AN INTRODUCTION TO

GEOGRAPHY

CLASS VII

DEPARTMENT OF SCHOOL EDUCATION
MINISTRY OF EDUCATION AND SKILLS DEVELOPMENT
ROYAL GOVERNMENT OF BHUTAN
THIMPHU

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Foreword

The purpose of education is the wholesome development of learners to equip them with relevant knowledge, skills and values crucial for them to deal with realities in life. Learners ought to learn, how to think, understand, integrate and evaluate diverse situations they face in their lives. This pre-empts that education be visionary and future oriented.

We live in an interconnected global world where Geographical perspectives including time and space, physical environment and people influence the world environment. Therefore, it is important for learners to understand and apply the different strands of geography education to help learners in making wise decisions. This is because human activities directly impact our environment.

Understanding of geography and practices of the basic theories of the subject should find link to higher level and transcend to career opportunities for learners. The diverse geography learning experiences and opportunities should stimulate love and care for our natural world to be educated and responsible citizens.

Thus, this book sets the foundation for the beginners to understand Geography based on astronomy, physical, human and economic dimensions of Geography education. In addition, it will help them to appreciate the importance of Geography in the conservation of the natural environment for sustainable socio economic development of the country. The textbook caters to the first time learners of Geography as a separate subject with clear and simple text with exciting learning activities, informative maps and pictures.

We are grateful to our writers and reviewers from the Royal University of Bhutan, the Ministry of Education, National Land Commission, Bhutan Council of School Examinations and Assessment and colleagues from the Royal Education Council for their valuable contributions. We hope that our teachers and learners enjoy teaching and learning the subject and contribute to the promotion of Geography education as a whole.

Tashi Delek!

Kinga Dakpa
Director

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Chapter One
Nature and Scope of Geography

Learning Outcome(s):

- Discuss nature and scope of geography.

1.1 What is Geography?

The word geography was first used by Greek Scholars to describe the earth surface. Geo means 'Earth' and Graphe means 'to describe'. Geography studies about what, how, where, and why human and natural activities occur on the earth. It tries to understand different pattern of human distribution in relation to society and physical environment. Therefore, the study of geography is essential in everyday life to understand our own place and space with greater interest.

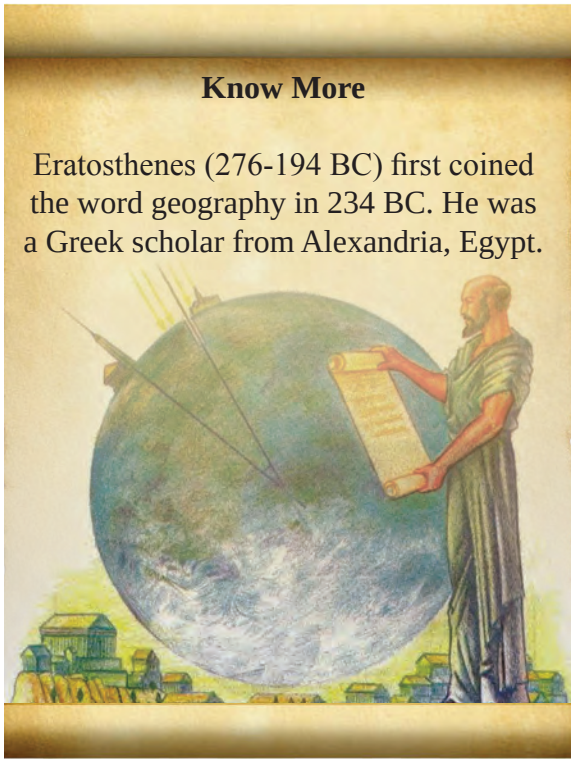

Figure 1.1: Eratosthenes

Immanuel Kant

Alexander Von Humboldt

Carl Ritter

Figure 1.2: Geographers

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1.2 Why Learn Geography

The study of geography helps in understanding our world in a better way. It has changed over time from descriptive studies to observational learning. The flowchart below shows the purpose of learning geography.

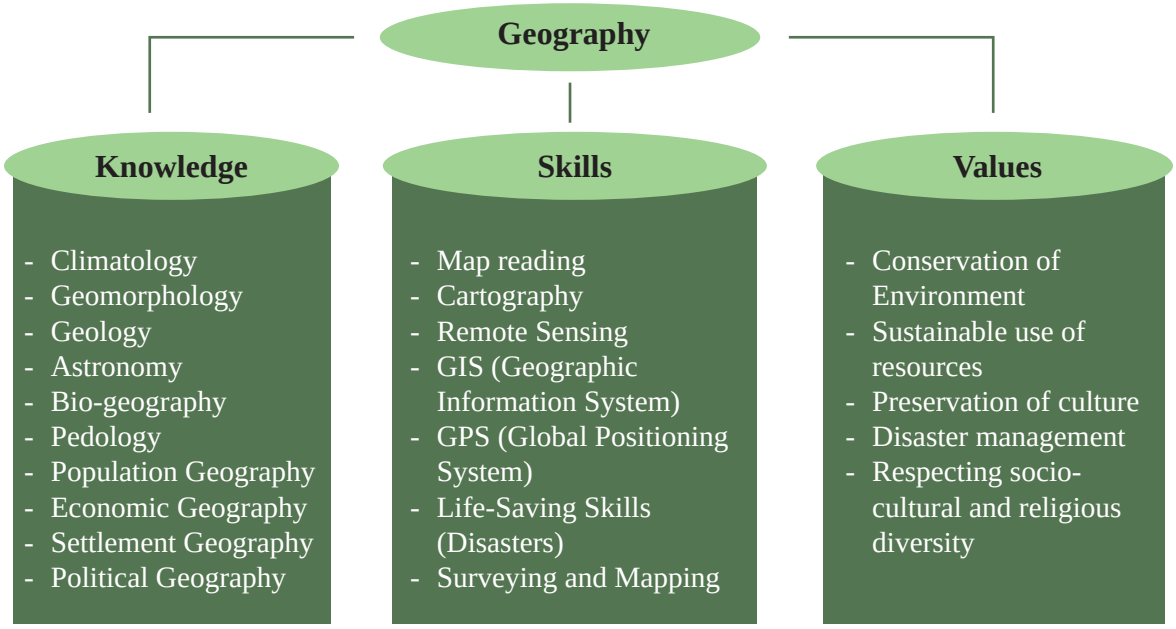

Figure 1.3: Purpose of learning geography

Learning Activity:

1. Visit your school library and learn more about the branches of geography.

Geography is an interdisciplinary subject. It provides overall understanding of the world through its linkage to various subjects. It draws knowledge from several other subjects like mathematics, economics, biology and other subjects. Thus the study of geography provides ample opportunities for better future.

