount of low–grade peat coal is found in Banghi and Chanda Beel of Madaripur and Gopalgonj, Kola Beel of Khulna, Brahmanbaria, Kishoreganj and a few places of Sylhet. Besides, a reserve of high quality coal of bituminous and lignite variety has been found in Rajshahi, Bogura, Naogaon and Sylhet. A high quality lignite coal is being extracted from the Barapukuria coal field of Dinajpur.

Hard rock: Hard rock is used in the construction of railways, roads, houses, bridges and in flood embankments. Hard rock is available in Ranipukur and Shyampur of Rangpur district and Madhyapara of Dinajpur district. Arrangement has been made to extract hard rocks in Ranipukur of Rangpur district with foreign assistance. Experts think 'Around 17 lakh tons of hard rock can be extracted every year from this field of rocks.' During the 2023-2024 fiscal year, 13.16 lakh metric tons of hard rock of different sizes were extracted from Madhyapara in Dinajpur district. (Source: Maddhapara Granite Mining Company Limited, Annual Report, 2023-2024).

The importance of petroleum, natural gas and coal on the economy of Bangladesh

Petroleum is an essential product in this modern civilization. It provides Electricity, energy and heat. Gasoline, diesel, gas, kerosene, lubricant, parafin etc. are the by products of refining petroleum. Petrol and diesel are used to run the railways, vehicles, ships and aeroplanes. Foreign currency can be saved if the available amount of oil is extracted from the gas fields. At the same time, the dependence on natural gas could be reduced.

Natural gas is used in mills and factories as raw materials. The natural gas of Haripur is used in the fertilizer factories of Fenchuganj and in cement factory of Chhatak. Natural gas of Titas is used in the fertilizer factory of Ghorashal as raw material. Natural gas is also used to make pesticide, rubber, plastic and artificial fibre. The tea gardens depend on the natural gas of Rashidpur. The natural gas is used in lieu of furnace oil in some electric plant of Brahmanbaria. Such as the Titas gas is used to produce the thermal electric plant of Siddhirganj, Ashuganj, and Ghorashal. The natural gas is also used for domestic and commercial purposes.

Task : Fill up the table below (individual work).	
Industry	**The name of used gas field**
Fenchuganj fertilizer factory	
Chhatak cement factory	
Ghorashal fertilizer factory	
Siddhirganj thermal electric plant	
Ashuganj thermal electric plant	

Coal can be used as fuel alternative to gas and firewood. At present around 65 percent extracted coal from Barapukuria is being used for the production of electricity at the thermal power plant of Barapukuria. The remaining 35 percent coal is being used in the brick-field, mills and factories along with other sectors. Coal is playing a significant role in saving the forest resources. The environmental pollution which is caused by burning wood and coal does not cause that pollution. Coal helps to protect the natural environment by protecting the forest resources. These mineral resources play a great role in developing the agriculture reducing the foreign exchange spending, government source of earning and creating the employment opportunities etc. We should be aware and careful of using these resources. We will not waste these valuable resources.

Major industries of Bangladesh

Industrialization is the precondition of the economic and social development of a country. The industrial sector can play a significant role in developing the socio-economic development and in reducing the poverty. The contribution of industries is increasing on domestic production day by day. According to Bangladesh Economic Survey, 2024 in the year 2023-2024, the contribution of industries to GDP is 35.30 percent. The main industries of Bangladesh are :

Jute industry

Jute industry is one of the main agro-based industries. There are skilled and cheap labour for jute industry in this country. Above all, the assistance and cooperation of the government for jute industry is offered. In the private sector, many jute mills have been established. Total number of jute mills are 205 and the annual production is 6,63,000 metric tons. Table below shows the jute industries, their products and the exporting countries.

Regions of Jute industries	Jute manufactured products	Exported countries
Narayanganj, Khulna, Chattogram, Demra, Ghorashal, Narsingdi, Bhairab Bazar, Gouripur, Madaripur, Chandpur, Sirajganj, Habiganj.	Hessian, gunny bags, carpet, ropes, sandals, mats, dolls, show pieces, juton.	USA, UK, India, Egypt, Russia, Poland, Bulgaria, Belgium, Canada, Italy, Germany, Japan, France.

Cotton textile industry

The second major industry is the cotton textile industry. Cloth is next to food among the basic needs. So, the cotton textile industry has great importance. Bangladesh is not self-sufficient in cotton textile industry. The climate required for cotton textile industry is favourable. The cotton textile industries of Bangladesh are located in some regions. Such as :

Dhaka region	Chattogram region	Cumilla and Noakhali region	Rajshahi and Khulna region
Mirerbagh, Postagola, Shyampur, Demra, Savar of Dhaka district; Narayanganj, Murapara, Kachpur, Dhamgarh, Laxmankhola, Fatulla of Narayanganj district; Tongi, Joydebpur, Kaliganj of Gazipur district; Narsingdi, Madhabdi, Baburhat and Ghorashal of Narsingdi district.	Faujdarhat, North Kattoli, Sholoshahar, Pachlayish, Jublee road, Halishahar, Kalurghat.	Durgapur, Daulatpur, Halimanagore, Arigola, Brahmanbaria and Banchharampur; Feni and Raipur of Noakhali region.	Rajshahi, Bogura, Sirajganj and Pabna less of Rajshahi division ; Dinajpur of Rangpur division and Kushtia, Magura, Noapara of Jashore district of Khulna division.

The cotton textile industries of Bangladesh are run by imported cotton and thread from abroad. In Bangladesh a huge quantity of cotton, textiles and yarns are imported from Japan, Singapore, Korea, India and Pakistan every year.

Paper industry

Paper industry is one of the largest industries of Bangladesh. The first paper mill was established at Chandraghona in 1953. At present there are six government paper mills, four board mills and one newsprint paper mill in Bangladesh (fig. 11.5).

Paper mills	Production raw materials	Produced paper
Karnaphuli paper mill at Chandraghona, the North Bengal paper mill at Pakshi in Pabna, Sylhet pulp and paper mill at Chhatak, Bashundhara paper mill, Magura and Shahjalal paper mills in Narayanganj, Newsprint paper mill in Khulna, Bangladesh Hard board mills, Adamjee particle board mills, Kaptai and Tongi board mills.	Bamboo, softwood, reeds, sugarcane wastage, jute sticks and raw jute.	Writing paper, printing paper, packing and other papers and newsprint.

Fertilizer Industry

Bangladesh is an agricultural country. The additional food is needed to meet the demand of food of increasing population. For this we need fertilizer. The first fertilizer industry was established at Fenchuganj in Sylhet district in 1951. Fertilizer is being produced from seventeen fertilizer factories. Among them the main fertilizer factories are Ghorashal Fertilizer Factory, Ashuganj Fertilizer Factory, Polash Urea Fertilizer Factory, Chattogram Triple Super Phosphate Fertilizer Factory, Urea Fertilizer Factory, Jamuna Fertilizer Factory and Fenchuganj Ammonium Sulphate Fertilizer Factory (fig. 11.5).

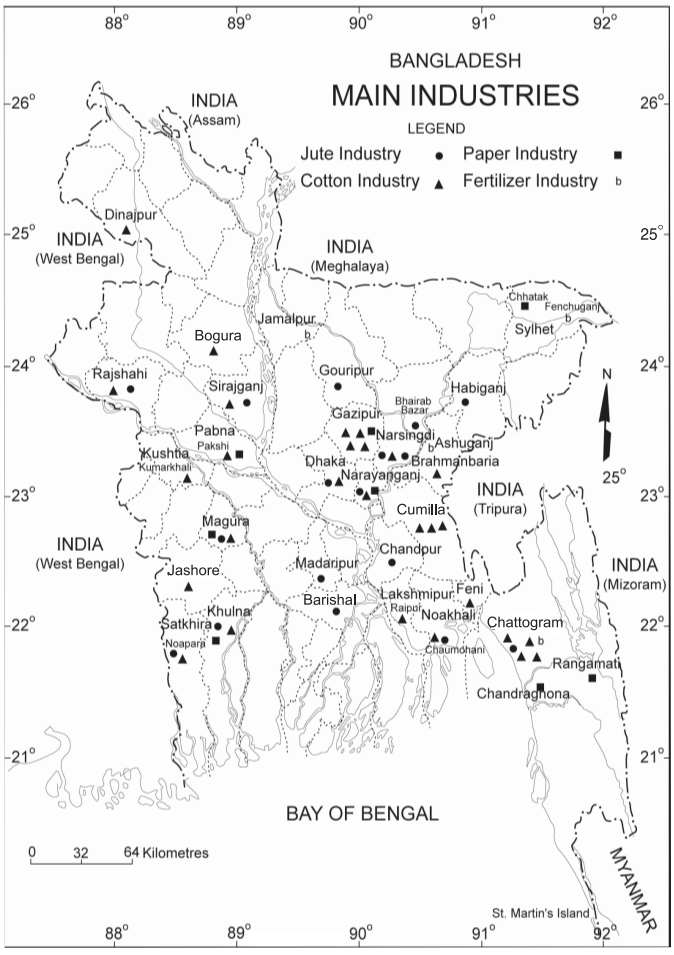


Fig. 11.5 : Main industries of Bangladesh

Fertilizer Industry is one of the largest industries in Bangladesh. We have a great opportunity to produce huge amount of fertilizer due to

the availability of natural gas. Bangladesh will be able to export fertilizer after meeting the country's demand within a few years.

Sugar Industry: The closed government-run sugar mills are being reopened. Currently, there are 15 government sugar mills and three private ones in operation.

Contribution of garment industries to the economy of Bangladesh

The garment industries of Bangladesh have been developed as an important sector. Export-oriented garments industries started to flourish during the later part of seventies and during early eighties. Afterward, this industry placed itself at the top most exporting sector of Bangladesh very rapidly. A number of garments industries are there in Bangladesh. Among them 75 percent garments industries are located in Dhaka region. Rest of them are located in Chattogram port city and a few in Khulna. During 2023-2024 fiscal year, Bangladesh earned 36,130 Million US dollars which accounts for 81.24 percent of total foreign currency earnings (Source : Bangladesh Economic Survey, 2024).

Produced garment	Exported countries
Trouser, jeans pant, skirt, tops, sweater, jacket, pullover, cardigan, blouse, T-shirt, shirt and pant.	USA, Germany, France, Italy, the Netherlands, Canada, Belgium, Spain, and UK.

A favourable environment excites for development of the ready-made industries in Bangladesh. The availability of manpower at a low salary is one of the major factors. The garment industry is known as a 'Billion dollar' industry.

EPZ : Export Processing Zone.

Tourism industry of Bangladesh

Bangladesh is a colourful country having different seasons in nature. The natural beauty of sea beaches, dense forests, and hilly areas makes Bangladesh suitable for tourism. In the 7th century, the famous Chinese traveler and poet Hiuen Tsang visited this land and joyfully described it as: "A sleeping beauty emerging from mists and water." Tourist attraction sites of Bangladesh make up the prospective sectors of development where the longest sandy sea-beach, mangrove forest, coral island, lake, river and the beautiful sceneries and the boat light fill the mind with delight. The hilly land surrounded by evergreen forest is also very attractive. Buddha Vihara and mounds

which are the ruins of ancient civilization are also places of interest. There are beautiful and attractive natural places like Haor or wetlands, Tea gardens of Sylhet, and the scenery of sun rising and setting of Kuakata beach. Apart from these there are many historical, archeological and many Bangalee cultural sites which can attract local and international tourists to visit those places.

Importance of tourism industry in Bangladesh

Tourism industry is an important industry in the modern world. By developing this industry, it can contribute greatly to the economic development of the country, social stability and regional development. It can contribute to enhance the relationship with other countries and provide impetus for environmental development. The tourism industry can be considered the best for displaying the social and cultural heritage of Bangladesh to the people of the world.

The national industrial policy of 2005 acknowledged tourism as an industry in Bangladesh and gave priority to develop this sector. Increased employment opportunity and national revenue can be achieved through tourism industry. The beauties of Bangladesh can be presented to the other people raising the tourism industry. Bangladesh still stays at a primary stage in such a risk less industry. The total number of tourists who came from the other countries to Bangladesh both in 2018 were around 2,92,882. Bangladesh has earned around 1056.74 US Dollar in 2018 from the tourists (Source : Bangladesh Tourism Ministry, Annual Report, 2018-2019).

Importance of tourism centres of Bangladesh

Bangladesh is naturally beautiful, archeologically and historically enriched country. So, every place of Bangladesh has the attractive elements for tourism. The name of regional important tourism places of Bangladesh are mentioned here (fig. 11.6).

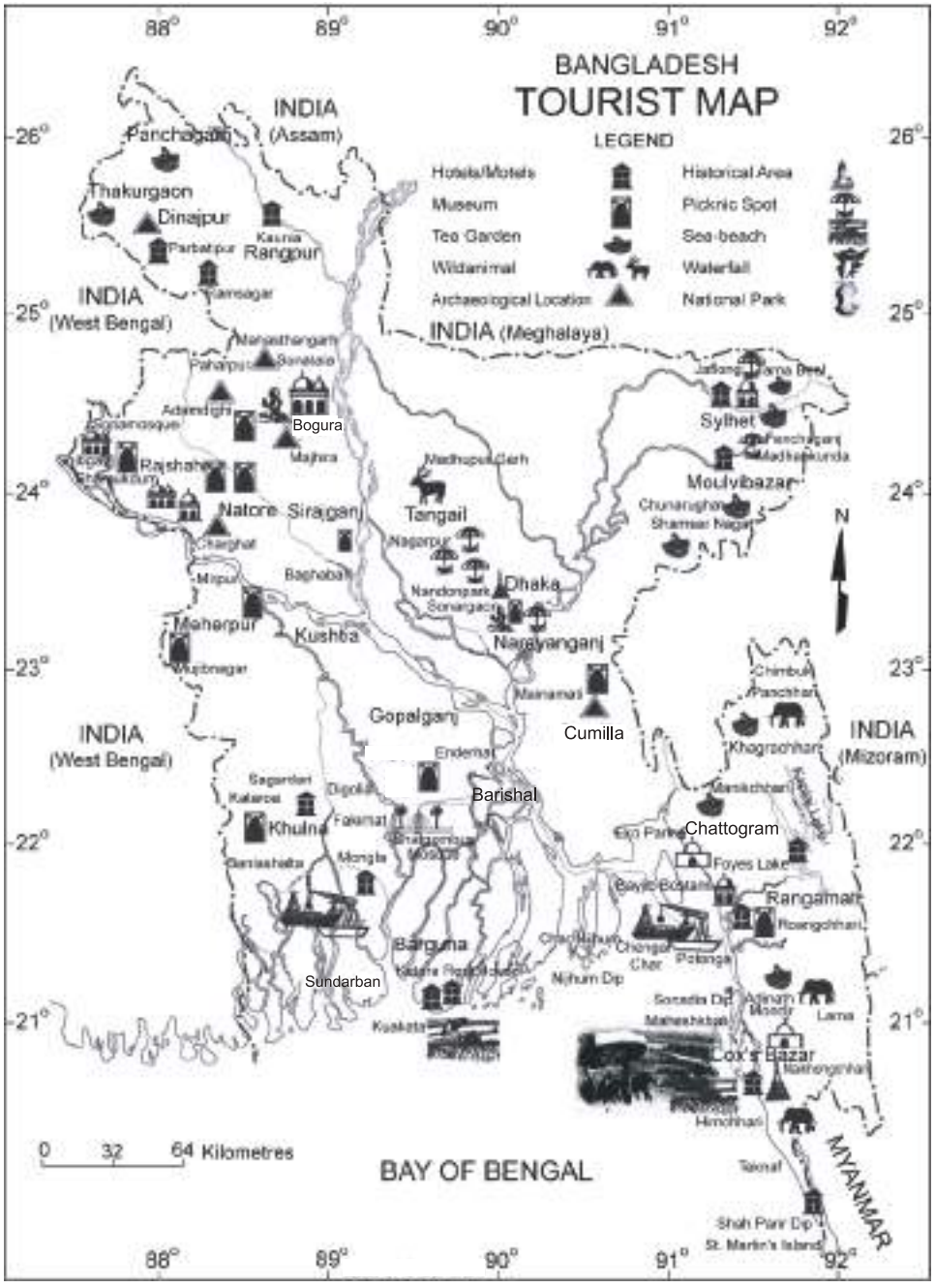


Fig. 11.6 : Tourism map of Bangladesh

Tourist places of greater Dhaka : Historically, Dhaka is both the capital and main city of Bangladesh. It is known as the city of mosques. The Satgambuj mosque was built in the l7th centaury, Tara mosque in the l8th century and Baitul Mukarram Mosque