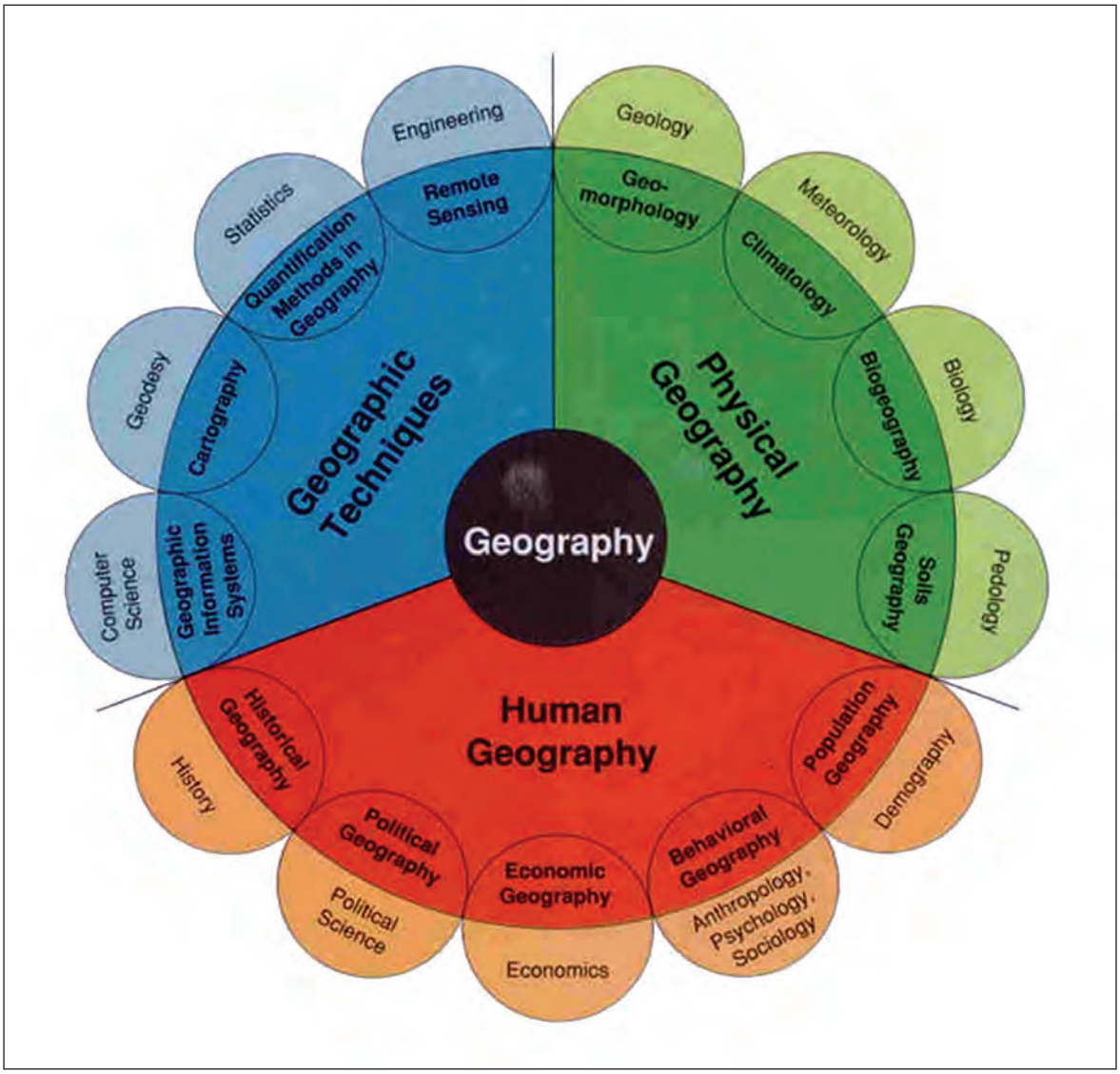

Figure 1.4: Interdisciplinary Chart

Learning Activity:

Refer figure 1.4, think of some future opportunities for you as a geography learner.

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Test Yourself:

1. Find at least 11 Words on branches of geography from the word puzzle given below.

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

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Chapter Two
The Earth in the Solar System

Learning Outcome(s):

- Discuss the solar system
- Explain the motions of the Earth

2. 1 Introduction

The celestial bodies that we see are just a fraction of bodies that exist in the universe. The universe is a huge space which contains everything. Solar system is a part of universe and our earth is a part of the solar system.

2.2 Solar System

The solar system comprises of the Sun and celestial bodies like the planets, their satellites, asteroids, meteoroids and comets. Solar system is elliptical in shape and is always in motion. The Sun is the centre of the solar system and the planets revolve around it. All the planets are spherical in shape but are of different size. Based on the distance from the Sun, they are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune. Each planet rotates on its axis and revolves on its orbit around the Sun.

Know More

1. Solar system was formed 4.6 billion years ago.
2. Earth is the 5th largest planet in the solar system (150 million Km from the Sun).
3. The moon is the only natural satellite of the earth.

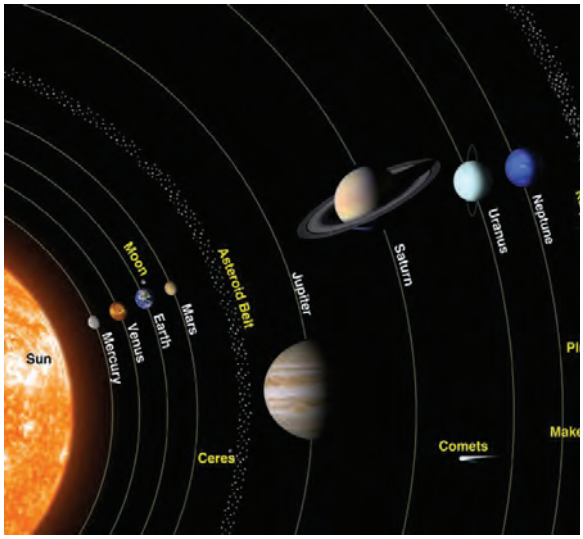

Figure 2.1: The Solar System

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2.3 Rotation

The earth is constantly in motion. The spinning of the earth on its axis is known as rotation. The earth rotates from west to east and completes one rotation in 24 hours. The axis is an imaginary line that passes through the centre of the earth from North Pole to South Pole. It is tilted at an angle of 23½ degrees from the line perpendicular to the plane of orbit.

The part of the earth which faces the Sun experiences day while the part away from the Sun experiences night due to rotation. The circle that divides day from night is called "the circle of illumination". The length of day and night remains same at the equator but changes towards the poles due to the tilted axis.

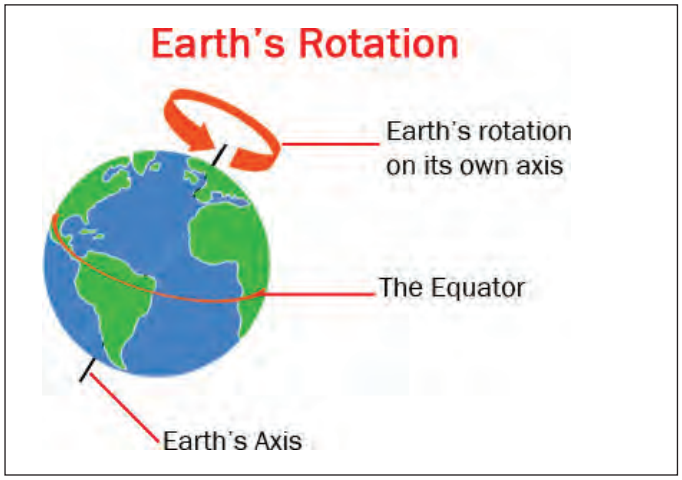

Figure 2.2: Rotation

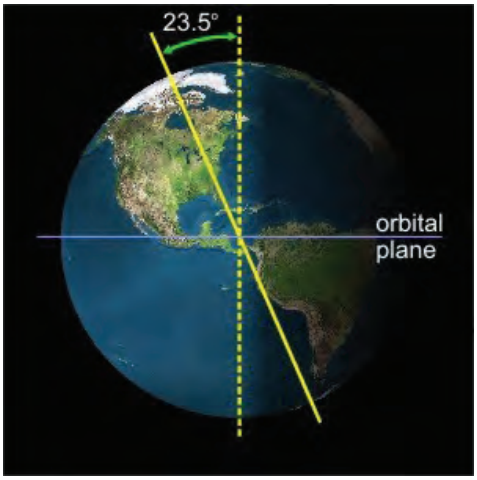

Figure 2.3: Earth's Axis

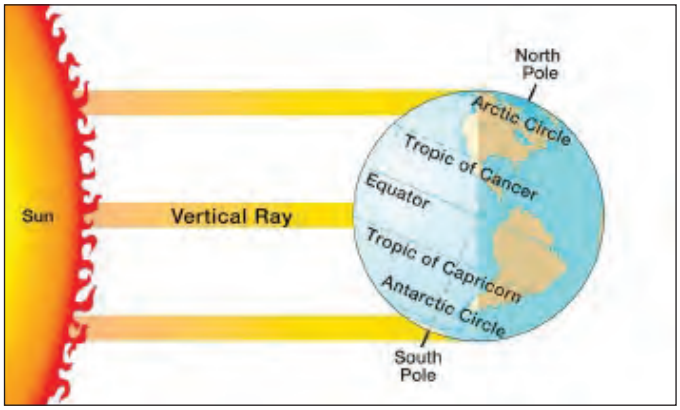

Figure 2.4: Circle of Illumination

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2.4 Revolution

The other type of motion of the earth is “revolution”. The movement of the earth around the Sun on its orbit is known as revolution. It takes 365 days and six hours (¼ day) to revolve around the Sun. One calendar year has 365 days and the remaining six hours is added to every fourth year to the month of February which is called as “Leap Year”.

The revolution of the earth and the tilted axis determines the intensity of heat received by the earth surface, resulting in the occurrence of seasons. The seasons are Spring, Summer, Autumn and Winter.

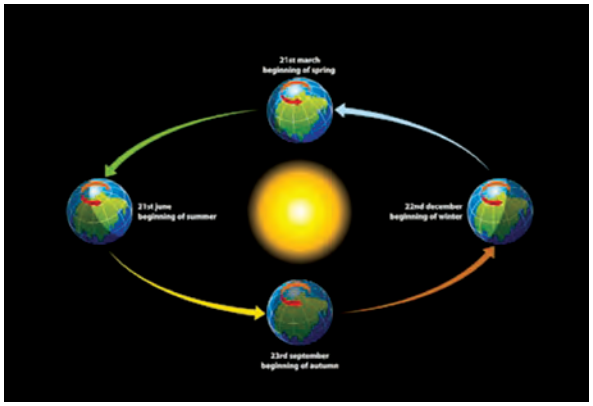

Figure 2.5: Revolution

Know More

1. During leap year the month of February has 29 days.
2. Leap year has 366 days.
3. Seasons are opposite in Northern and Southern Hemisphere.
4. Equator does not experience all the seasons.

Learning Activity:

1. Demonstrate how rotation and revolution occur using the following suggestive materials:
   You may use; globe/ball, torch/bulb, threads etc.

2. Explore for suitable simulation/videos, pictures and animations from different sources to learn more about motions of the earth.

Test Yourself:

1. *Mercury is the nearest planet to the Sun. Do you think mercury is the hottest planet in the solar system? Why?*
2. *‘The axis is tilted at an angle of 23½ degree from the line perpendicular to the plane of orbit’. What would happen if the axis of the earth was not tilted?*
3. *How do changes of season affect the life of people in different places?*

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Chapter Three
Latitude and Longitude

Learning Outcome(s):

- Discuss essential properties of map
- Differentiate latitude and longitude
- State the importance of latitude and longitude
- Calculate time using longitude

3.1 Introduction

There are many places on the earth. Is it possible to exactly locate these places? Can you locate your school on the map?

A map is a graphical representation of the earth's surface on a plane surface. It is used to show shape, size, distance and direction of various features of the world.

3.2 Properties of map

A map must have Title, Key, Scale and Direction. The title indicates what the map is about and a key or legend explains what each symbol or colour or shading represents. A scale on a map enables to measure the distance and calculate the area. A direction on a map is indicated by points on the compass. It is usually shown by an arrow indicating North.

i) Types of maps

Maps are broadly categorized as political, physical, topographic, climatic and economic or resource.

A political map shows cities and boundaries of countries while physical map generally shows features like mountains, rivers, plains and oceans. A topographical map shows physical features using contour lines and human made features of a small area. Climate map

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provides information about the climatic conditions of an area like temperature and precipitation. An economic or resource map shows the various economic activities and natural resources present in an area.

Figure 3.1: Political map

Figure 3.2: Physical map

In order to accurately locate the position of any place on the map, a grid system is used. It shows the location by using coordinates namely latitude and longitude. The network of latitudes and longitudes is called "Earth's Grid".

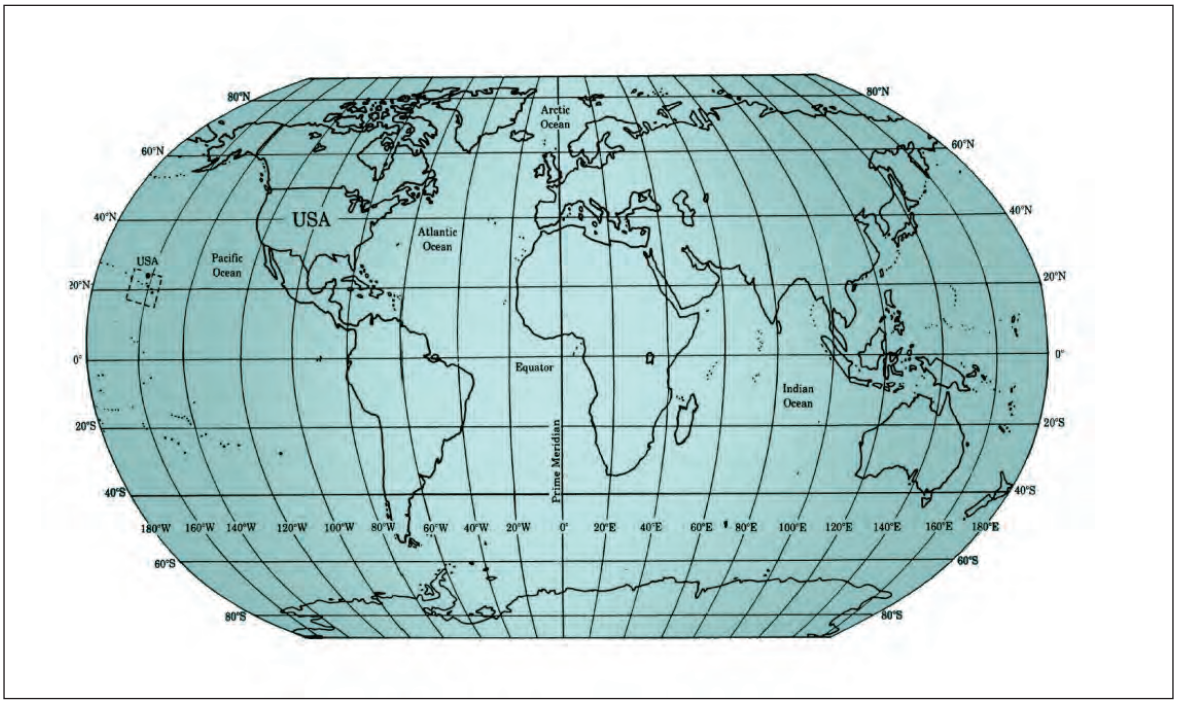

Figure 3.3: The Earth Grid

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3.3 Latitude and Longitude

Latitude is the angular distance of a place north or south of the Equator, measured in degrees. It is also known as Parallels. The equator is zero degree latitude and is the largest circle while the poles are 90 degrees with just a dot.

The latitudes are related to climate. The intensity of heat varies from equator to the poles which determine the climatic zones of the world.

Longitude is an angular distance of a place east or west of the Prime Meridian. It is also referred to as Meridian. The Prime Meridian is zero-degree longitude and passes through Greenwich, London. All other meridians are numbered at either sides of the Prime Meridian upto 180 degree. Longitude helps in determining time.

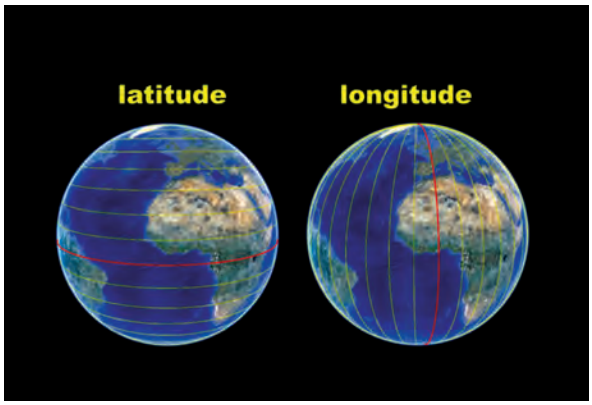

Figure 3.4: Latitudes and Longitudes

Know More

1. The oldest globe that still exists was made in the year 1492 by Martin Behaim.
2. There are 180 lines of latitudes and 360 lines of longitudes.
3. 180 degree longitude is International Date Line.

Learning Activity:

1. Find out the latitudinal and longitudinal extent of Bhutan from an Atlas.
2. Refer the map in figure 3.5 and identify the country which lies on the given coordinates:

Sl.	Latitude	Longitude	Country
1.	15^0 N	75^0 E	India
2.	15^0 S	60^0 W	…….
3.	60^0 N	15^0 E	…….
4.	45^0 N	105^0 E	…….....

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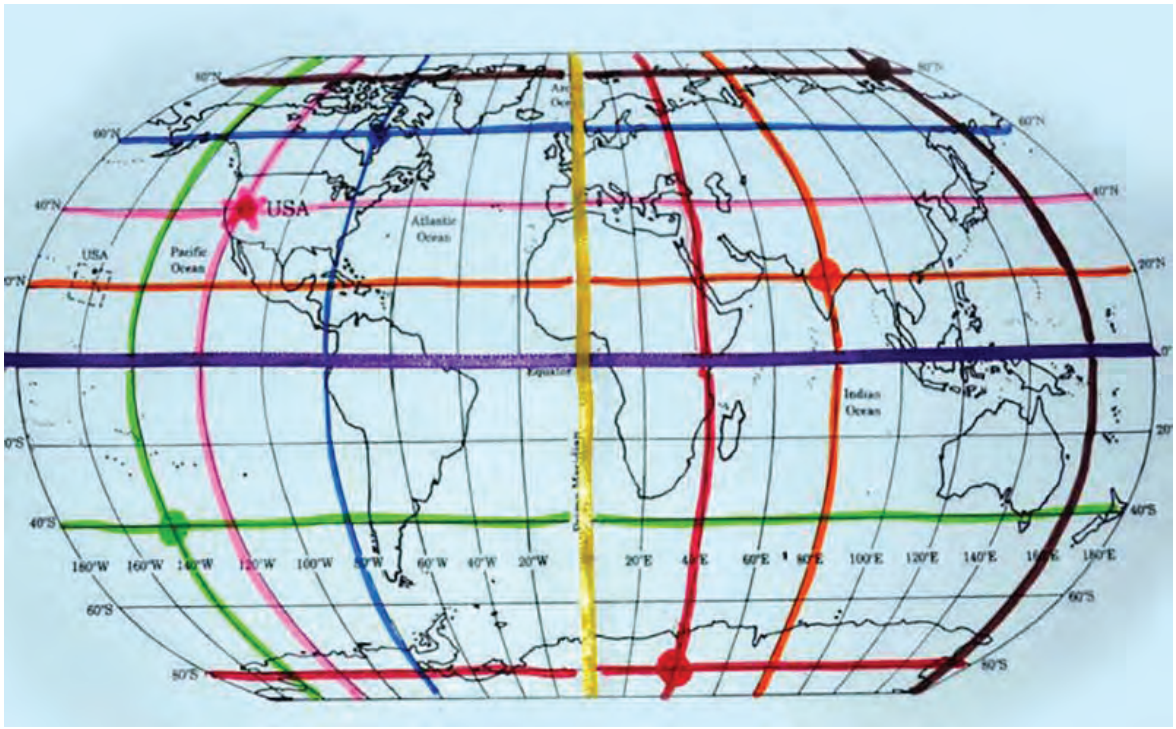