was built very recently. They are famous example of tourism places. Dhakeshwari Temple was built in the 11th century. Lalbagh fort was built by the Mughal Emperors on the banks of river Buriganga. Bahadurshah park was built in 1857 as a mark of respect to the last Emperor of Mughal dynasty. There are other places like Ahsan manjil, Carzon hall, Dhaka university, Memorial of National Poet, National Museum, Mirpur Intellectual Graveyard, Central Shahid Minar, Martyr Memorial of Rayerbazar, Sohrawardy uddan- the venue of historic 7th March speech, etc. attracts the tourists specially. Bhawal Garh and Jamindar Bari of Gazipur, the historic Sonargaon and Panam Nagar of Narayanganj are also important tourist spots.

Tourist Places of the eastern Bengal : Atia Mosque of Tangail, Grave and Memorial of Politician Maulana Bhasani in Tangail, Jamuna Bridge, Madhupur Tract, Darirampur, Mymensingh, a memorial place bearing the memory of national poet Kazi Nazrul Islam. Mazar of Hazrat Shahjalal (R) and Hazrat Shahparan (R), Keene Bridge, Jainta hill at Jaflong, Eco park at Lauachhara, Madhubkunda waterfall of Moulvibazar etc. Buddist monastery and Shalban Vihara at Mynamati, War cemetary for the Soldiers of second world war in Cumilla. Bajrashahi mosque, Gandhi Ashram, Hatiya and Nijhum island of Noakhali are the tourism places in Eastern Bengal.

Tourist Places of the northern Bengal : Borendra museum and Mazar of Shah Makhdum (R) of Rajshahi, Sona mosque at Shibganj of Chapainawabganj, House of Rani Bhobani and Rajbari at Dhighapatia (Uttara Gono-bhabon), Buddha Vihara at Paharpur in Naogaon, Mahasthangarh in Bogura and the Mazar of Shah Sultan Bolkhi, Kantajee temple of Dinajpur are the tourism places in Northern Bengal.

Tourist Places of the southern Bengal: The shrine of mystic poet Lalon Shah in Kushtia and Rabindranath's Kuthibari in Shilaidaha, birth place of poet Michael Madhusudhan Datta at Sagoredari in Jashore, 'Shishu Sargo and Art Gallery' on the bank of Chitra river of painter S.M Sultan in Narail, the Memorial at Mujibnagar in Meherpur, Shat Gambuj Mosque at Bagerhat, Sea-beach at Kuakata in Patuakhali, the natural Mangrove forest Sundarban located in greater Khulna. are the tourism places of Northern Bengal.

Tourist Places of Chattogram Hill Tracts : The Kaptai lake is the main attraction here (fig. 11.7). The natural beauties surrounded by greenery of hills, deep black water of the lake is a source of unlimited enjoyment. Buddha Vihara and the house of Chakma King are the tourist sites. People also enjoy the forest, hills and the natural water flow of Khagrachhari. There are many attractive tourist places in Bandarban named Meghla, Nilgiri, Shailopropat and Nilachal (fig. 11.8).



Fig. 11.7 : Kaptai lake



Fig. 11.8 : Nilachal

Tourist Places of Chattogram : The attractive tourism place of Chattogram are Patenga sea-beach, Mazar of Hazrat Shah Amanat (R), Foy's lake, DC Hill, Court building and Hills of Sitakunda.

Tourist places of Cox's Bazar : The world's longest sea-beach and charming scenery of Cox's Bazar are the attractive tourism sites.

There are hills sloping down to the waters of the Bay of Bengal. Some important tourist places of Cox's Bazar are Himchhari, Inani beach, Kolatoli beach, Buddhist templels of Cox's Bazar and Ramu, Moheskhali island, Saint martin's island (fig. 11.9) etc.



Fig. 11.9 : Saint martin's island

Sample Questions

Multiple choice questions

1. In which districts of Bangladesh is wheat cultivation more widespread?

(a) Eastern region (b) Western region

(c) Southern region (d) Northern region

2. What type of soil is required for sugarcane production?

i. Sandy loam

ii. Silty loam

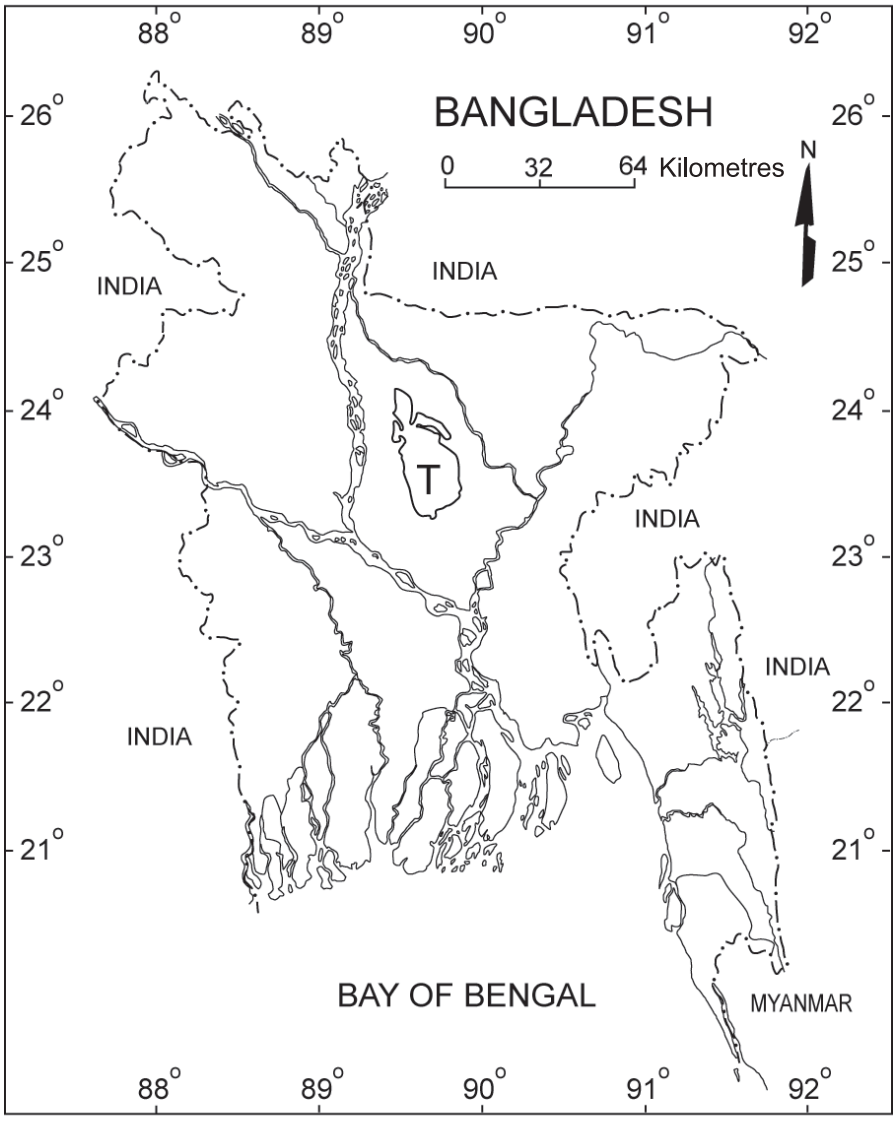
iii. Loam mixed with organic matter

Which of the following is correct?

(a) i and ii (b) i and iii

(c) ii and iii (d) i, ii and iii

Observe the map below and answer the question number 3 and 4 :



3. What kind of forest is found in the area labeled 'T'?

(a) Tropical evergreen (b) Tropical deciduous

(c) Stream/Mangrove (d) Tropical evergreen and deciduous

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4. What types of trees grow in the aforementioned forest?

i. Chapalish

ii. Shal

iii. Hijal

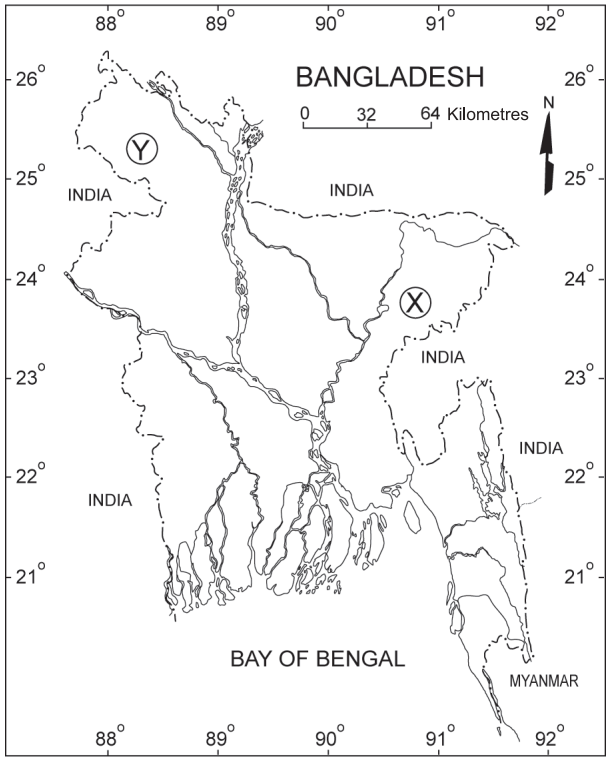
Which of the following is correct?

(a) i and ii (b) i and iii

(c) ii and iii (d) i, ii and iii

Creative questions

1.



a. What is a cash crop?

b. Explain the climate suitable for wheat cultivation.

c. Explain the reason for the production of the important crop in region 'X'.

d. Give your opinion on which of the significant mineral resources found in regions 'X' and 'Y' is of greater economic importance.

Short-answer questions

1. Write four essential points of the tourism industry in Bangladesh.
2. What is meant by crop diversification?
3. What are forest resources?
4. Write about the soil suitable for rice cultivation.
5. Write the role of forest areas in the development of industry.

Chapter Twelve

Transport System and Trade of Bangladesh

Transport plays a significant role in the economy by transporting passengers and commodities within the country and outside. The transport system plays an important role in transporting the raw materials, movement of people from one place to another, marketing of products and stability of the price of products. Trade is influenced by the transport system. Trade is an important part of the economy of a country which maintains a balance between agriculture and industry.



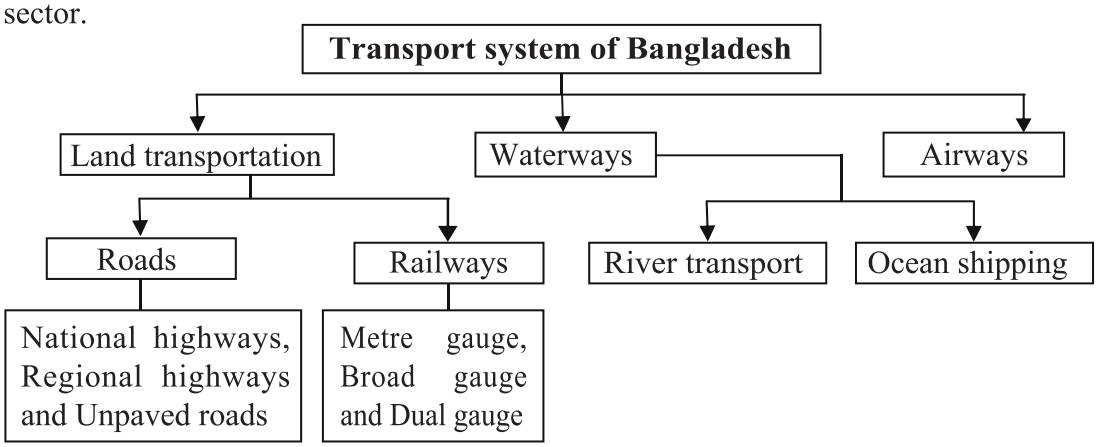
Transport system of Bangladesh

At the end of this chapter, we will be able to–

- provide description of the roads, the railways, the waterways and the airways of Bangladesh;
- analyze the importance of roads, railways, waterways and the airways;
- try to avoid accidents while travelling by roads, railways, and waterways and make others aware of it;
- explain the domestic and foreign trade of Bangladesh;
- give an account of the import and export products.

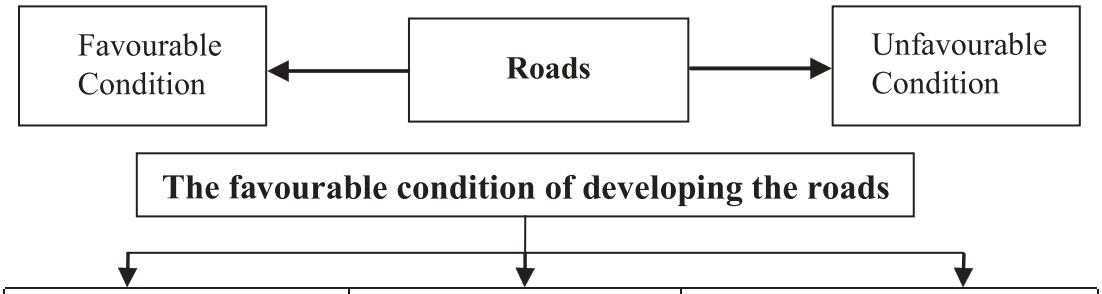
Transport system

Passengers and goods moving from one place to other are known as transportation. Geographical causes have influenced the development of the transport sector.



Roads

Distribution of agricultural products, marketing and for rapid transport, roads are very important. It is not possible to go anywhere by railways. So roads are necessary for easy transport. The following are some geographical causes which influence the development of roads.



The favourable condition of developing the roads

Plain land	Structure of the soil	Location of the sea and industry
The plain land is required to develop the road communication. For this reason, most of the roads have been constructed in Dhaka, Khulna, Rajshahi, Chattogram and Sylhet areas.	If structure of soil is strong and permanent it is not damaged by rain. Roads built on hard soil last longer.	Ports develop near the coastal area. A large number of roads are developed centering around the ports and industries. For this reason, roads have been developed in Mongla and Chattogram and other industrial areas also. Waterways were given priority in this region.

The unfavourable conditions of road development

Rugged topography	Slope of the land	Lowland and riverine areas
It is very expensive and difficult to built roads on the hilly and rugged areas. Due to this, the roads are few in the Chattogram Hill Tracts.	It is very difficult and more expensive to build roads on the slope. Fuel cost is high. It is a barrier to build roads on slopes. In Bangladesh the density of roads is less in the south east part of the country. Therefore there are few roads in the south-eastern Bangladesh.	More culverts and bridges have to be built on the lowlands and riverine areas which cost more. So, few roads are built in these areas. In the haor regions of Sylhet and in the southern part of Bangladesh roads are few. River transport get priority in this region.

The roads of Bangladesh have been built in an unplanned way on the basis of settlement pattern. Most of the roads have been built for local area connectivity as a complimentary to the waterways and railways. Usually unpaved roads are transformed to paved roads. According to the report of Roads and Highways Department, the length of different types of roads are given in a table.

Table-1: The length of different types of roads under Roads and Highways Department

Year	2019	2021	2024
National highway (kilometres)	3906	3944	3991
Regional highway (kilometres)	4483	4883	4897
Jilla road (kilometres)	13207	13592	13588
Total	21596	22419	22476

Source : Bangladesh Economic Review, 2024

Task : Fill up the table taking information from above data.			
The name of road	**Increased**	**Decreased**	**Due to**
National highway			
Regional highway			
Jilla road			

The unpaved and the regional roads of our country are badly damaged by the rainy season and flood. As a result, the roads are usually repaired throughout the year. Besides these, as a riverine country, culvert construction and maintenance cause a barrier on the road construction.

Internal road transport routes of Bangladesh are based on Dhaka as the centre. The routes are as follows–

Dhaka ⟷ Pabna, Rajshahi, Bogura, Rangpur, Dinajpur and Tetulia via Aricha-Nagorbari.

Dhaka ⟷ Faridpur, Kushtia, Jashore, Khulna, Barishal via Daulatdia.

Dhaka ⟷ Tangail, Jamalpur, Netrokona, Mymensingh,

Dhaka ⟷ Cumilla, Noakhali, Feni, Chattogram, Rangamati, Bandarban, Khagrachhari, Cox's Bazar, Teknaf.

Dhaka ⟷ North Bengal via Jamuna Bridge.

Dhaka ⟷ South Bengal via Padma Bridge.

The roads of Bangladesh make a significant contribution to the economy of Bangladesh. At present, the Bangabandhu Bridge constructed over the Jamuna river plays an important role in the development of roads in Bangladesh. The roads are spread out like a net across the country.

The road has played a great role in the balanced economic growth, agricultural development and distribution, industrialization, development of trade and commerce and employment opportunities.

Railways

The railway network of Bangladesh is relatively small but it plays an important role in transporting heavy goods, industrial and agricultural products and labourers. It connects the main sea-port, cities, trade and industrial centres (fig. 12.1).

The railways of Bangladesh

- Bangladesh has 659 kilometres of broad gauge railways which exit on the western side of the Jamuna river in the division of Khulna and Rajshahi.
- Bangladesh has 375 kilometres of dual gauge railways from Jamtoil to Joydebpur.
- Metre gauge railways on the eastern bank of the Jamuna river in the division of Dhaka, Chattogram and Sylhet which is 1,943 kilometres in length.

Can railways develop everywhere? The development of railways is influenced by some geographical factors.

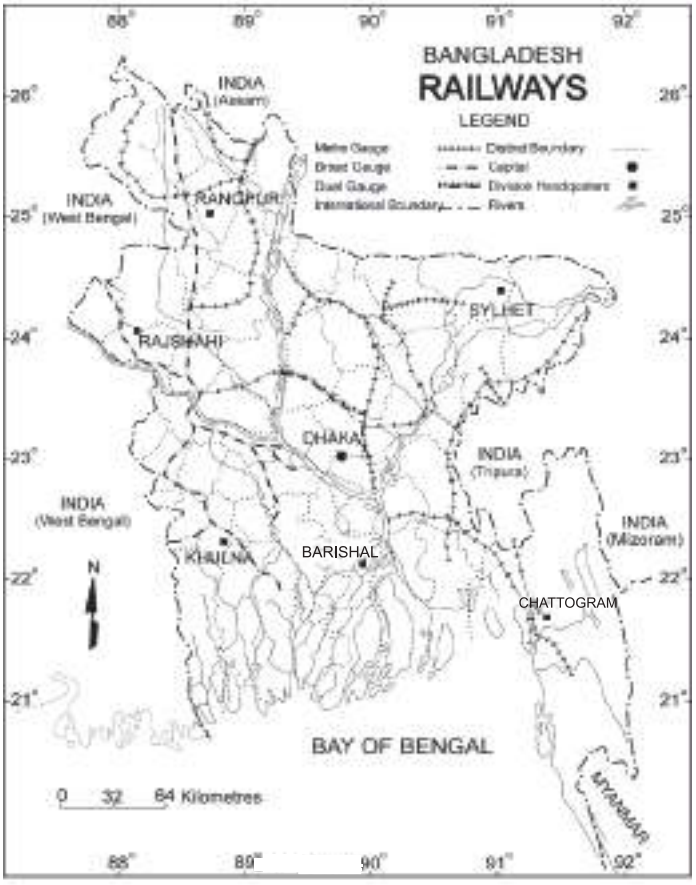


Fig.12.1 : Railway Network of Bangladesh

The favourable condition of railway development	
Plain land	**Location of the sea**
The plain land is perfect to construct the railways. It costs little and is easy to construct. Most of the areas of Bangladesh are plain land. The railways developed everywhere except the hilly areas, forests and wetlands.	Ports develop in the coastal areas. The railways developed to connect the ports even though there are problems in constructing it. In Chattogram the railway has developed only in the plain land not in the hilly areas.

The unfavourable condition of railway development	
Rugged topography	**Soil and lowland**
It is very difficult and more expensive to construct the railways on the rugged topography. So, railways are hardly seen in the hilly areas of Bangladesh.	The railways do not develop on the soft soil. Besides it is difficult to develop railways in riverine areas. So, there is a few railways in southern part of Bangladesh.

One metre wide rail line is known as metre gauge and 1.68 metre wide rail line is known as broad gauge.	At present two railways ferries are running from Tistamukhghat to Bhahadurabad ghat and from Sirajganj to Jagannathganj.

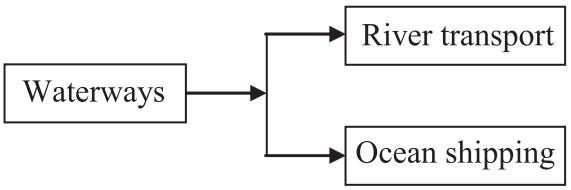
The Kamalapur rail station of Dhaka is the largest rail station of Bangladesh. People can travel from Dhaka to almost all important towns of Bangladesh by railways. There are 498 rail stations in total (Source : Bangladesh Railway Wikipedia).

The railways have been playing an important role in marketing of agricultural and industrial products, regular movement of raw materials, passengers and labourers, employment opportunity along with the balanced economic development and reconstruction of Bangladesh.

The Government of Bangladesh has taken different projects to achieve the commercial and economic success of railways. If these projects are implemented successfully then Bangladesh railways will become a modern transport system.

Task : There are no railways in the regions of Khagrachhari, Rangamati, Bandarban, Barishal, Patuakhali, Madaripur, Shariatpur, Meherpur, Cox's Bazar and Lakshmipur. Find out the geographical causes why there are no railways in those districts and submit it to the teacher explaining the causes in a group.

Waterways : Waterways are divided into two types.



River transport

Bangladesh is a land of rivers where waterways are spread like a net. The geographical structure of Bangladesh is favourable for the waterways. Geographical features are the causes of easy development of waterways.

The favourable condition of developing the waterways	
Lowland	**Riverine areas**
Lowland is easily affected by floods. As a result, roads and railways cannot develop. Due to this reason, the waterways are the only transport mode in the Haor areas of Sylhet, and in the southern part of the country in Faridpur, Madaripur, Bhola and Barishal.	Usually, roads and railways cannot be constructed easily in the riverine areas. As a result, the waterways are mostly used ın the southern areas of country.

Waterways are the cheapest means of transport in Bangladesh. There are 8,400 kilometres of inland navigable waterways with innumerable rivers, canals and wetlands. Out of this, 5,400 kilometres remain navigable all the year round. And the rest 3,000 kilometres are used only during the rainy season. Generally, the rivers in the south and in the east are more suitable for inland communication. The overall condition of inland waterways is given below.

Overall condition	
Launch ghat	380
Ferry ghat	53

Year	Earning from inland waterways (crore taka)
2013-14	320.04
2014-15	354.58
2015-16	506.64
2016-17	603.40
2017-18	477.50

Source : BIWTA, Ministry of Shipping

Task : 'River transport is cheap. Explain.

River ports : Dhaka, Narayanganj, Munshiganj, Goalondo, Barishal, Khulna, Bhairab Bazar, Ashuganj, Mohonganj, Chandpur, Jhalakhathi, Aricha, Ajmiriganj, Madaripur are important river ports of Bangladesh (fig. 12.2).

The inland waterways play a significant role in the economy of Bangladesh by providing transport for goods, passengers and trade.

Task : Identify the main river ports of Bangladesh in a map and submit it to the teacher.

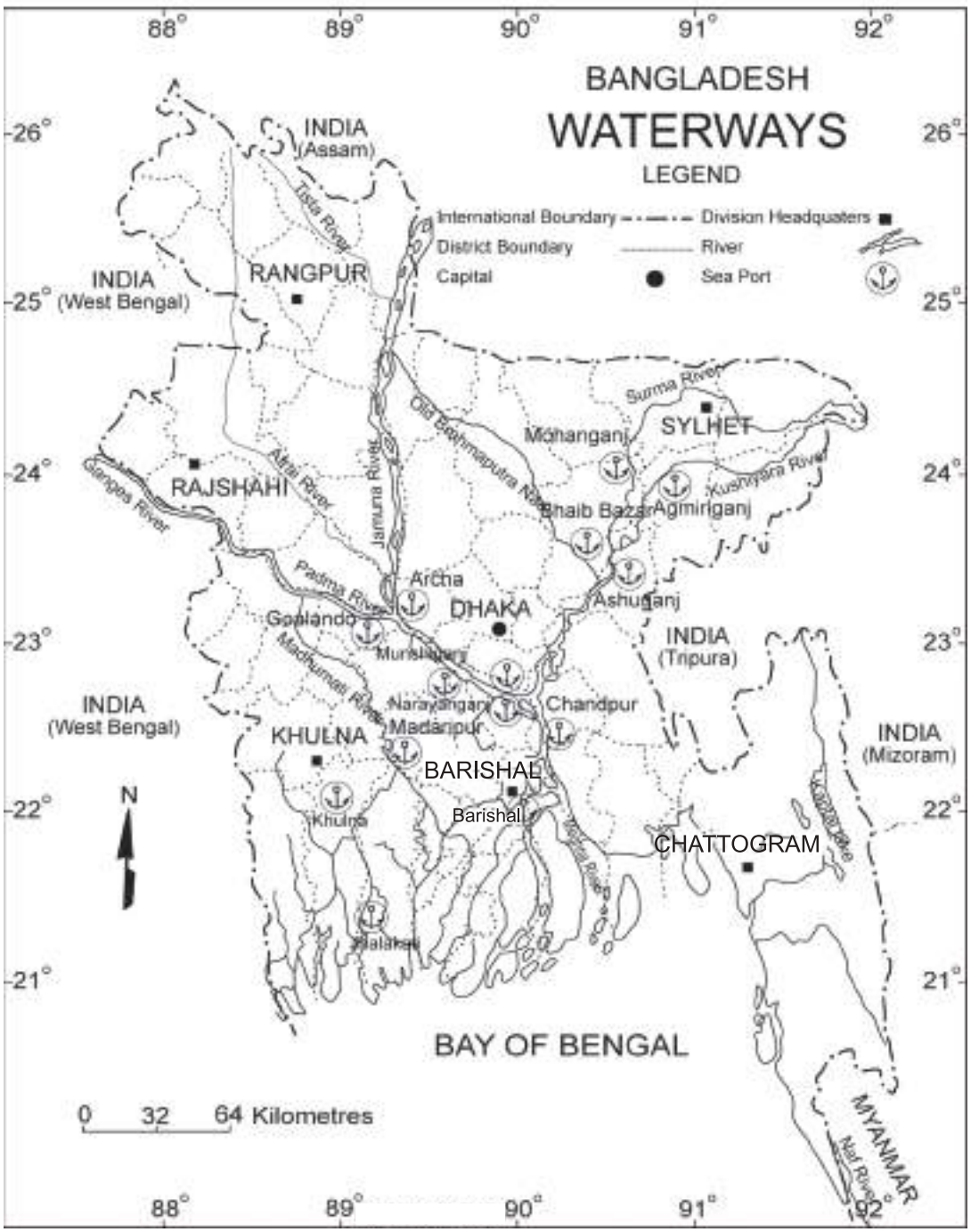


Fig. 12.2 : Waterways of Bangladesh

Ocean Shipping

A country needs to be located beside a sea in order to develop its ocean shipping. Not only the location of the sea, but also there must be some geographical characteristics to establish the sea port. With the establishment of sea port, proper ocean shipping can develop.

The geographical conditions for the development of ocean shipping			
Harbours	**The depth of coast**	**The wide plains**	**Climate**
The ships can be saved from storms, cyclone and tidal waves if there are harbours.	The coast near the sea port should be deep enough so that all kinds of modern ship can move easily.	For the construction of jetties and dockyard for ship repairing, wide plains are needed.	Ice, fog, mists are barriers to the ocean shipping which are absent in the coastal areas of Bangladesh. As a result, the ocean shipping has increased.