Figure 3.5: World map with major grids

3.4 Finding Time

To maintain international uniformity, one uniform time, corresponding to the Prime Meridian, is adopted by all countries. This is called the Greenwich Mean Time or GMT. The time east of GMT is ahead while it is behind towards the west of GMT as the Earth rotates from west to east.

The earth rotates 360 degrees in 24 hours. It covers 15 degrees in one hour, which is one degree in four minutes.

24 hours = 360° longitude
1 hour = 360° ÷ 24 = 15°
60 minutes = 15° (or)
60 ÷ 15 = 4 minutes
Therefore, 1° = 4 minutes

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Solved Example:

What will be the time in Bhutan (90°E), when it is noon at Greenwich?

Solution:

Number of longitudes between Bhutan and Greenwich = 90 - 0 = 90°

Since, 1° = 4 min

$90^\circ = 90 \times 4 = 360$ min

or $\frac{360}{60} = 6$ hours

Since Bhutan is east of Greenwich, time in Bhutan will be 12 + 6 = 18 hours or 6 PM.

Learning Activity:

1. When it is 10 AM in Bhutan (90° E), what will be the time at a place 45° E longitude?
2. What will be the time at 105° W, when it is 9 AM at 75° W?

Test Yourself:

1. *Learning about latitude and longitude, what difference can you draw between them? Explore more on the topic.*
2. *A pilot took off at 7 AM from GMT. He will be covering 30 longitudes west to reach his place. At what time will he reach his destination?*

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Chapter Four
River System

Learning Outcome(s):

- Discuss the river systems
- Locate major rivers on an outline map of Bhutan
- Identity the major rivers

4.1 Introduction

The first image that comes to our mind when we think of a river is that of continuous flow of water. All flowing water is not considered a river. A river is a large natural body of water flowing in a channel and draining into larger body of water. Both river and stream are fast moving bodies of water, but a river is larger, deeper and longer than a stream.

A river system is a group of rivers which consists of a main river and its tributaries that drains from source to its mouth. The source is where the river originates (precipitation, spring and glacier) and the mouth is where the river ends (other larger river, lake, sea and ocean).

4.2 Drainage Basin

A drainage basin is the area drained by a river and its tributaries. It includes the stream channels and areas between the streams beginning from the source to the mouth.

The high land that separates two drainage basins is called the watershed or water divide. Two or more rivers join to become a larger river. The place where the rivers join is called a river confluence.

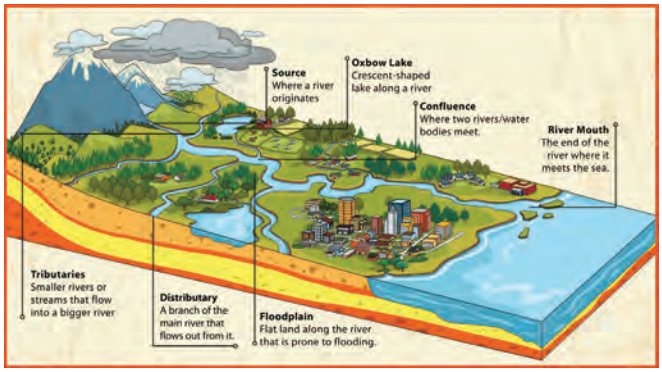

Figure 4.1: Drainage basin

Know More

- Catchment area: Upland area from which river draws its water.
- Tributary: A river or stream that flows into larger river.

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Learning Activity:

Study the figure and label the features of drainage basin with correct terms.

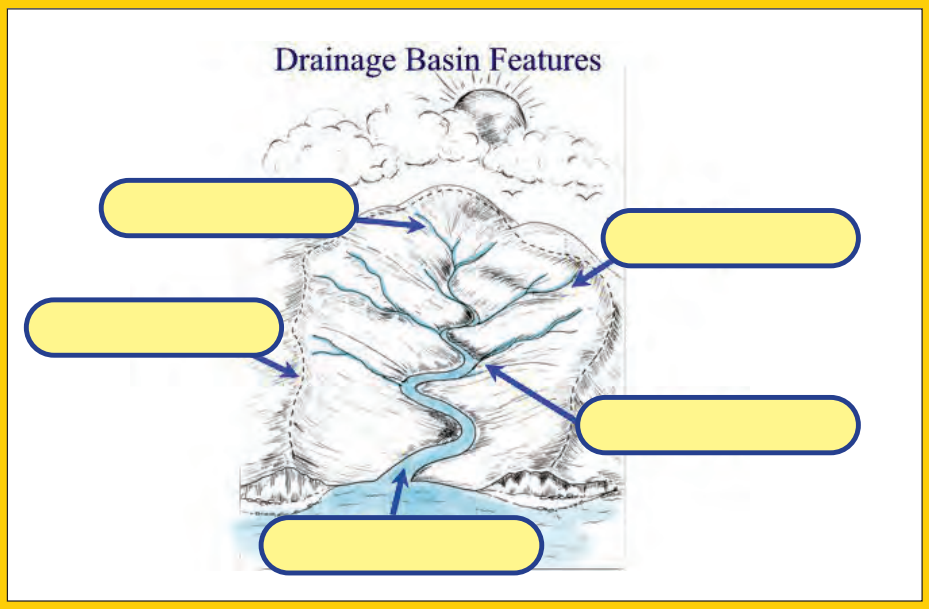

Figure 4.2: Features of Drainage Basin

4.3 Drainage Pattern

The shape formed by a river and its tributaries in a particular drainage basin is called drainage pattern. There are different drainage patterns of which following are common:

i) Dendritic Pattern

It is a tree shaped drainage pattern where the tributaries join the main river. The main river looks like a tree trunk and tributaries as branches. Almost all drainage basins in Bhutan have this type of drainage pattern.

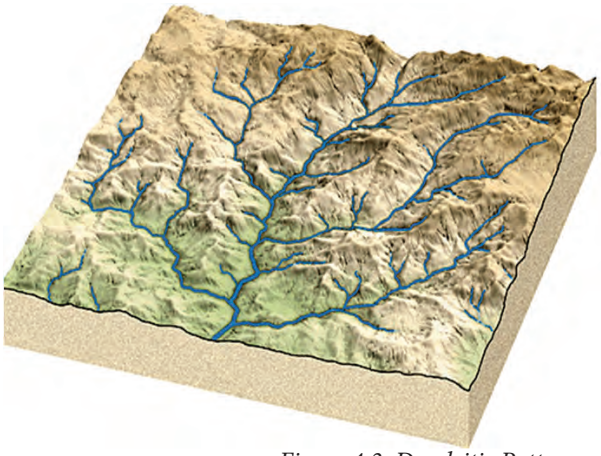

Figure 4.3: Dendritic Pattern

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ii) Trellis Pattern

As the main river flows, small tributaries feed into it from steep slopes on the sides of mountain. This tributary enters the main river at 90-degree angle causing trellis drainage pattern. This pattern resembles the grape vine spreading on trellis.

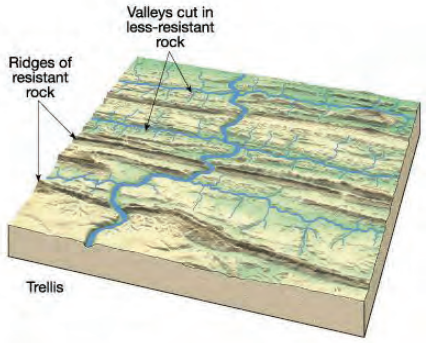

Figure 4.4: Trellis Pattern

iii) Radial Pattern

This type of pattern develops when streams flow in all directions from the center. It resembles the spokes of a cycle wheel, which radiate outward from the center point. This type of pattern is commonly found in isolated hills, elevated domes and volcanic cones.