The waterways along with the river transport and ocean shipping play a great role in both the internal and international trade and commerce. There are three sea ports in Bangladesh– Chattogram, Mongla and Payra. About 85 percent of import trade and 80 percent of the export trade are carried out through Chattogram port. From Mongla port 13 percent of the export trade and 8 percent of the import trade are carried out. Importance of waterways and ocean shipping are greater than other modes of transport in the economy.

Airways

The airways have a major role for rapid passenger movement and perishable commodities. During war, famine and natural disasters, airways play an important role. Nowadays connectivity with the world without the airways cannot be imagined. The airways have immense contribution to education, culture and international relations.

The favourable condition for the development of airways	
Plain land	**The place free from smog and thunderstorm**
The sufficient plain land for is required landing and taking off.	Airways need an airport free from smog and thunderstorm.

Dhaka is connected with Chattogram, Cox's Bazar, Sylhet, Jashore, Rajshahi, Saidpur and Barishal by air (fig. 12.3). Private airlines also operate air service in domestic routes. Hazrat Shahjalal International Airport is the main airport of Bangladesh. In addition, there are two more international airports, named Chattogram Shah Amanat and Sylhet Osmani International Airport.

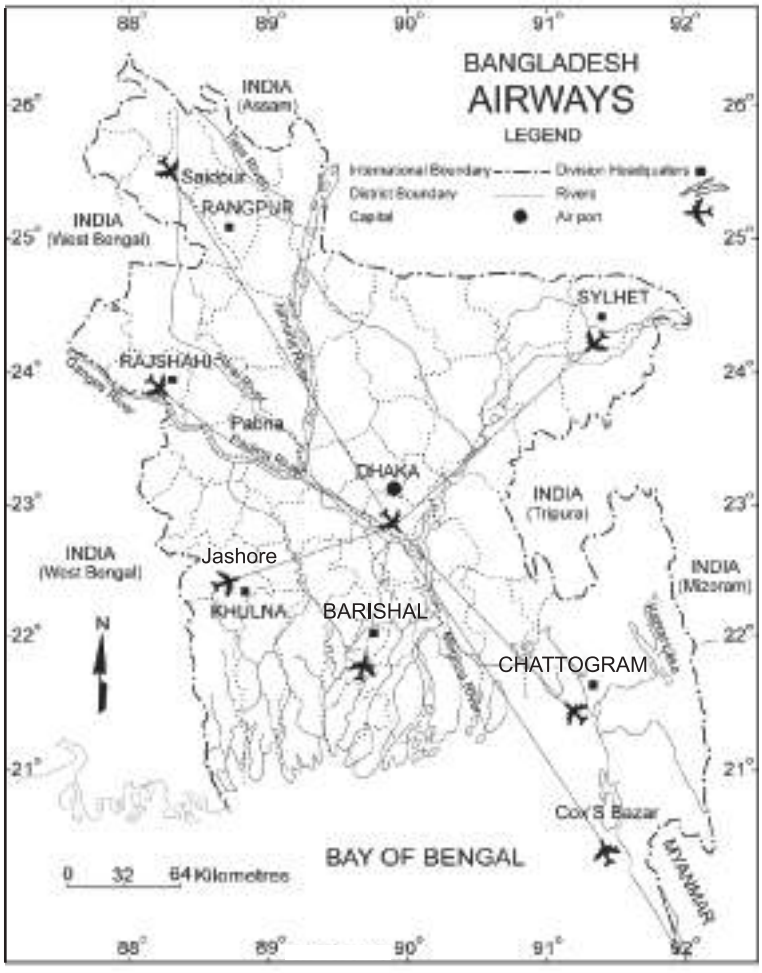


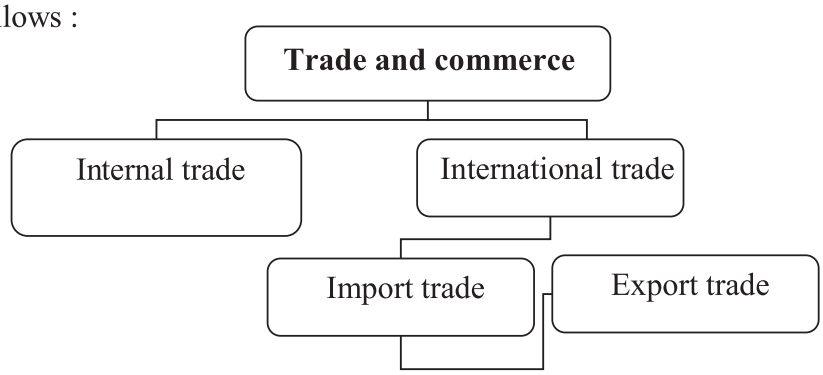
Fig. 12.3 : Airways of Bangladesh

Trade

Selling and purchasing of goods to meet the demands of the people and the related activities are known as trade and commerce. The commodities which we need are not produced or made in one place. As a result, these commodities have to be

distributed and that is trade and commerce.

Trade is as follows :



Internal trade

The internal trade of our country means collecting raw materials and food crops from village or hat/primary market and distributing manufactured industrial goods in the districts, district head quarters, secondary markets and hat. The internal trade is the balance between the demand, supply and consumption of the country. Transport plays an important role in the internal trade of Bangladesh. It is easier to market different types of produced goods through the roads, railways and waterways.

Task : Make a list of different types of products that are brought into different shops from other areas and the products from your area which are sold to other areas.

Task : Show the link between trade and transport in your locality.

Commodities going from your area	Transport mode	Commodities coming to your area

Foreign trade

In the past, foreign trade in Bangaldesh was mainly characterized by the export of raw materials. At present around 75 percent of foreign exchange earnings are coming from the ready-made garments and knitwear. While agricultural product imports have increased, export trade has decreased gradually.

In the international trade, we have to increase exports for economic development. In view of this, we have to increase production, upgrade the quality of products,

decrease production cost, decrease export tax, improve transport system, and make advertisement for exportable items is necessary. Bangladesh imports from China, India, Malaysia, South Korea, Japan. Bangladeshi products are exported to the USA, the UK, Germany, France, the Netherlands, Canada and Italy.

We have natural resources but for lack of capital and technological knowledge the proper utilization of natural resources is not taking place. As a result, imbalance between export and import is taking place.

Import and export products

In Bangladesh, labour intensive export production is gradually increasing. The USA is the largest destination of our exporting products. As the main importer of Bangladeshi products, the USA held the top most position in the fiscal year of 2016-17. The second biggest importer is Germany, the third is United Kingdom and the fourth is France.

The main export goods are :

1. Primary goods : Frozen food, agricultural products, raw jute, tea, other primary goods.

2. Industrial goods : Ready-made garment, knitwear, chemical products, plastic products, leather, handicrafts, jute and jute goods, home textile, shoes, ceramic products and engineering products.

Fiscal Year	Export earnings (In million US dollars)	Import expenditure (In million US dollars)
2020-2021	38,758	65,595
2021-2022	52,083	89,162
2022-2023	46,495	75,062
2023-2024	44,475	66,725

Source : Bangladesh Economic Review, 2024

In the import sector in Bangladesh, China has the top most position. In the fiscal year of 2018-2019, 29.43 percent of total imports came from China and the next is India while Singapore is in the third position.

The main import goods are :

1. **The main primary products :** Rice, wheat, oil-seeds, crude petroleum, cotton.
2. **The main industrial goods :** Edible oil, fertilizer, staple fiber, thread, clinker and petroleum products.
3. **Capital goods**
4. **Other goods (Goods which produced at EPZ)**

Sample Questions

Multiple choice questions

1. How many kilometers of waterways in Bangladesh are suitable for year-round navigability?

(a) 3,000 (b) 4,883
(c) 5,400 (d) 8,400

2. To increase exports in foreign trade-

i. The cost of manufactured goods must be reduced
ii. The tariff on manufactured goods must be increased
iii. The quality of goods must be improved

Which of the following is correct?

(a) i and ii (b) i and iii
(c) ii and iii (d) i, ii and iii

Read the following paragraph and answer questions 3 and 4:

Mr. Ryan is a computer trader. He imports computers from China every year.

3. By which route does Mr. Ryan import computers?

(a) Road (b) Railway
(c) Air (d) Sea

4. The advantages of bringing the goods by this route are-

i. Time saving
ii. Low transportation cost
iii. Less chance of damage to parts

Which of the following is correct?

(a) i and ii (b) i and iii
(c) ii and iii (d) i, ii and iii

Creative questions

1. Last winter vacation, Shayan traveled from Rajshahi to his aunt's house in Sylhet. He selected a route that offered an affordable and comfortable journey. After a few days, the entire family headed to Dhaka, but he opted for a different route this time to reach quickly due to his aunt's illness, which turned out to be more expensive.

a. What is internal trade?
b. What is the density of roads in the southeastern part of Bangladesh? Explain.
c. On the map, Indicate Shayan's route from Rajshahi to his aunt's house.
d. Conduct a comparative analysis of the transportation system between Shayan's route from Sylhet to Dhaka and the one used by his aunt.

2.

Fiscal Year	Export earnings (In million US dollars)	Import expenditure (In million US dollars)
2020-2021	38,758	65,595
2021-2022	52,083	89,162
2022-2023	46,495	75,062
2023-2024	44,475	66,725

a. What is import trade?
b. What is the most convenient way to export frozen food in foreign trade and why?
c. In which year in the above table was the balance of export and import trade the lowest? Explain.
d. Examine the table above and share your thoughts on the future economic development of Bangladesh.

Short-answer questions

1. Outline the favorable conditions for road development.
2. Why weren’t railways developed in the hilly regions of Bangladesh?
3. Describe the route utilized for the affordable exchange of goods.
4. Identify two favorable conditions for the development of waterways.
5. Why are harbors built along the sea route?

Chapter Thirteen

Development Activities and Environmental Balance in Bangladesh

The elements of the environment depend on one another. Plants, insects, animals and human live in a harmony in the environment. The dependency is interrupted if the harmony of the environment is altered. Development is very important for any country. Development depends on the economic activities. The economic activities of our country are still dependent on the natural resources. So, the sustainability and development will have to be ensured through the environmental balance. A coordinated effort must be initiated for a lasting environmental development.



Some development activities

At the end of this chapter, we will be able to–

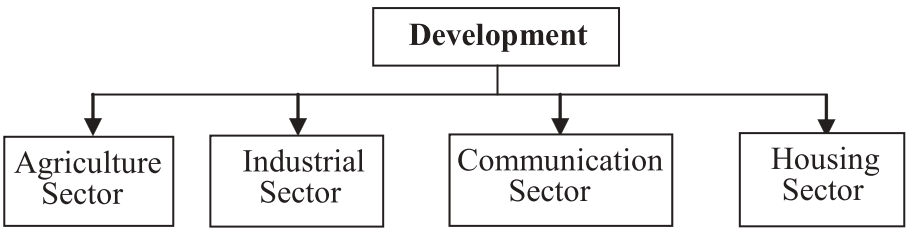
- explain the balance and imbalance of the environment;
- explain the development activities along with the explanations of some mentionable development activities of Bangladesh;
- explain how the environment was polluted and imbalance was created at the time of implementation of the development activities;
- analyze the result of environmental imbalance;
- analyze how the environmental balance influencs the development activities;

- find out the measures of protecting the environmental balance of during implementation of the development activities;
- make ourselves aware of the results of the environmental imbalance and make others aware of these.

Development activities and environmental balance

Development is very important for a country. Every man and the country want development to raise the standard of living. Therefore, some internal developments have to be done for this. These types of development should be conducted in a coordination with the environment. So, the development activities should be conducted in such a way that it does not harm the environmental balance.

If the road from your house to the school is unpaved or broken, you will see that sometime later it is repaired so that people can move easily. And if you pay your attention a little bit to your surroundings, you will notice that the houses made with tin or wood are being replaced by buildings. When the skill is increased with the demand it is known as development. If we consider it in a larger perspective, we can observe the development of a country like the diagram below :



Bridges, dams, culvert, industries, roads, railways are to be built in such a way that cannot affect the natural elements of environment. Bangladesh slopes gradually from north to south. For increasing the road connection form west to east, it is essential to build sufficient numbers of bridges with proper drainage system to avoid flooding. Industrial polutants have polluted different rivers. Industries and housing have been established on the fill up rivers. So, development should be initiated in such a way that it does not affect environment and resources . So the development works should be designed in such that they do not affect environment and resources.

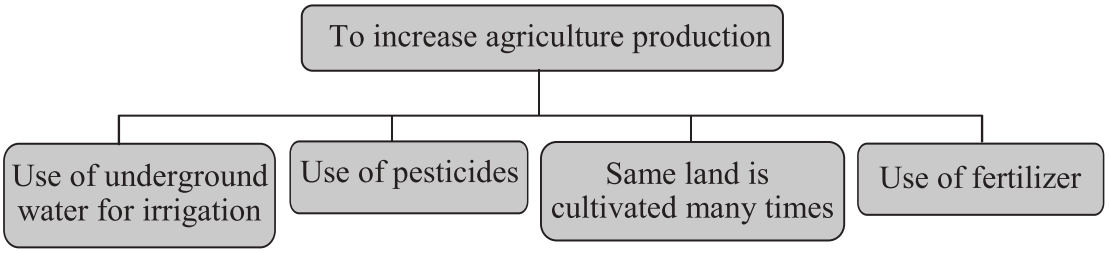
If a development work around a pond is conducted by cutting the trees around it, it will result in the destruction of small plants, insects and fish . Gradually the pond will be filled up with silt and long term resource gathering will come to an end. At last, the pond will lose its existance.

Some development activities of Bangladesh

We have known from the previous discussion that increasing the ability according to the demand of man is called development. Darkness is removed by lighting a oil lamp directly. Oil, gas or coal are used to produce the electricity. The electric lights have more power than oil lamp. This change is called development. Various developmental sectors are discussed where Bangladesh is doing good.

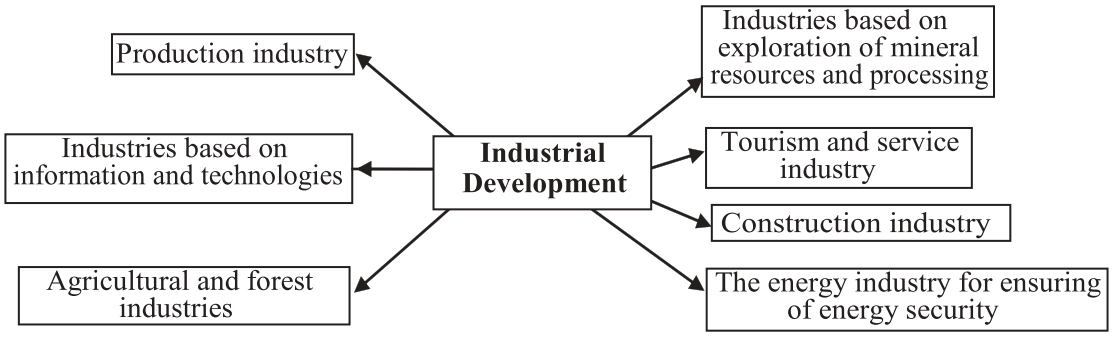
Development in agriculture sector

The economic development mostly depends on the development of agriculture. To ensure the food security, the development of agriculture sector is required. The amount of chemical fertilizer used in agriculture is increasing gradually over the years for the increasing production of food due to the growing demand from the population. The same land is cultivated round the year. What we do for the development of agriculture is given below.



Development in industrial sector

Rapid industrialization is necessary for the progress of social development. The role of industries in the economic development of Bangladesh is very important. The industry sector can be developed in many ways which are mentioned below.



Development in transport and communication sector

The transport and communication accelerate the development of agriculture and industry. The development of a country depends on transport and communication sector. Well-organized infrastructure and modern transport system are essential for development. The socio-economic development of a country depends on the massive transport development. Information and communication teachnology has spread over rural areas of Bangladesh. Technology related to internet, mobile phone, television, radio have extended rapidly.

Construction of highways, bridges, flyovers and ferry terminals have a profound influence on the development of transport sector.

Development in housing sector

Development in housing sector depends also on the development of other sectors of the country. It is an infrastructural development (fig. 13.1). Housing sector development indicates a coordinated development in safe water supply of drinking water, healthy sanitation system and drainage for sewerage disposal.

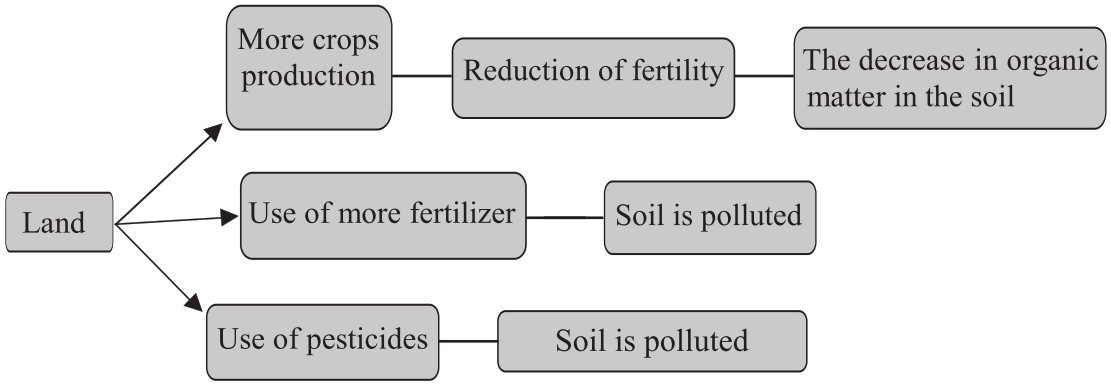


Fig. 13.1 : Infrastructural development

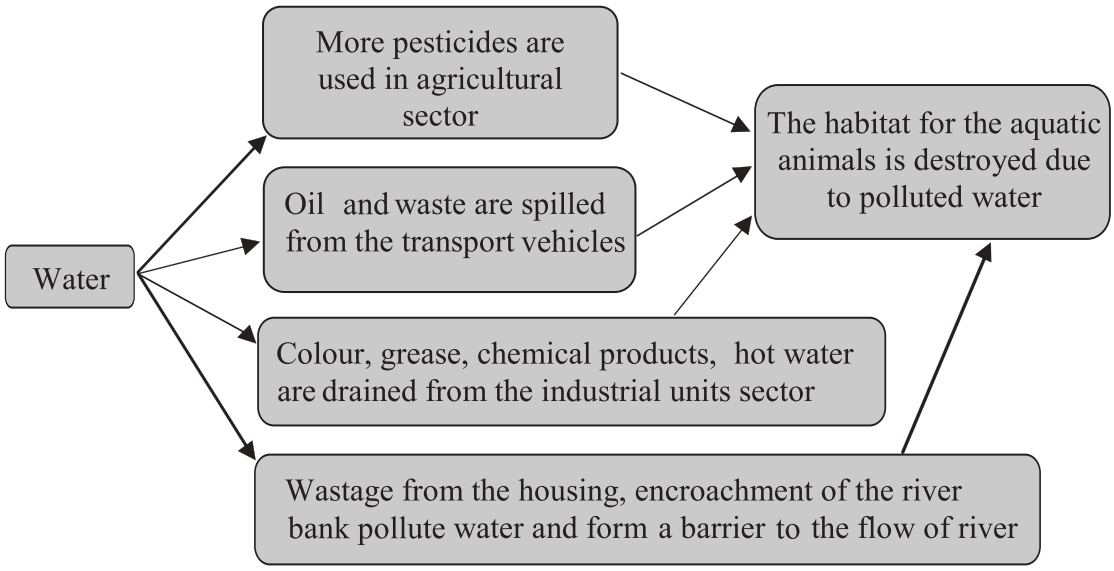
The housing development means supply of pure drinking water, healthy sanitation system and sewerage disposal infrastructure.

Development activities in Bangladesh and environment pollution

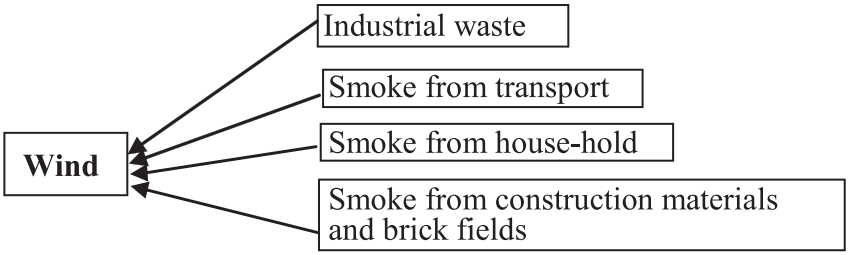
Development is expected in all the countries. The sustainable and environment friendly development brings well-being for the country. We pollute the environment due to the lack of knowledge or education, information about environment and profit-driven motives. The main elements of environment are land, water, wind and forest resources. The way the elements of environment are polluted for development has been discussed before. It can be understood easily by a schematic diagram.



Result : Insects and micro organism in the soil are affected. The habitat for the small wild animals are destroyed. The plants cannot grow in the polluted soil. As a result, soil turns into desert.



Result : The small aquatic plant named plankton, water hyacinth and moss cannot grow. The small fishes which eat these aquatic vegetation suffer from food shortage and thus big fishes are in trouble too.



Outcome: In the long-term, humans face increased risks of cancer as well as lung and heart diseases. Children's mental and physical development is hindered. Plant growth is disrupted, and soil fertility declines. Global warming intensifies, ice melts, sea level rise, and the frequency of cyclones, droughts, heavy rainfall, and other extreme weather events increases.

Forest resources

The forest resource is a great factor which maintains the environmental balance of a country. The total areas of our forest land is around 17 percent. We use wood as fuel and for making furniture, building constructing and industry. The environment is being spoiled as a result of this. The forests are being deforested and the soil is getting exposed. So the soil is eroded rapidly and thus the fertility is decreasing.

Result of environmental imbalance

The overuse of water, forest, and land resources disrupts the balance of the environment. Many aquatic animals and fishes have been extinct due to polluted aquatic systems. Many types of forests are extinct now and others are in the process of extinction. Many wild animals have also disappeared.

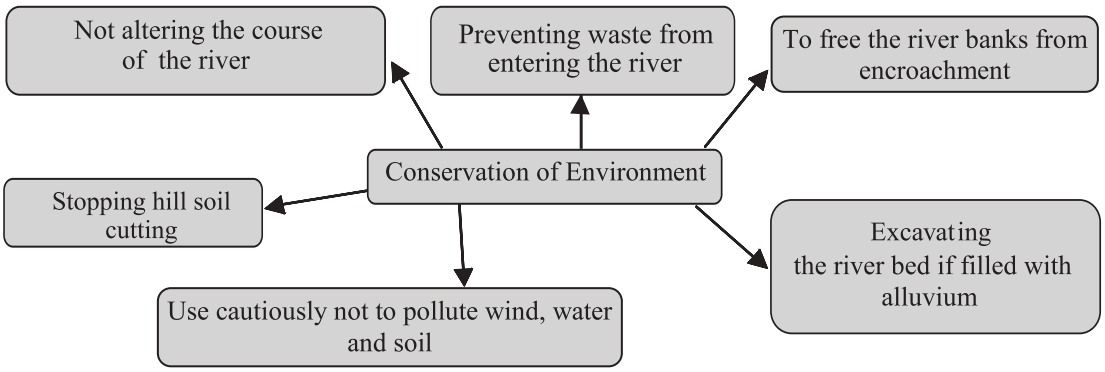
The habitat of foxes, hares and wild cats was destroyed due to deforestation which has broken down the food chain. This has negative impact on land ecosystem as well as on society. Over use of natural resources is causing imbalance in the nature. As a result, temperature has increased in summer and has decreased in winter in the northern areas of Bangladesh. Besides frequency of cyclone and tidal waves have increased. Major parts of Shatkhira, Barishal, Narail and Noakhali districts will go under water due to green house effect. Besides, saline water is entering inland areas. This will hinder the natural growth of plants (fig. 13.2). Landslide is increasing. Resulting in water logging. Indirectly, many


Fig.13.2 : Increase of salinity in coastal region

diseases are increasing such as asthma, skin disease and stomach problem and other infectious diseases. The total environment will be imbalanced if this continues resulting in disaster. So, a tolerable and sustainable environment is desirable. We can save the environmental balance through proper management and awareness.

Techniques of keeping the balance of environment

We use the natural resources from the environment. The environment will exist if the natural resources are used properly. So, we have to be responsible to maintain the environmental balance by conservation.



The environment is damaged everyday. Who will save it? It is our duty to save. We should be careful about the environmental element, use it with great care and compensate the environmental damage. Thus, the environment will be preserved.

The forest resources also play a great role to keep the balance in the national economy and environment. Increasing population, felling the trees for fuel from the forest and deforestation for agricultural purpose are causing negative impact on the environment. The environment may be preserved if soil pollution, air pollution and water pollution are controlled.

Massive afforestation and forest conservation in the country, Replenishing the shortage of forest resources, Ensuring raw material supply for wood-based industries, conservation of biodiversity.	⇒ **Forest development and conservation**

The measures which should be taken for conservation of the forest are given below :

1. Extend forest areas by afforestation on the deforested hills and on khas lands.
2. Plant trees in marginal and an uncultivated pices of land in rural areas.
3. Afforestation should be done on all the embankments especially along roads and railways.
4. Increase the public awareness for conservation of forest and forest resources.
5. Implement special projects to preserve the biodiversity.

We have to strengthen our fuel security. We have to invent new techniques for energy production using renewable sources as solar, wind, bio-gas, sea, animal, and human energy. To preserve and control the environmental pollution, the following steps should be taken:

1. Control the production and use of polyethylene bags.
2. To build up suitable effluent treatment plant for the industries.
3. To implement the conservation of biodiversity.
4. To build up the social forestation.
5. To control air pollution.
6. Save the river movement.
7. To control the use of wood at brick kiln.

All out effect has been taken to observe.	
Bangladesh is a member of United Nation environment activities (Unicef) and a member country of South Asian Cooperation on Environmental Organization Programme (Sacep).	The different international days about environmental issues declared by UN such as world environment days, world desertification day, international ozone day, world climate day will create public awareness.

To ensure sustainable development and to decrease environmental degradation, a coordinated policy, development of organizational structure, introduction of sustainable method to implement the environmental agenda are necessary.

Biodiversity

Normal condition of various types of plant and animal living together in the same environment is called biodiversity and this ensures the environmental balance.

Conservation of biodiversity

Biodiversity is the main factor to maintain environment and environmental balance. Natural resources are the source of producing the necessary goods and service for man. Man is dependent on nature for food, clothing, housing, medicine, recreation etc. These natural resources are available from forests, rivers, wetlands and oceans.

Due to the short sightedness of man, human activity is gradually decreasing the biodiversity. If this condition continues, by 2025 about 20-25 percent living things and plants will be extinct.

Bangladesh has a vast biodiversity and has great prospects. But those are now at a threat. The habitat for animals are being decreased due to growing population. They have lost their hunting ground. Once upon a time the Royal Bengal Tigers were found in many areas of Bangladesh. Now they are found only in the Sundarban. At the very beginning of nineteenth century, elephants were found in the forests of Bhawal and Madhupur Garh. Nowadays it is only found in the hilly areas of Chattogram Hill Tracts, Sylhet and Mymensingh.

In Bangladesh 119 types of mammals, 578 types of birds, 124 types of reptiles and 19 types of amphibians have been identified. 'Red Data Book' published by the International Union for Conservation of nature has identified 23 species of animal of Bangladesh as endangered species. In this list there are Royal Bengal Tiger, Cheetah, Elephant, Python, Crocodile and Estuarine Crocodile. According to some other estimates 27 wild animals are endangered and 39 more are at risk. In the 19th century 19 species became extinct. Among these are 3 types of cows, wild buffalo, a type of black swan, various types of deer, sweet water crocodile etc.

For conservation of biodiversity strong, immediate and active steps must be taken. Cooperation and assistance among the different international organizations, regional organizations, NGOs, private sectors and monitory institutions, along with United Nation should be strengthen and the activities given below are to be initiated.

- To survey at the national level to assess the present condition of biodiversity of Bangladesh.

- For conservation of biodiversity and sustainable use, national policy should be made which will be in coordination with the national development policy.
- Encourage the participation of people in order to protect the biodiversity, conservation, and growth.
- To preserve the natural habitat through identification and introduce restricted areas. The Forest Directorate of Bangladesh has taken some activities.
- Projects taken in order to develop the production and maintain the ecosystem by restricting forest areas of Sundarban.
- To stop the illegal wild life trade within the internal boundary of the country and to take the project in order to preserve, develop and manage the diversity of different restricted areas.

Recently, several wildlife sanctuaries — Sonachor, Chandpai, Dudhmukhi, and Tangmari have been estiblished to preserve biodiversity and natural environment.

Sample Questions

Multiple choice questions

1. Which district in Bangladesh will be submerged due to the greenhouse effect?

(a) Noakhali (b) Dinajpur
(c) Rangpur (d) Bogra

2. To prevent environmental degradation, it is necessary to-

i. Integrate policies
ii. Develop organizational structures
iii. Formulate and implement environmentally sustainable methods

Which of the following is correct?

(a) i and ii (b) i and iii
(c) ii and iii (d) i, ii and iii

Read the following paragraph and answer questions 3 and 4:

Sumi visits her uncle's house in Khulna during winter vacation. One day, while exploring the Sundarbans with her uncle, she observes various animals and trees. She learns from her uncle that there used to be more animals and plants in the forest in the past.

3. In the forest that Sumi sees, the following are found:

(a) Koroi, Gajari (b) Goran, Golpata
(c) Chapalish, Telsur (d) Shawl, Segun

4. If the forest is destroyed-

i. The salinity of groundwater will increase
ii. The environment for plant growth will be destroyed
iii. The amount of damage caused by tidal waves will decrease

Which of the following is correct?