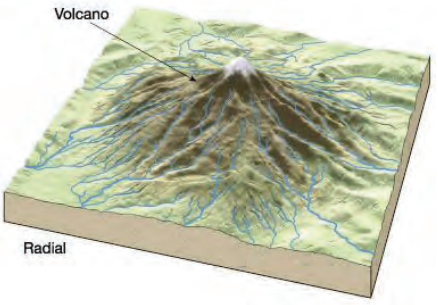

Figure 4.5: Radial Pattern

Learning Activity:

Study the figures carefully and identify the types of drainage pattern formed by rivers and answer the following questions:

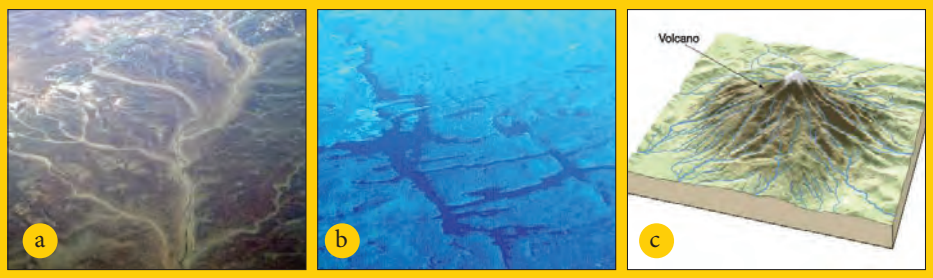

Figure 4.6: Drainage Pattern

i. Name the drainage pattern:
   a.
   b.
   c.

ii. Write the differences among these drainage patterns

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4.4 Drainage basin and major rivers of Bhutan

All the rivers in Bhutan originate from the high Himalayan Mountains. They flow south and drain into river Brahmaputra in India. There are five river systems in Bhutan:

a. The Amo Chhu
b. The Wang Chhu
c. The Puna Tsang Chhu
d. The Drangme Chhu
e. The Nyera Ama Chhu

Amo Chhu originates from a glacier in Chumbi valley in Tibet and enters Bhutan at the western foot of Masang Kyundu mountain in Haa. The Amo Chhu takes a south-easterly course to Phuentsholing and enters the Indian plains. Finally, it drains into the Brahmaputra in Bangladesh. The Amo Chhu is the fourth largest drainage basin.

Wang Chhu consists of three main tributaries: the Haa Chhu, Paa Chhu and Wang Chhu. These tributaries flow through the valleys of Haa, Paro and Thimphu in western Bhutan. Wang Chhu drains through deep narrow valleys and flows south to Chhukha before entering India. It ultimately merges with the main channel of the Brahmaputra river in Northern Bangladesh. This is the third largest drainage basin.

Puna Tsang Chhu is the second largest drainage basin. It has four tributaries: Pho Chhu, Mo Chhu, Dang Chhu and Daga Chhu. Pho Chhu has its source in Lunana region. Mo Chhu originates in Laya and Lingzhi region and flows through Gasa. Pho Chhu and Mo Chhu join near the Punakha Dzong to form Punatshang Chhu. It meanders along a wider valley towards Wangdue Phodrang and then drains through a narrow valley in Tsirang to India.

Drangme Chhu is the largest drainage basin. It has five main tributaries. The two western tributaries are Mangde Chhu and Bumthang Chhu. They start from the glacier of Gangri region in the north. While Mangde Chhu flows through a narrow valley in Kheng, Bumthang Chhu meanders through the wide valley of Chhhoekor.

The two eastern tributaries are Kurichhu and Kholong Chhu. One of the main tributaries of Kuri Chhu starts in Tibet behind the Lhodrak La. Kholong Chhu originates in the northern mountain glaciers of Yangtse. The other main tributary of Drangme Chhu comes from Merak in the east as

Know More

- Amo Chhu is known as Toorsa
- Wang Chhu is known as Raidak
- Puna Tsang Chhu is known as Sunkosh
- Drangme Chhu is known as Manas
- Nyera Ama Chhu is known as Badanadi

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Gamri Chhu. All tributaries join in the Kheng region to become the mighty Manas before entering India.

Nyera Ama Chhu is the fifth largest drainage basin. It originates in Merak in Trashigang and flows through Samdrup Jongkhar into India.

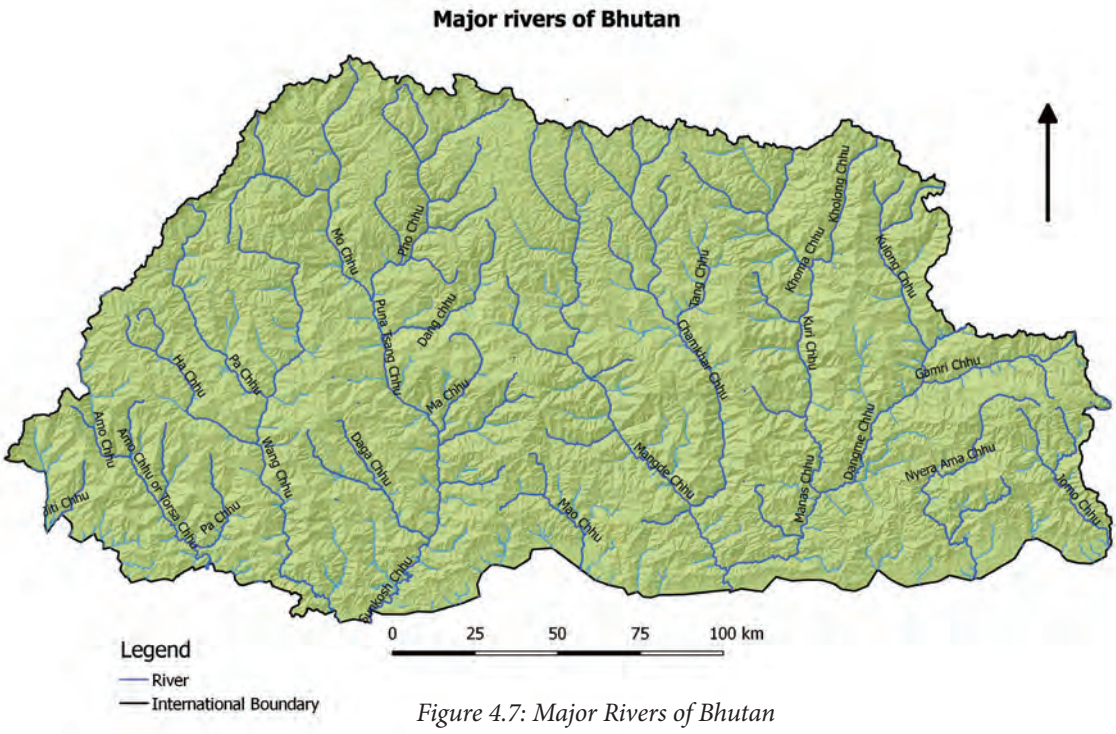

Figure 4.7: Major Rivers of Bhutan

Learning Activity:

Study Figure 4.7 and carry out following activities

a. Complete the following table.

Major river systems	Tributaries	Sources
Amo Chhu	----------	----------
Puna Tsang Chhu	----------	----------
Wang Chhu	----------	----------
Drangme Chhu	----------	----------
Nyera Ama Chhu	----------	----------

b. Why is Drangme Chhu considered the largest river basin?

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4.5 Importance of rivers

"Water is to us what oil is to the Arabs". Druk Gyalpo Jigme Singye Wangchuck.

Rivers are one of the most important resources of our country. Our main source of income is hydroelectricity which is produced from the force of running water. Bhutan being an agrarian country, rivers play an important role in agriculture. Besides, water from the rivers are used for domestic and industrial purposes. Thus, rivers need to be protected from excessive use and pollution.

Learning Activity:

Study Figure 4.8 and find out at least 10 words and fill in the following table giving a brief description for each word.

Sl No.	Words	Description

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

Figure 4.8: Word Search

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Test Yourself:

1. *Describe characteristics of rivers in Bhutan.*
2. *Differentiate between river system and drainage basin.*
3. *"Water is to us what oil is to Arab". Explain the statement.*
4. *Explain one of the drainage patterns with the help of an illustration.*
5. *Classify the rivers as per their importance and describe two most important river systems.*

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Chapter Five
Landforms

Learning Outcome(s):

- Explain the basic processes of land formation
- Describe different types of landforms

5.1 Introduction

The earth's surface has various natural features. Features such as mountains, valleys, plains and plateaus are called landforms. They are categorised into three orders on the basis of size. The first order landforms are continents and oceans. The second order landforms are mountains, plateaus and plains. The third order landforms include hills, valleys and deltas. These landforms are formed by internal and external forces. The study of landforms, their characteristics and processes helps to understand the immediate environment.