(a) i and ii (b) i and iii
(c) ii and iii (d) i, ii and iii

Creative questions

1. A group of students takes a boat trip on the Shitalakshya River. There, they are astonished to see that the water in the river lacks its usual color.

a. What is biodiversity?
b. How does soil get polluted? Explain.
c. Why is the water in the river that the students saw not its normal color? Explain.
d. What measures should be implemented to return the water in the aforementioned river to its normal color? Share your thoughts.

2. On the way to Savar, Kanak and Kakan feel a burning sensation in their eyes after crossing Amin Bazar. They notice many brick kilns lining both sides of the road.

a. What is air pollution?
b. What is meant by environmental imbalance? Explain.
c. Explain the reason why Kanak and Kakan's eyes burn.
d. Examine how the previously mentioned environment will impact the flora.

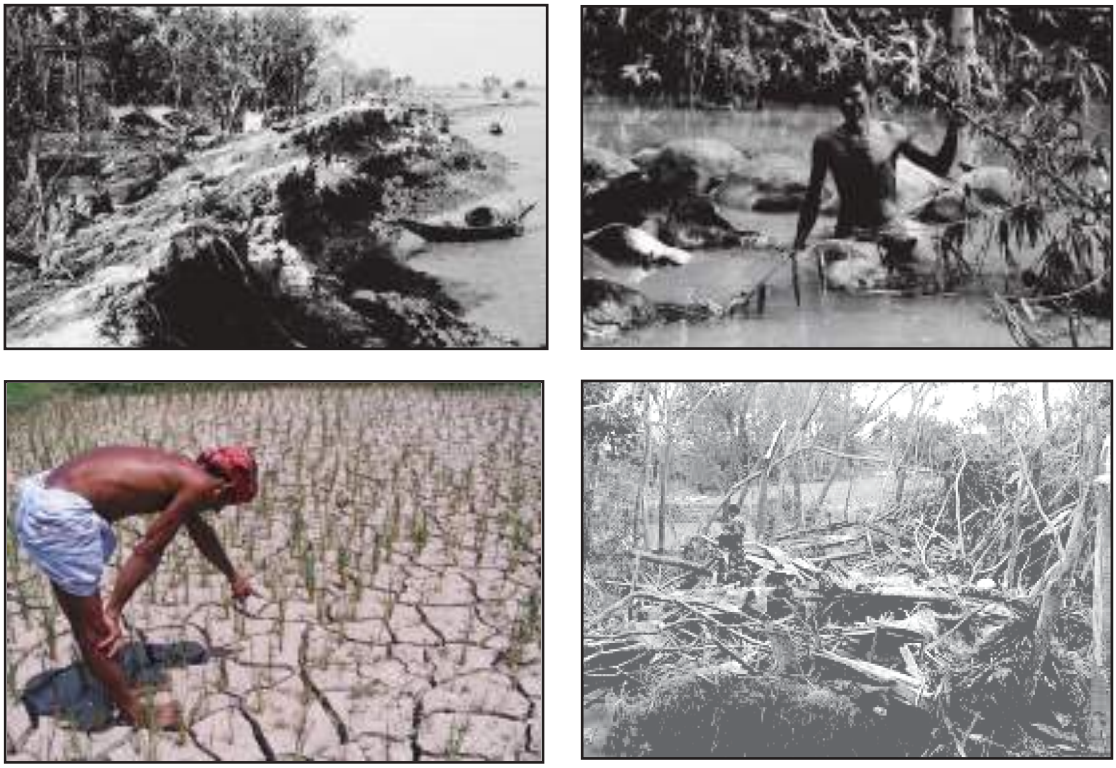
Short-answer questions

1. How can agricultural production be increased?
2. Which areas require development for industrial development?
3. What does housing development mean?

Chapter Fourteen

Natural Disaster of Bangladesh

Bangladesh is one of the most natural disaster prone countries in the world. The natural disasters like cyclones, tidal waves, flood and drought damage our property, human lives, animals and environment every year. Our geographical location and climate change are notable causes for these disasters.



Some Natural Disaster

At the end of this chapter, we will be able to–

- explain the disaster and hazard;
- explain the different kinds of natural disasters of Bangladesh;
- explain the disaster management cycle;
- explain the disaster management of the natural disaster of coastal areas of Bangladesh;
- evaluate the functional and technological use of warning about the Tsunami and the scale of earthquake;
- make people aware about how to confront natural disaster and what are the measures to mitigate it.

Disaster and hazard

The people of disaster-prone countries like us should have clear information about disaster, hazard management etc. Disaster is such a thing which disturbs the normal activities greatly and it damages lives, properties and environment. It is a very difficult task for the affected societies to tackle the loss by their own resources after disaster. As a result, the humanitarian aids or relief are needed from the foreign countries to tackle the post disaster situation.

On the other hand, hazard refers to a sudden and extreme natural or man-made event that adversely impacts life, property and other vital aspects.

Natural disasters in Bangladesh

Flood

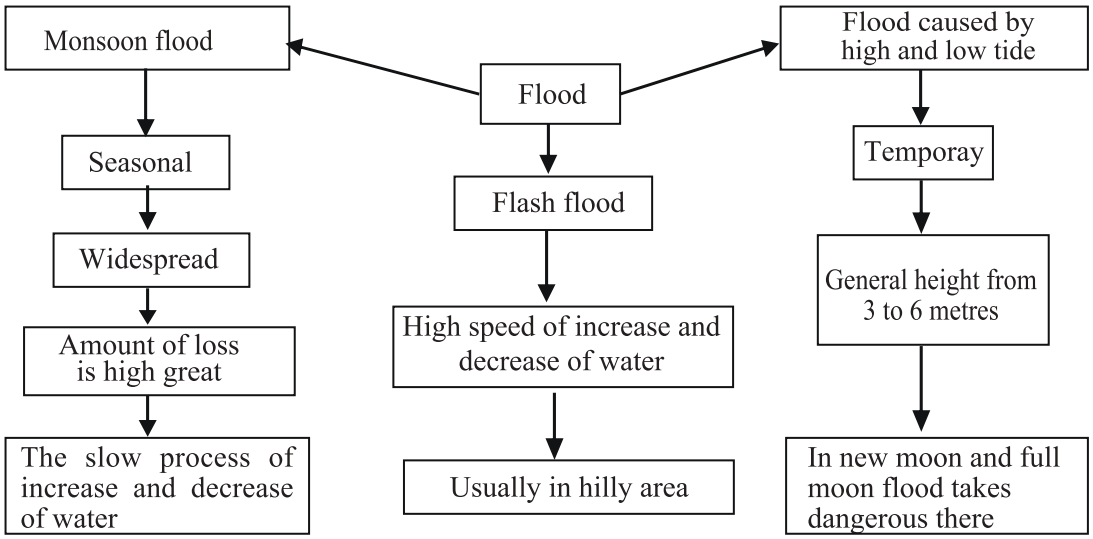
Flood is one of the natural disasters in Bangladesh. Floods are considered harmful to people of this country when it damages the crops and lives, but it plays a significant role on the economic condition of this country. In the context of Bangladesh, when an area goes under water and human lives and resources are damaged, it is known as flood.

Bangladesh is a rainy and riverine country. The annual rainfall amounts to 2,300 millimetres. There are 700 rivers along with the 57 international rivers which is spread out across the country like a net in Bangladesh. There are 54 rivers which originate from India.

Causes of flood

Physical factor	Man-made factor
Heavy rainfall in upstream Geographical location Influence of Monsoon climate Less depth of river Water flow from melted ice of Himalaya High and Low tides of Bay of Bengal Earthquake	A large number of trees are cut along the river plains Farakka bridge constructed over the Ganges Impact of damps constructed on other rivers Unplanned urbanization

Classification of flood



Impact of flood

The havoc of flood is enormous in Bangladesh. A huge amount of crops are damaged due to flood. People die and normal life is hampered. Life of birds and animals is destroyed and endangered. Resources are damaged. During the flood of 2000, 1.84 lakh hectors of crops in 16 districts were damaged. Loss of production amounted to 5.28 lakh metric tons.

Task : Prepare a bar graph in percentage in the last five years of the flood affected areas.

Flood has occured in the sloping low-lying plain land of the largest deltaic Bangladesh in different centuries. Between 1954 and 2004, in 1974, 1978, 1984, 1988, 1998, 2004 some of the most devastating floods occured. Among these the duration of 1998 flood was the longest and many areas were affected. The record of flood during rainy season is incomparable.

Due to geographical location and climate of Bangladesh, flood is a familiar natural disaster. The natural calamity makes human life terrible.

This can be termed as disaster. The loss must be brought under control. For this reason, people are undertaking steps to reduce the damage from flood for a long time.

Flood control measures

Some of the flood control measures are :

A. General management

1. Construction of easily transferable homestead.
2. To make dense forest by the banks of the rivers.
3. To ensure river reigning system.
4. To develop forecasting of flood and cautionary signal management.
5. To excavate the ponds, the canals, the rivers, and preserving irrigation water.
6. To build up a permanent administrative body for flood management on a yearly basis.

B. Labour intensive and expensive engineering management

1. To increase water flow of the river through dredging.
2. By constructing water reservoir in the vicinity to fully control the water flow.
3. To control and drain water flow from India by constructing dam or embankment.
4. To stop entering saline water in the coastal regions.
5. By changing the river course to ensure water flow directly.

C. Easy engineering management

1. To construct dams on both sides of the river bank to check overflow of river water.
2. To provide afforestation all over the country.
3. To make planned drainage system while constructing roads.

4. To make shelters above the highest flood level in flood prone areas.
5. To make urban protection dams.

Task : To visit a flood affected area for giving relief, prepare a table on the issues that to be given priority, make a plan on it.

Flood hinders normal life and development work of the country. So, it can be said that flood is a great problem for the people of Bangladesh. Many steps have been undertaken to control this problem and some steps are under planning process. The origin of three main rivers of Bangladesh are in China, Nepal, India and Bhutan. Total catchment area of these three rivers are 15,54,000 kilometres of those only 7 percent area is in Bangladesh. More than 80 percent of water of these rivers come from outside and 90 percent of water responsible for flood is flowing through these three rivers. So, to control flood and damage, regional and international assistance is required.

Drought

A drought is a period of unusually dry weather that persists long time. It causes environmental or economic problems, such as crop damage and water supply shortages. Humidity of soil decreases due to rainless condition. For this reason, soil loses normal characteristics of softness and gets rough.

Rainless or impact of drought

- ✦ Agricultural production decreases due to drought in north-east region of Bangladesh.
- ✦ Famine occurs due to food shortage.
- ✦ In the affected area, scarcity of water exists.
- ✦ Outbreak of various types of disease due to high temperature takes place.
- ✦ Environment becomes rough.
- ✦ Fire incidents take place very often.

Normal activities of man and wild life are hampered due to rainlessness and drought. By increasing the forest resources through afforestation and reducing the consumption of underground water these sorts of natural disaster can be brought under control.

Cyclone

A cyclone is an atmospheric system characterized by the rapid inward circulation of air masses about a low pressure centre, usually accompanied by stormy often destructive weather. Storms that begin in the Southern Pacific and Indian ocean are called Cyclones. Clockwise in the southern hemisphere and counterclockwise in the northern hemisphere.

Among the most powerful and dangerous natural disasters, cyclone is one of them. Cyclones are named after the places of origin. In Bangladesh, this type of cyclone occurs in the months of March-April and October-November (fig. 14.1). Due to funnel shaped coastal area of south Bangladesh more cyclones occurs here.

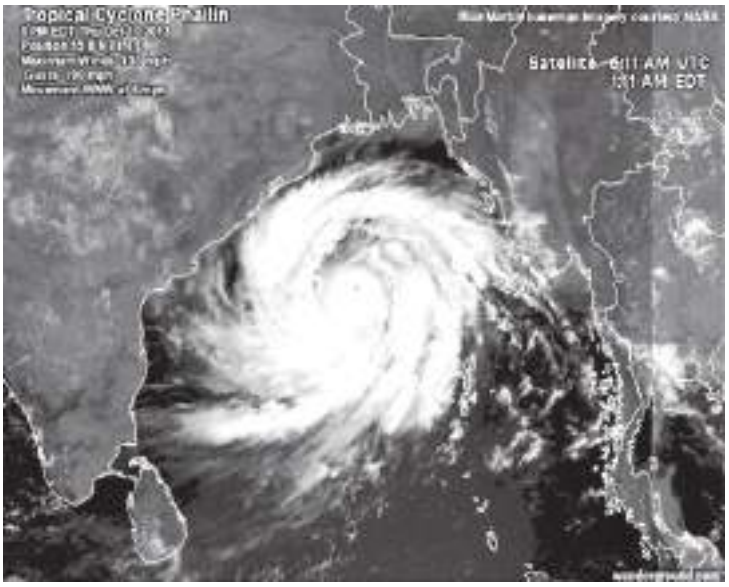


Fig. 14.1 : Cyclone

Task : Make a list of losses excepting the death toll of people from cyclones in Bangladesh.

Cyclone is a temporary natural disaster. In the last three decades cyclones occurred more in the Eastern part of Bangladesh. It happened especially in Chattogram, Cox's Bazar, Teknaf, Swandip, Hatia, Kutubdia, Urirchar, Char Jabbar, Char Alexandar etc. Some of the cyclones occurred in the coastal areas of Bangladesh and their years of occurance and impact is shown is the table below :

Table 1 : Some of the cyclones occurred in the coastal areas of Bangladesh

Year of occurance	Name of the cyclones	Number of casualties
12th November, 1970	Tropical cyclone	approx 5,00,000
29th November, 1988	Tropical cyclone	approx 1,08,000
29th April, 1991	Tropical cyclone	approx 5,708
15th November, 2007	Sidr	approx 3,447
25th May, 2009	Aila	approx 330

River bank erosion

Lateral erosion caused by the flow of water in river channels is known as riverbank erosion. In the alluvial plains of Bangladesh, formed by sediment deposits, riverbank erosion leads to the destruction of countless homes and roads every year. Many lives are also lost as a result.

Task : Mention the names of the river following situation.		
1	2	3

Causes of river bank erosion

- Climate Change.
- River course and strong current.
- Change of river course.
- Rock content in the river bed.
- Presence of chemical substance.
- Hardness of the transported rock.
- Fault in the river bed.
- Deforestation.

Task : How do the causes influence the river bank erosion effectively? Explain two reasons dividing into groups.	
Causes	**Effective rate**
1.	
2.	

River bank erosion is a dangerous natural disaster in a small country like Bangladesh. River erosion takes place more during the rainy season. Particularly, the river bank erosion is caused more during the flood season and it happens in 40 small and big rivers every year. Sometimes, due to drought, cracks develop at the river bank and cause erosion and a chunk of land goes under water (fig. 14.2). The loss from river bank erosion is irreparable. Besides, the socio-economic impact is much higher.