5.2 Basic Processes of Land formation

The formation of physical features on the surface of the earth is the result of different processes. These processes are the forces that combine to form the landforms. These forces are broadly categorised into internal and external. The internal forces are those movements inside the earth crust. These movements are convergent and divergent. The external processes operate on the surface of the earth. These processes include weathering, erosion and deposition.

i) External Processes

The features on the earth surface is gradually changed by the agents of external processes such as running water, glacier, wind, ground water and sea waves. The external processes are as follows:

a) Denudation

Denudation is an erosive process of breaking and removing of rocks from the surface of the earth and exposing the underlying rocks. It is the result of weathering, erosion and transportation.

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Know More

- Denudation: The term denudation has been derived from the Latin word 'denudare' which means laying- bare.

Figure 5.1: Denudation

b) Weathering

The process of decaying and breaking up of rocks under the influence of heat and pressure is known as weathering. The types of weathering are:

- **Physical Weathering**

The process of breaking down of rocks by physical processes is known as physical weathering. It is caused by effects of changing temperature on rock, leading the rock to break. This is more common in places where there are less plants and little soil such as in mountains and deserts.

Figure 5.2: Physical Weathering

- **Chemical Weathering**

Chemical weathering is the process of breaking down of rock due to chemical reactions. The rain water absorbs carbon dioxide from the atmosphere. Such rain water dissolves minerals from rocks like limestone, marble and gypsum causing the rock to break.

Figure 5.3: Chemical Weathering

- **Biological Weathering**

Biological weathering involves the action of plants and animals. Plant roots entering into the cracks in rocks result in breaking them. Burrowing animals are also agents of biological weathering. Human activities like mining and constructions also lead to weathering.

Figure 5.4: Biological Weathering

c) Erosion

The process of removal and transportation of weathered materials from one place to another is known as erosion. Running water, rain, wind and moving ice are some agents of erosion.

Figure 5.5: Erosion

d) Deposition

The materials eroded by different agents are transported and deposited in different areas. It is caused by running water, wind, glacier, sea wave and ground water. Deposition usually occurs in low lying areas and leads to the formation of different landforms.

Figure 5.6: Deposition

Learning Activity:

1. Identify a suitable place and describe the process of land formation.

5.3 Types of Landforms

Different processes lead to formation of different landforms. The landforms play a significant role in shaping the structure of the earth. The common landforms are:

i) Mountains

Mountains are the raised part of the earth with the height of at least 900 metres above the sea-level. They are usually steeper than hills and have pointed peaks. Mountains are formed by processes such as folding, faulting and volcanic eruptions.

They are classified as fold mountains, block mountains and volcanic mountains based on their formation. The mountains of Bhutan are examples of fold mountains.

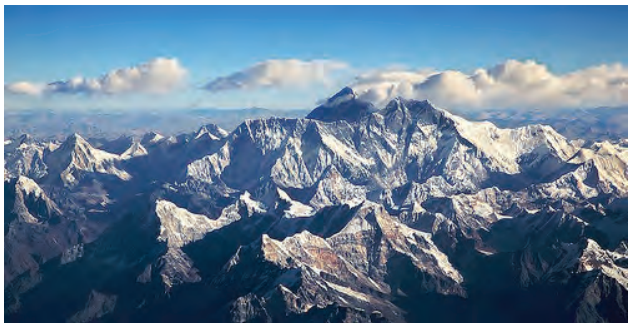

Figure 5.7: Mountains

Know More

- Folding: The bending of horizontal layers of rocks.
- Faulting: Development of cracks and fractures in the rock layers due to intense folding.

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ii) Plateaus

A plateau is an elevated land as compared to its surrounding areas. It usually consists of relatively flat top with one or more steep slopes. It is often known as table land. Plateaus are classified as intermontane, piedmont and continental plateaus based on their geographical location. They are formed by processes such as rising of volcanic magma, and erosion by water and glaciers.

Figure 5.8: Plateau

Know More

- Intermontane plateau: Found in between two mountains.
- Piedmont plateau: Found at the base of the mountain surrounded by ocean or plain.
- Continental plateau: Surrounded by sea or plain from all sides.

iii) Plains

Plain is a relatively flat low lying land surface with the relief less than 150 metres. There is least difference between highest and lowest points. They are formed by, upliftment, erosional and depositional processes. Plains are classified as structural, erosional and depositional plains based on the formation.

Figure 5.9: Plain

Learning Activity:

Complete figure 5.10 with at least one similarity between each.

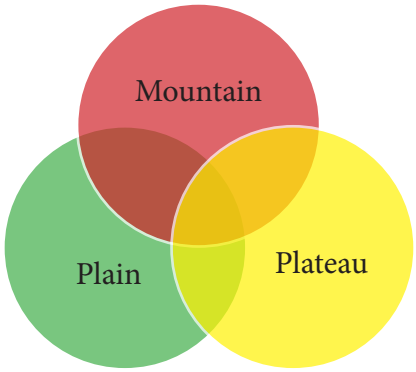

Figure 5.10: Landforms

Test Yourself:

Match column A with column B.

Column A		Column B
Plant roots enter the crack of the rocks and breaks them		Erosion
Rain water can dissolve minerals such as gypsum and limestone causing them to break		Deposition
Changing temperature can cause rocks to break		Biological weathering
The process of removal and transportation of weathered materials from one place to another		Chemical weathering
It occurs in low lying areas and leads to the formation of different landforms		Physical Weathering

1. *Samtse dzongkhag lies at an elevation ranging from 300 – 800 meters above mean sea-level and temperature varies from 15 to 30 degree Celsius. The Dzongkhag receives an annual rainfall of 1500 – 4000 mm.*

   Gasa dzongkhag lies at an altitude of 1500 – 4500 meters above sea level. The average temperature is 10.3 degree Celsius and rainfall is 1093 mm.

   Qi. Identify the landform of the above two dzongkhags.
   Qii. If you were to settle in one of the dzongkhags mentioned above, which one would you choose and why?

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2. *After a heavy rainfall, we see deposition of debris, twigs and sand near banks of rivers and streams. How does a running water act as an agent of denudation?*

4. Who am I?

i. *I have many small branches and all these branches join the main river at 90 degree angle.*
ii. *I resemble an octopus and am mostly found in the hilly areas. I originate from a main source and flow in different direction.*
iii. *I look like a tree. My tributaries are the branches of the trees.*
iv. *I have the second largest drainage basin and have four tributaries.*
v. *My origin is in Merak and I flow through Samdrup Jongkhar into India.*

1. *Explain how would decrease in the volume of rivers affect the following?*
   a) *Farmers*
   b) *Generation of hydroelectricity*
   c) *Bhutan's economy*

2. *If you receive information on the outburst of a lake in Lunana, which dzongkhags would you inform first for the people settled along river valleys to move out? Why?*

Chapter Six
Rocks and Minerals

Learning Outcome(s):

- Explain the processes of rock formation
- Describe different types of rocks
- Discuss minerals and types

6.1 Introduction

The history of Earth is understood through the study of rocks. A rock is a naturally occurring the solid part of the earth's crust. The materials of the earth's crust or lithosphere are generally called as rocks. The word lithosphere, in fact means rock sphere as the literal meaning of 'lithos' is rock. Rocks are composed of one or more minerals. Minerals are substances that are formed naturally in the earth. It is usually solid, inorganic and in crystal form.

6.2 Types of rocks

Rocks are found in different shapes, sizes, colours and textures. Based on the formation, rocks are classified broadly as:

i) Igneous rock

The most common rock found on the earth is igneous rock and considered as primary rock. Igneous rocks are hard, compact and free of fossils. They are formed by cooling and solidification of molten materials that come from interior of the earth. Based on place of occurrence, igneous rocks are classified as:

a) Extrusive igneous rock

During volcanic eruption, magma comes from the interior of the earth. Magma reaches the earth surface and cools quickly and solidifies to form rocks. Such rocks are known as extrusive igneous rock. They have fine texture. Basalt is an example of extrusive igneous rock.

Figure 6.1 Basalt

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b) Intrusive igneous rock

The magma that cools and solidifies within the earth's crust forms the Intrusive igneous rock. They have coarse texture due to slow cooling. Granite is an example of such rock.

Figure 6.2 Granite

ii) Sedimentary Rock

The materials deposited by rivers, winds, glaciers and sea waves form sedimentary rocks. The formation of sedimentary rock is a slow process which involves sedimentation and cementation in layers over a period of time. Sedimentary rocks are relatively soft and porous. They often contain fossils. Based on their mode of formation sedimentary rocks are classified as:

a) Mechanically formed sedimentary rock.