Fig.14.2 : River bank erosion

Loss from river bank erosion

River bank erosion is a common problem in Bangladesh being a riverine country. The loss caused by river bank erosion turns into a great problem. The river bank erosion causes in and around 410 rivers, tributaries along with the Padma, the Jamuna, the Meghna, the Tista. People of this country are more or less associated with the river bank erosion. Among them above 1.5 million people are directly affected by the river bank erosion. Around 3 lakh people take shelter in different government and non-government educational institutions, roads and embankments. Bangladesh loses around 200 crore taka every year. Around 8,700 hectors of land goes under water due to river bank erosion.

The components which is damaged by the river bank erosion are.

Farm
Cultivable land
Disaster shelter
Electricity poles
Family property and other resources
Houses
Crops
Domestic animals
Trees
Irrigation projects
Social institution

Task : Show the erosion occurring areas of the Padma and the Jamuna in the map.

River bank erosion is a continuous process in Bangladesh. River bank erosion process is caused more or less by the rivers and their tributaries The river bank

erosion occurs in about 100 upazilas in the country. The land owners are badly affected by river bank erosion from the excessive rainfall in the monsoon from June to September. They never can recover the lost land. For this reason, the landless people migrate. They lose their job and social status. As a result, they become the object of famine and migrate within the cities as floating people.

Earthquake

Since Bangladesh lies far away from the oceans, this country is not supposed to be an earthquake prone area. But, on the north of Bangladesh, Khasia and Jainta hill of Assam, foothills of Himalayas, Andaman islands and the ocean floor of Bay of Bengal are earthquake prone areas. Also structural movement is active in this area. Overall situation indicates that Bangladesh is becoming more vulnerable to earthquake (fig. 14.3).

There are some tertiary hills in the eastern side of Bangladesh. The folded mountains running in north-south direction belongs to the same group of Lusai mountains of Assam and the Arakan mountains of Myanmar. Due to the structural nature, these areas are earthquake prone.



Fig. 14.3 : Building destroyed by earthquake

The Pleistocene terraces, The Barind Track, Madhupur and Bhawal Garh and the Lalmai hills are formed from old rocks. Other areas are newly formed alluvial plains. So, from the point of geological structure, the northern and eastern side of Bangladesh is earthquake prone area.

Himalayan terrace and the plateau in the north, Arakan Yoma mountains of Myanmar in the east and in the north-east the Naga-Disang-Jaflong regions have made it an earthquake prone area.

From 1548 earthquake records are collected for Bangladesh and its surrounding regions. There are three types of measurements related to the epicenter and focus of an earthquake:

- Shallow focus (0-70 kilometers)
- Intermediate focus (70-300 kilometers) and
- Deep focus (up to 1,300 kilometers)

Therefore, even if the epicenter is not located within Bangladesh, the country may still feel the tremors of an earthquake if it occurs adjacent regions.

In 1993 entire Bangladesh has been divided into three earthquake zones. Those are : Zone 1. High risk zone, measuring 7 on Richter scale are the areas of north and north eastern part of Bangladesh. Zone 2. Medium risk zone, measuring 6 on Richter scale are the areas of middle region. Zone 3. Less risk zone, measuring 5 on Richter scale are the area of south western regions of Bangladesh (fig. 14.4). Earthquakes occurred in Bangladesh are given in the table below.

Table 2 : Some of the earthquakes occured in Bangladesh

Year	Richter Scale	Loss
April, 1762	To the greatest extent in the country	Massive destruction in Dhaka and Chattogram
1June, 1897	8.00	Causing damages in Pabna and Sirajganj. Changing river course of the river Brahmaputra
July, 1999	5.2	Causing much damages in Moheshkhali

Source : Banglapedia

What is to be done in earthquake

Electricity line has to be disconnected at home during earthquake. Gas connection should be disconnected. One should get out from house as soon as possible.	One should stand still holding any material during earthquake if one is traveling by train or car.

Try to get down as quickly as possible during earthquake if you are in a lift. Try to contact the maintenance officer if you are stuck in the lift.	A fearful situation may be caused by the earthquake while in the market, cinema hall, and shopping mall etc. Fire may start which is normal. In this situation it is better to sit down or lie down and when the situation improves one should leave the place quickly.

Do not stand under large building or structure when you are out of home. Stand in a open space or playing field. Keep always a metal-cutting saw, water bottle, and fire extinguisher near at hand.

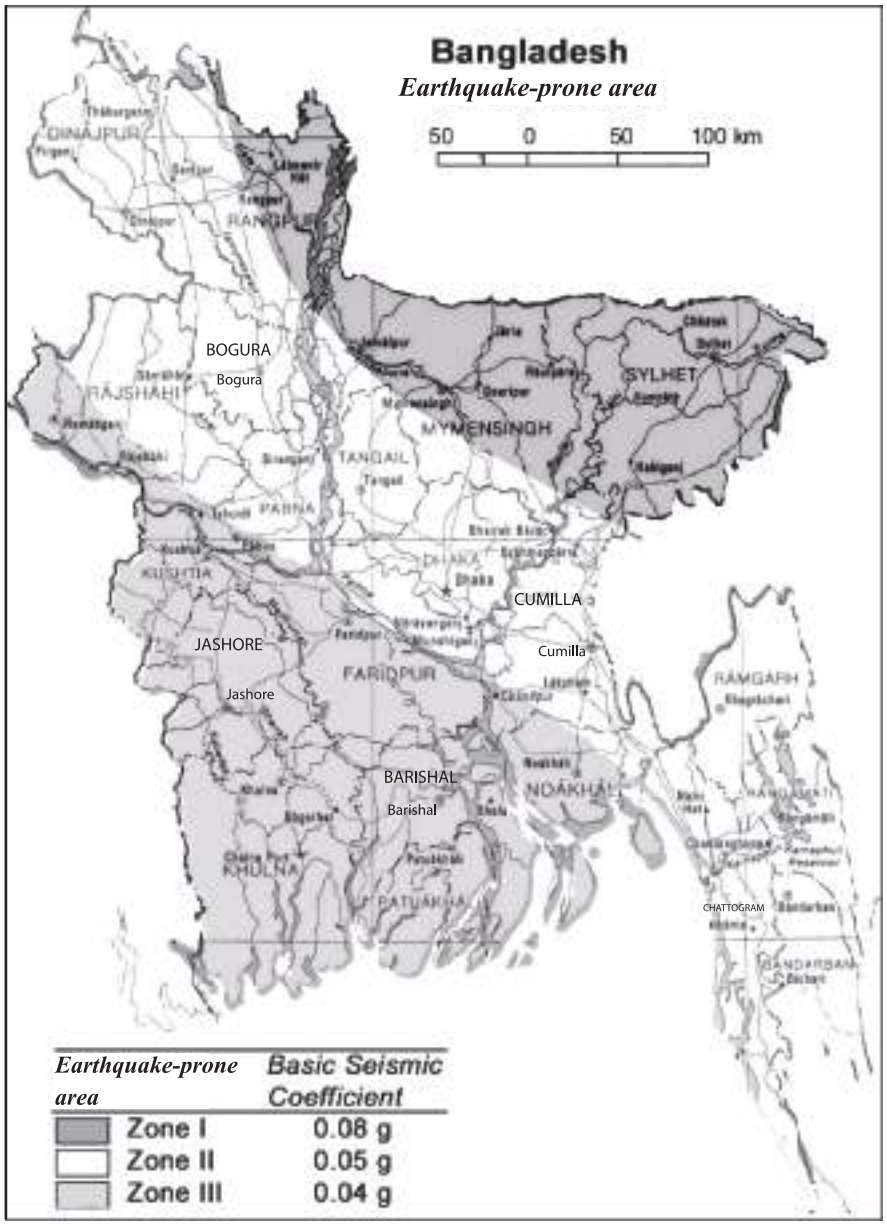


Fig. 14.4 : Earthquake zones of Bangladesh

Task : Make a list of items which can save you from the earthquake.

In Bangladesh earthquake takes place from ancient times. Due to the structural cause earthquake happens in our country. As the underground water level is falling rapidly some places are losing natural balance. Dhaka city is prone to earthquake due to underground water level depletion. For its growing population it is becoming more risky.

Essential measures

1. Massive advertising is needed to make public awareness about the earthquake.
2. Building code and structural code of Building must be mandatory in the construction of building across the country.
3. The policies for building construction of RAJUK should be amended according to the present situation.
4. The roads should be widened across the country.
5. The machineries which are used in rescuing after the earthquake should be handed over enlisted names by to Disaster Management Bureau and preserved at the district commissioner's office.
6. In the risky areas a team of voluntary workers has to be organized and trained.
7. In disaster affected areas Police and Navy should use "Dog Squad" for relief work.
8. There should be some field hospitals in affected works.
9. Atomic Energy Centre should have direct communication with meteorology offices of Dhaka, Chattogram, Rangpur, and Sylhet.

Task : What issues are important after a major earthquake? Discuss.

Tsunami

Tsunami is the large ocean wave created from an earthquake or volcanic eruption. Tsunami does not happen in Bangladesh. It happened only in the distant past in 2nd April 1762 in Cox's Bazar and its adjoining. In the coastal region of Arakan in Myanmar a 7.5 Richter scale earthquake was the cause of Tsunami in the Bay of

bengal. For the Tsunami happened in the Bay of Bengal due to the earthquake in the sea of Andaman in 1941, the east coast of India was greatly damaged. As a result, 5000 lives were lost. On 26 December 2004, an earthquake struck off the Indonesian island of simua-lue, triggering a tsunami that killed a huge member of people.

Disaster management

Disaster management is kind of practical science which includes the activities of proper observation and prevention through disaster preparedness and disaster response and recovery.

The main objectives of disaster management :

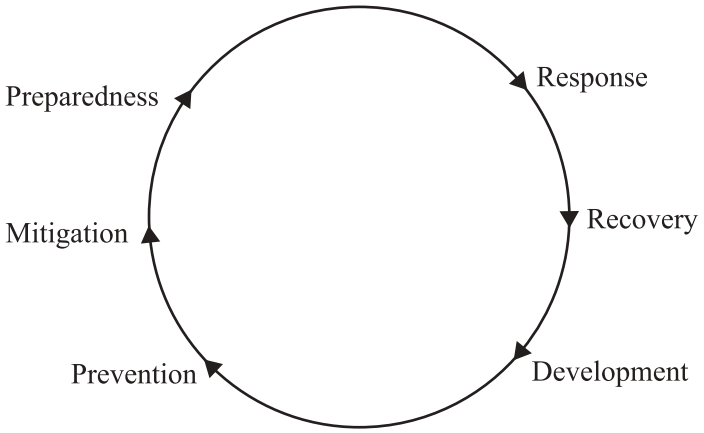
(a) To avoid or reduce of the amount of loss of lives, property and environment which are damaged during the natural disaster.

(b) To distribute the relief materials and to rehabilitate the affected people as early as possible.

(c) To work after the disaster in order to recover and go back to normaly.

Disaster management circle :

Disaster occurance and its impact



The main elements of disaster management are disaster prevention, disaster

mitigation and disaster preparedness. We have to take elaborate programme to face the disaster. The disaster management factors are response, recovery and development. The other management factors include rescue and development. But, in past, response is considered as only factor of disaster management.

Prevention

The prevention activities can bring the success in the case of reduction of damages in the natural disasters. The structural and the infrastructural facilities are available to prevent the disasters. Different kinds of structural construction activities were implemented, such as building embankments, construction of shelters, construction of pucca and strong houses, river excavation etc. As structural mitigation is very expensive, poor countries cannot afford it. The infrastructural mitigation which means training, raising public awareness, preparedness etc is less expensive.

Mitigation

Disaster mitigation means keeping of disasters at bay and the preparedness to face disaster. The disaster mitigation includes construction of pucca and strong building, crop diversification, formulating policies for using the land properly, economic development, shifting people to the less risky areas, institutional structure etc. The government has been working for the construction of embankment, excavation of the rivers, building shelter, afforestation etc. with its limited resources.

Preparedness

Disaster preparedness refers to the measures taken before a disaster to reduce its risks. It includes identifying vulnerable areas and populations in advance, formulating disaster-related plans, establishing institutional structures, ensuring the availability of necessary resources to handle emergencies, conducting drills or role-playing exercises, and preparing infrastructure such as roads, vehicles, radios, and other equipment prior to a disaster.

Response

Response is only a part of disaster management. Response is essential after the disaster. Response includes the activities of shifting the vulnreralbe people to safe places,earching and recovery, estimating the amount of relief and rehabilitation.

Recovery

Recovery means bringing everything back to normaly through rebuilding of environmental social and economic ambiance and infrastructure. In this case the concerned authority needs the assistance and cooperation of public, non-government voluntary and international organizations to meet the challenge.

Development

The development activities come after recovering the affected areas from disaster and they should consider the geographical and environmental issues.

Coastal disaster management

In the coastal regions of Bangladesh, cyclone and tidal waves are the major disasters. So, the steps taken for the disaster management are mostly applicable for the coastal areas of Bangladesh. Usually the other areas of Bangladesh are affected by river erosion, flood and earthquake. The natural disasters like cyclone, tornado, drought and excessive rainfall are common in Bangladesh.

The major prevention of natural disaster is prior information, through weather forecast. Bangladesh Weather Directorate provides the weather forecast regularly. Sparrso is a public organization for space research. Sparrso provides the satellite images of clouds regularly to the meteorological department for weather forecast and signal.

Our armed forces help out in emergency situation by cooperating with the civil administration in treatment, rescue, distributing relief goods and rehabilitation. Bangladesh Radio and Television play an important role in providing information and signal about disaster. In addition to that the non-government organizations such as Oxfam, Disaster forum, Care Bangladesh, Caritas, Proshika, CCDB, BDPC, [Bangladesh disaster preparation centre] etc. play significant role in disaster mangement. We have to live with the natural disaster. If we can maintain the disaster

management and preparedness programme, we can successfully reduce the sufferings caused by disaster, and will be able to save lives, property and environment. However awareness raising is also very important. We have to campaign at personal, family, village, union, upazila and district levels for ensuring the appropriate action of disaster management.

Sample Questions

Multiple choice questions

1. What is the man-made cause of floods?

(a) Unplanned urbanization
(b) Himalayan glacier flow
(c) Shallow river depth
(d) Geographical location

2. The objectives of disaster management are-

i. To reduce the extent of damage
ii. To ensure relief and rehabilitation
iii. To complete the recovery work well

Which of the following is correct?

(a) i and ii
(b) i and iii
(c) ii and iii
(d) i, ii and iii

Read the following paragraph and answer questions 3 and 4:

A cyclone in Shyamnagar Upazila recently caused extensive damage to life and property. Rafiq and his friends distributed dry food to the victims and provided medical treatment to those injured.

3. What can be called the work that Rafiq and his friends did?

(a) Prevention
(b) Remediation
(c) Response
(d) Recovery

4. Ways to mitigate the impact of the above natural disasters:

i. Construction of shelters
ii. Training on disasters
iii. Raising public awareness

Which of the following is correct?

(a) i and ii (b) i and iii
(c) ii and iii (d) i, ii and iii

Creative Questions

1.Scenario: A- Sonia's village is submerged in a natural disaster yearly.

Scenario: B- Shahed is a farmer. Every year, many houses in his village are submerged by a natural disaster. However, he has noticed that the soil of his agricultural land has been gradually drying up recently and becoming rough.

a. What is a disaster?
b. What does mitigation refer to in disaster management? Please explain.
c. Describe the natural causes of the disaster in Scenario A.
d. Which of the two disasters in Shahed's village do you believe has a more damaging impact? Conduct a comparative analysis.

Short-answer questions

1. List the categories of floods.
2. What does drought mean?
3. Write the causes of river erosion.
4. Why is river erosion considered a persistent problem in Bangladesh?
5. What does pre-disaster preparation mean?

Chapter Fifteen

Sustainable Development Goals (SDG)

Since its inception, the international organization, United Nations (UN) has earned tremendous success in achieving its goals. The United Nations is committed to exploring everybody's potentials, dignity and equality. It has been trying to achieve Sustainable Development Goals comprising elements of economic, social and environmental development. We have learned about SDG in the previous classes. It is to mention here that like other nations in the world, Bangladesh has also been working towards achieving UN-set SDG. It's not an easy job. It needs concerted efforts or partnership between the government and the people of this country. In this chapter, we will learn about the importance of partnership in achieving SDGs, the benefit of achieving these goals, the challenges Bangladesh faces and our responsibilities to overcome those challenges.

After the completion of the chapter we will be able to–

- explain the importance of partnership in achieving SDG;
- analyse results of achieving SDG;
- identify the challenges of achieving Sustainable Development Goals;
- explain actions needed to address challenges of achieving SDG;
- design posters in order to create awareness among people about their responsibilities in achieving SDG;
- be self-motivated in implementing SDG.

Lesson 1: Importance of partnership in achieving SDG

Before explaining the importance of partnership in achieving SDG, we need to know what partnership is. A group of people work for and enjoy the benefits of any development are partners. They have some duties and responsibilities to enjoy the benefits. They have ownership in the development when they perform these duties and responsibilities perfectly. It is not possible for any development worker or the government to continue the trend of development alone. For example: for good harvesting the government or any development organization would supply fertilizer and necessary pesticides. But if the users use more than what is needed carelessly, it won't be friendly to the environment. The user has to be responsible in the use of required amount of fertilizer and pesticides. Partnership emphasises maximum benefits for maximum number of people. Whatever development be carried out, it has to be done considering the interest of all concerned. Whatever responsibility one has, he/she has to be considerate from his/her respective position. Partnership is very vital in implementing SDG. In this regard, everyone or every sector has a stake. Everyone in the government or non-government sectors; every individual person or groups at all levels of the society has to come forward and work together to achieve the goals of sustainable development. And these efforts should be well coordinated.



National partnership is an important issue in achieving the SDGs. Not only the people at the upper sections of the society should be involved here, even the most common people have to be included in this process. People should be made conscious about their roles. In this regard, the importance of international partnership is immense. Achieving the SDGs is not confined to any territory, it is applicable to all nations in the world.

For this to work there should be partnership between the society and the institutions that have influence over the state.There might be differences of interest among the partners. The implementing countries will decide their priorities. For example, holistic development is a top priority in Bangladesh. The main goal

of sustainable development is to establish international cooperation which can be established through mutual partnership. Each country will work for the macro development of their own country as well as of the international community as per their own capacity. If some people are left behind, the development will not be sustainable nationally or globally.

Task: Discuss and write why partnership is necessary for sustainable development.

Lesson 2: Probable results of achieving SDG

In order to safeguard the planet called the Earth, the implementation of SDG is very important. Climate change has been a big concern for the conscious people of the world. The effect of climate change has been affecting human beings, society, agro production, and lives on land and in water. Bangladesh along with other countries has been working to minimise the effects. Bangladesh is going ahead in all indicators of economic and social progress. The country's poverty has decreased, and its income has risen, resulting in significant progress in capacity building and economic growth. We have attained unprecedented success in achieving the MDGs. We believe in consistent future development. We have earned socio-economic capacity to march hand in hand with the world. We will stand upright in the world forum. After we have achieved the MDG, now we are working for SDG. We hope we will also achieve the goals successfully. This will help drive out our poverty. Disparity will be reduced, there will be a balance between income and consumption. A peaceful co-existence will take place in the world based on the mutual cooperation at both national and international levels.

The proposed advantages for Bangladesh by attaining the SDGs are-there will be no burden of foreign loans, employment opportunity will be created, disparity between men and women will disappear, all will work hand in hand for the development of the country. The doors of education, culture and knowledge will remain open. There will be free flow of information and right to information will be protected. We will be able to think of ourselves as global citizens because of the rapid development of communication system. We will move forward in the field of sports, science and technology. All the facilities required to live in an open world will be available to our doorsteps. We will be able to establish our dignity as a peaceful and prosperous nation.

In a nutshell, the following are the probable results of achieving sustainable development goals:

- The poverty line will be brought to almost zero.

- The basic needs like food, clothes, shelter, education, healthcare and entertainment will be met.
- Women repression will decrease as a result of gender equality and women empowerment.
- Environment for healthy living will be created through supply of clean water and sanitation in both rural and urban areas.
- Different natural disasters like flood, drought, tidal surge, cyclone, river erosion will minimize.
- Due to the raise of renewable sustainable energy, agro and industrial production will increase.
- Anarchy will decrease and stability will increase through justice in the society.
- Political instability will reduce by strengthening democratic institutions.
- Social, economic and political problems will be resolved through expanded partnership with the other countries.

Task-1: What could be the advantages for Bangladesh by achieving sustainable development goals? Discuss in groups, make posters and present them.

Task-2: Draw a mind map on the advantages we will get upon achieving the sustainable goals.

Lesson 3: The challenges of Bangladesh towards achieving Sustainable Development Goals (SDG)

Bangladesh has achieved unprecedented success in achieving UN declared Millennium Development Goals (MDG). The UN has assigned its member states including Bangladesh to work with partnership and take responsibility for achieving Sustainable Development Goals (SDG). The objective is to ensure universal welfare all over the globe. In order to attain equality and development in the world with no disparity, the



Sustainable Development Goals (SDG)

SDGs have to be achieved by 2030. All the nations of the world are pledge-bound to achieve these goals. This lesson focuses the challenges Bangladesh may face in achieving these goals.

A country has to plan for total or holistic development to earn the highest success. Sustainable Development Goals are the structured plan of that total development. The remarkable challenges for sustainable development goals are unequal distribution of resources, disparity, and poverty. While we are talking about zero poverty, the disparity of wealth and resources is being widened in the world. Poverty has been acute due to the increasing gap between the rich and the poor. The more the disparity lies with the resources in the world, the division between the rich and the poor will be more obvious. And the more the division is, the more will be the hatred and distaste.

The development the present world has been experiencing is not any balanced development; it is rather creating further divisions among human beings. This typical development has been rather creating and expanding discriminations among humans and nations. This increasing acute discrimination and division are barriers against SDG. Bangladesh is also not out of this situation. Although in the recent time the rate of poverty and extreme poverty has reduced significantly here, the gap between earning and consumption is still evident. Over the last few years, although the rate of this disparity has reduced to some extent, it is still high. There is no doubt about it that the disparity of wealth is raising rapidly in our country too. A section of people is becoming immensely rich by grabbing the land, rivers, forest or even capturing financial institutions in the society. This is creating an imbalanced society and thus damaging the environment. Due to uninterrupted race for development worldwide and use of unplanned fossil-energy, the adverse impacts of climate change are obvious to all. Lack of transparency and accountability down from individual to collective level has become a challenge towards achieving the SDG.

Lack of co-ordination and partnership between public and private institutions may pose a threat for sustainable development. Not only the disparity of wealth; but also the disparity of earning, consumption, and gender; even the regional disparity could become a challenge towards sustainable development. The problems originating out of unplanned industrialization and urbanization account for challenges towards achieving Sustainable Development Goals. Lack of measures in addressing natural or social disasters would also slow down the process of development. Achieving the sustainable development goals appears

to be difficult considering weaknesses in infrastructural development; shortage of gas, fuel and power supply; and mismanagement in appropriate marketing of agro-products.

Task-1: Identify Bangladesh's challenges in achieving SDG.
Task-2: 'Disparity in all sectors is the biggest challenge in achieving SDG' - give reasons in favour of and against the statement.
Task-3: 'Climate change and environment pollution is the main challenge to achieve SDG'- arrange a debate on the issue in the class.

Lesson 4: Actions needed to address the challenges

We have known that sustainable development focuses on society, economic and conservation of environment. These are the elementary issues to consider. If any development plan is formulated and implemented by keeping these things in consideration, it is expected that the sustainable development will take place in all sectors. It is not possible on the part of the government alone, or any individual or institution, to address the challenges of sustainable development goals. Each of us, from our own position, has to come forward in this regard. When a person becomes conscious, the members of his/her family will also become conscious. Awareness leads a nation to one step ahead. For example: one of the challenges of development is environment pollution.

We know that heavy rainfall causes water logging in big cities. It hampers road transportation and damages roads and walkways; the low earning group of people loses their work; people cannot reach schools, colleges or work places in time, and shops remain closed. During this time there is an outbreak of different diseases. In fact, we have destroyed our cities on our own. Instead of throwing away litters, polythene bags, used packets of chips in a specific place; we throw them away indiscriminately. As a result, roadside sewerage is blocked and water cannot flow properly. Due to long time water stagnation, different problems and crises occur. We have to come out of these practices. At first, we have to be aware of the consequences of such activities. We have realized that Bangladesh has to face a number of challenges in implementing SDG. We will now identify the steps we need to take to meet all these challenges.

To bring disparity at all levels down to a tolerable level is very important for implementing SDG. Reducing disparity in income, consumption, gender, region and wealth to a greater extent is needed to eradicate poverty in all sectors. For this, appropriate strategies should be taken and they should be institutionalized. Adopting and implementing coordinated programs with the participation of the government and other partners has to be undertaken. Resource mobilization from home and abroad has to be expedited. Ensuring uninterrupted flow of information and analysis of data, an acceptable databank has to be included in sustainable development program. To address the effects of climate change, conservation of environment and development, measures have to be taken according to necessity. In this regard, enhancing skills of the common mass and creating employment opportunities for them as well as reasonable supply of fund or wealth should be ensured. Besides facilities for education, health care, training and other services, infrastructural facilities have to be enhanced as per the necessity. In this regard, skills development of general people is important. Creating facilities for them and providing them with institutional assistance are equally important. If these opportunities are created, people can mobilize resources using their skills and contribute to the social development process of the country.

For the expansion of rural economy, the non-agro sector has to be given priority. Priority should be given to different deprived communities and far flung regions of the country in development planning. Special programs are needed to eradicate extreme poverty and minimise poverty rate. Economic policy should be taken in a way so that socio-economic development appears even. Priority has to be given on the improvement of education, culture, health and sanitation. Apart from increasing budgetary allocations in these sectors, management and monitoring has to be strengthened.

The main focus of sustainable development is to keep the trend of development and progress sustainable and expedite its speed. We are dreaming to achieve SDG by 2030 and turn Bangladesh into a developed country by 2041. For these to happen, we all have to join the journey towards development.

If this is not done, there may be a rise in our growth rate, but it will never be sustainable. We have to ensure that everyone has equal rights as a citizen of the country and everyone has equal human dignity. There has to be improvement and awakening in education and cultural sectors. Although the energy sector has been given priority in the present budget, strong monitoring is needed at the implementation level. Measures have to be taken to address the challenges needed for carrying out investigation on land and in the sea to ensure gas supply.

Whatever be the development, there are some negative factors attached to that and they affect the socio-economic condition of a country. For example: the country has advanced immensely in ICT, but we are undergoing some negative experiences as well due to insufficient precautions to defend them. For example, our young children are falling victim to the misuse of IT. Therefore, before considering anything as good, we should take precautions considering its adversity and risk factors. If this is done, we can address risk factors.

If we undertake development plans considering these factors seriously and proceed to implement them, the result could meet our expectations. It is obvious that every society has some existing problems as well as a few new ones to add to the list. This sometimes gives birth to unwanted situations. The most daunting task at present is to ensure the progress achieved so far is balanced and consolidated. Besides, initiatives should be taken to speed it up further. This needs both human capacity building and human development. Among others, adopting different programs based on priorities, effective implementation of the planned activities, stopping any kind of waste, combating corruption and inclusion of the country's citizens in the process of socio-economic development are also vital. Equally important is to ensure transparency and accountability of the state.

Task 1: Identify the action needed to address the challenges towards achieving SDG.

Task 2: How can we contribute towards achieving sustainable development? Discuss in groups and write an essay in 200 words.

Sample Questions

Multiple choice questions

1. Which of the following initiates a mutual partnership?

a. Cooperation of a certain group
b. Economic and social cooperation
c. National and international cooperation
d. State Cooperation

2. What change has alarmed the conscious people of the world?

a. Birth rate
b. Climate
c. Temperature
d. Social indicators

Read the following paragraph and answer questions 3 and 4:

"The success achieved in 2015 of a program launched by the United Nations has made Bangladesh optimistic about achieving the 2030 goals," remarked Mr. Shahed Mansur as he began his speech titled "Development Planning and Bangladesh." At the end of his speech, he stated, "By achieving the goals by 2030, we will establish ourselves as a happy and prosperous nation with gender equality."

3. What success did Mr. Shahed discuss in his speech in reference to 2025?

a. SDG
b. MDG
c. Environmental development
d. Social development

4. Shahed's last speech highlighted-

i. Possible results of achieving the goals
ii. Benefits of achieving success
iii. Dream of a prosperous future

Which of the following is correct?

a. i and ii
b. ii and iii
c. i and iii
d. i, ii and iii

Creative Question

Scenario-1	A real estate company is filling in part of the Balu River, putting up sign-boards and selling plots along with some adjacent land.
Scenario-1	After the establishment of a tannery in Savar, waste is dumped into the nearby canal without proper waste management.
Scenario-1	The citizens of City Corporation 'A' have turned it into a beautiful and livable community by fulfilling their responsibilities and duties without relying on the government.

a. What is climate action?
b. Why is partnership essential for sustainable development?
c. What do Scenarios 1 and 2 reveal? Explain.
d. Evaluate Scenario-3 as an example of ensuring overall and universal well-being throughout the world.

Short-answer questions

1. What does "partnership" mean?
2. List four potential outcomes that could result from implementing the SDGs in Bang ladesh.
3. What does sustainable development mean?

The End

2026 Academic Year

Classes Nine and Ten : Geography and Environment

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