This type of rock is formed from the particles of other rocks broken due to weathering. Sandstone is an example of mechanically formed sedimentary rock.

Figure 6.3 Sand stone

b) Chemically formed sedimentary rock.

The dissolved material precipitates and solidifies as a result of evaporation and leads to formation of rock. Gypsum is one of the examples of chemically formed sedimentary rock.

Figure 6.4: Gypsum

c) Organically formed sedimentary rocks

This type of rock is formed from the remains of dead plants and animals through the process of sedimentation and cementation. Hard parts of animals such as bones and shells get cemented together over a long period of time to form rock. Usually the bones and shells form calcite or other mineral that eventually form limestone. Fossils are generally found in such rocks.

Figure 6.5 Limestone

iii) Metamorphic rocks

Metamorphic rocks are formed as a result of transformation of original rocks due to heat and pressure. There is a change in physical (colour, hardness and texture) or chemical composition (mineral composition). These types of rocks are very hard and closely banded with interlocking crystals. Slate and marble are examples of such rock.

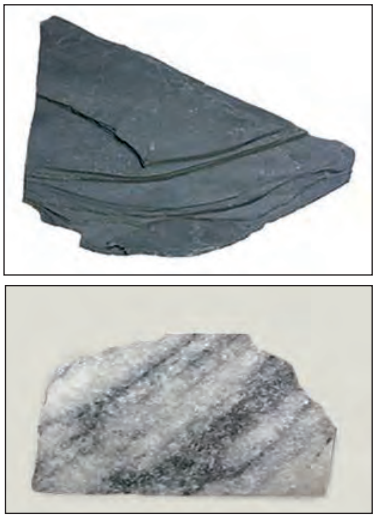

Figure: 6.6 Slate and Marble

Know More

- Primary rocks: Found maximum and first rock to form.
- Magma: Hot molten material found below earth's surface.
- Banded: Joined together.
- Precipitates: Substances becoming solid and separates from liquid.
- Fossils fuels: Coal, crude oil and natural gas
- Corrosion: Eroding of rocks by chemical solution.
- Cementation: Hardening and joining of sediments deposited.

Learning Activity:

Go around the school campus, collect two different rock samples and identify them (Igneous, sedimentary or metamorphic). Describe two visible characteristics.

Identify the rocks given in figure: 6.7.
Based on their characteristic features, name and tick correctly (in the boxes given below). Last column is an example.

			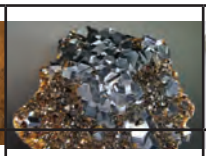	
Type of Rock				Sedimentary
Soft (put tick)				✓
Hard (put tick)				
Layered (put tick)				✓
Presence of fossils (put tick)				✓
Interlocking of crystal (put tick)				

Figure 6.7: Identification of Rocks

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6. 3 Minerals

Rocks are made of minute naturally occurring substances called mineral. Some are rare and others are commonly found in different parts of the earth. The most common mineral on the earth is silicon.

Minerals are identified based on the following characteristics:

- naturally occurring
- inorganic
- solid
- definite chemical composition
- ordered internal structure

Mineral resources are classified as metallic and non-metallic based on metal content.

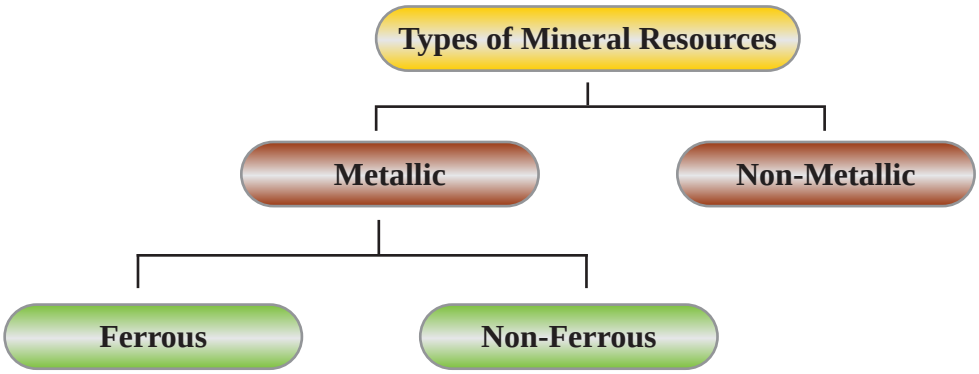

Figure 6.8: Types of Minerals

i) Metallic mineral resources

Metallic minerals are hard and shiny. They are good conductor of heat and electricity. These types of minerals are mostly found in igneous rocks. Gold, silver, copper, iron, nickel, tin, lead, zinc and aluminium are some examples. Metallic minerals are further classified as:

a) Ferrous metallic minerals

Metallic minerals contain iron. They are magnetic and are less resistant to corrosion. Iron ore and Manganese are some examples of ferrous metallic minerals.

Know More

- Corrosion: It is disintegration or decaying of metals. Rust is an example.

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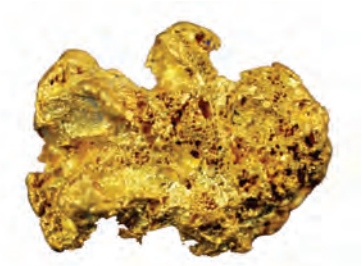
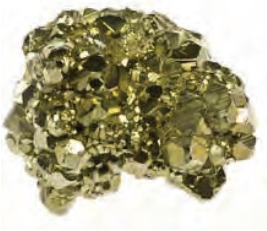
b) Non-ferrous metallic minerals

These minerals do not contain iron. They are not magnetic and more resistant to corrosion. Gold, silver, copper and lead are examples of non-ferrous metallic minerals.



Gold

Copper



Pyrite

Figure 6.9: Non-ferrous metallic minerals

ii) Non-metallic mineral resources

Non-metallic minerals have less or no metal content and are not shiny. These minerals do not undergo chemical change and are mostly found in sedimentary rocks. Carbon, precious stones, fuels, bitumen are some examples of non-metallic mineral.

Figure 6.10: Gravels

Learning Activity:

Identify the minerals based on the riddle: "What am I?" given in the Box 6.1

What am I?

1. I am found in Samdrup Jongkhar, I am black and give you heat energy……..
2. I am smaller than rock but bigger than sand, people use me for road construction……
3. I am found extensively in Pema Gatshel, I am part of cement and I create plaster of Paris…….
4. I have my home in Gidakom (Thimphu), my parents are metamorphic rock and I am used for construction…..……
5. My name starts with letter G, I can write your name too and my home is in Paro……

Box 6.1: What am I?

6.4 Minerals of Bhutan

There are about 14 types of minerals found in Bhutan. Non-metallic minerals like limestone, dolomite, gypsum, coal and marble are mined. Metallic minerals like copper, lead, zinc and tungsten are not mined due to limited deposit. Coal, gypsum and dolomite are some of the minerals exported to neighbouring countries.

Sl.No.	Minerals	Mining area
1.	Coal	Samdrup Choling, Samdrup Jongkhar
2.	Gypsum	Khothagpa, Pema Gatshel
3.	Dolomite	Phuntsho Pelri, Samtse
4.	Limestone	Phuntsholing (Howree Khola) and Samtse (Suk Raythi)
5.	Marble	Gidakom, Thimphu.
6.	Quartzite	Samtse (Tintaley)
7.	Graphite	Paro

Table 3.1: Minerals of Bhutan

Learning Activity:

On an outline map of Bhutan given in Figure 6.11, locate and name the places where following minerals are found:

1. Coal ----------
2. Dolomite ----------
3. Quartzite ----------
4. Marble ----------
5. Gypsum ----------
6. Limestone ----------

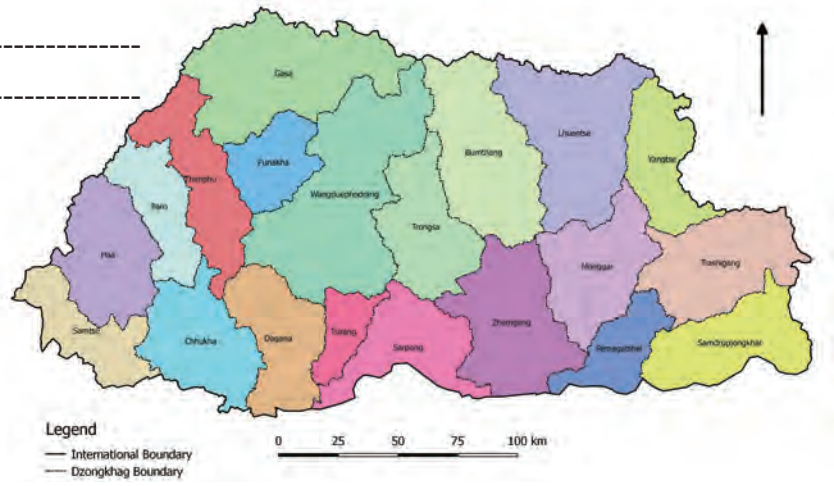


Figure 6.11: Map of Bhutan

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6.5 Importance of rocks and minerals

Rocks were used by people from ancient times. The minerals in rocks have been essential to human civilisation. Rocks and minerals are used for different purposes. People use different rocks to make buildings and roads. Rocks that contain minerals such as calcium and silicate are source of fertile soil for cultivation. Some industries use rocks as raw materials to produce finished products. Sedimentary rocks are a source of fossil fuel. Precious and semi-precious metal that come from rocks are used as jewellery and ornaments.

Test Yourself:

1. *State three differences between extrusive and intrusive igneous rocks.*
2. *Why are fossils never found in igneous rocks?*
3. *One type of rock is also named as stratified rock. Name the rock and give reasons.*
4. *How are rocks and minerals useful for the construction of houses?*
5. *"Sedimentary rocks are formed from other rocks." Explain.*
6. *Choose the most suitable answer.*

Marble is an example of ……

A metamorphic rock.
B extrusive igneous rock.
C sedimentary rock.
D intrusive igneous rock.

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Chapter Seven
Atmosphere

Learning Outcome(s):

- Explain the structure of atmosphere and its significance

7. 1 Introduction

Atmosphere is one of the four spheres of the earth. It is composed of gases, particles and aerosols that surround the earth. Atmosphere extends to approximately 10,000 kilometres (Zell, 2017) above the earth surface. It is held to the earth by gravity. Air is the most important components of atmosphere which is colourless and odourless.

Know More

- Four spheres: Lithosphere, hydrosphere, atmosphere and biosphere.
- Aerosols: Fogs, dust, steam, smokes and haze.

7. 2 Structure

Atmosphere consists of layers with varying thickness. It is divided broadly into four layers based on difference in temperature, pressure, and density. Each layer has its own characteristics.

i) Troposphere

This is the first layer of the atmosphere from the earth surface. It extends up to 14.5 kilometres (Zell, 2017). Troposphere contains 75% of the gases in the atmosphere. Nearly all weather phenomena take place in this layer and it is important for living beings. In this layer, temperature decreases with increase in height. On an average, temperature decreases by about 6.5^{o}C (Degree Celsius) per kilometre. This layer extends up to Tropopause.

ii) Stratosphere

The second layer extends from 14.5 to 50 kilometres. In the lower part of this layer the temperature remains fairly same, while in the upper part temperature increases. This increase in temperature is due to the presence of ozone layer that absorbs ultraviolet rays.

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This layer is free from clouds and associated weather phenomena and provides ideal conditions for flying jets. Stratosphere extends up to Stratopause.

iii) Mesosphere

Mesosphere is the third layer that extends from 50 to 85 kilometres. In this layer the temperature decreases to about -100° C. This is the coldest layer of the atmosphere and protects the earth from meteors. Mesosphere extends up to Mesopause.

iv) Thermosphere

This layer lies above the mesosphere. It extends beyond 85 kilometres. Temperature often increases beyond 2000°C in this layer because gas molecules in this layer absorb the X Rays and the short wave ultraviolet radiation of the sun. This results in the breakup of gas molecules into positively and negatively charged particles known as ion. Radio waves transmitted from the earth are reflected back to the earth by these ions. Thus this layer is known as ionosphere. Thermosphere also protects us from falling meteors.

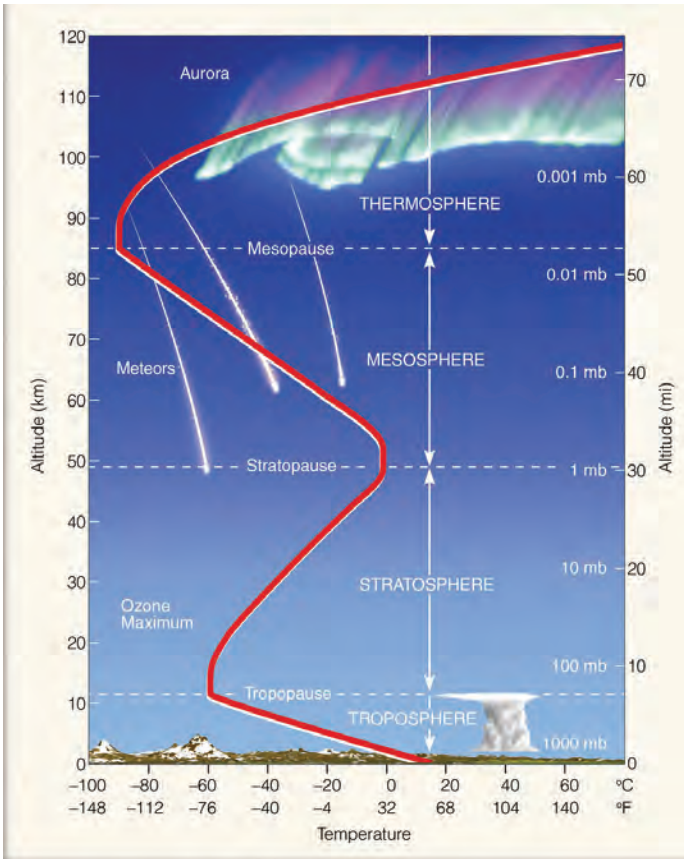

Figure 7.1: Layers of Atmosphere

Learning Activity:

1. Study figure 7.2 and match the inner box with the outer box. It is possible to have more than one inner box matching with outer box.
2. In group, describe the relationship between the two boxes.

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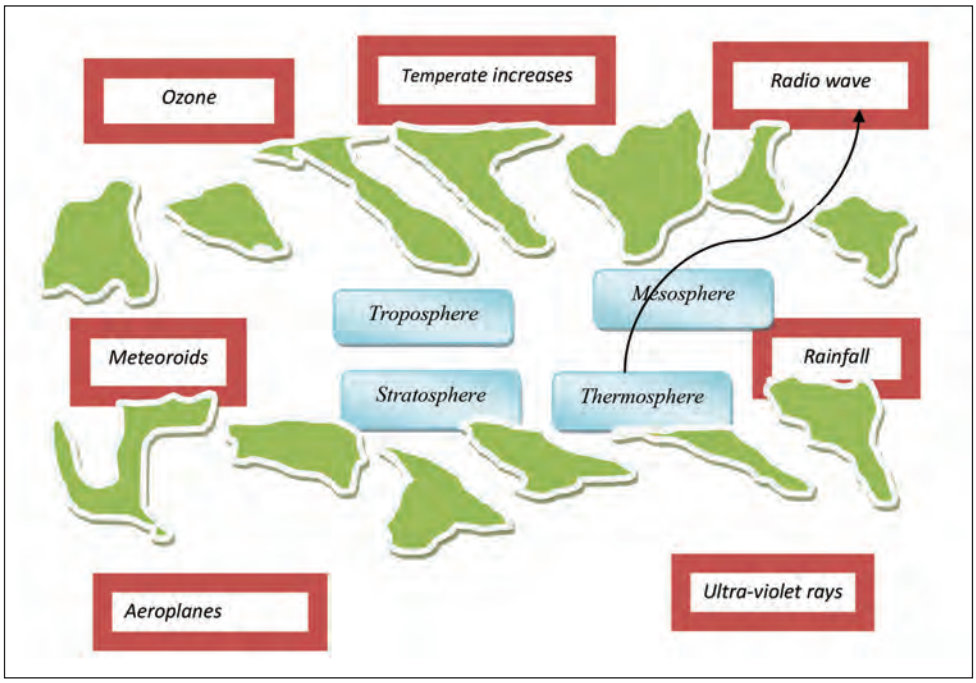

Figure 7.2: Structure of Atmosphere

7.3 Significance of Atmosphere

Earth is the only planet that supports life due to the presence of atmosphere. It contains oxygen, which is vital for breathing and carbon dioxide, which is useful for photosynthesis. Ozone in the atmosphere protects us from harmful rays of the sun. It helps in balancing the temperature of the earth. The hydrological process such as evaporation, condensation and precipitation takes place in the atmosphere. It also protects us from falling meteors.

Learning Activity:

1. Why do mountaineers carry oxygen while climbing mountains?

Test Yourself:

1. *Why stratosphere is important for life on earth?*
2. *Distinguish between troposphere and stratosphere.*
3. *Name the layer that has the coldest temperature of the atmosphere.*
4. *How does ionosphere help in reflecting radio waves?*
5. *What type of conditions would prevail on earth if there is no atmosphere?*

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Chapter Eight
Weather and Climate

Learning Outcome(s):

- Distinguish between weather and climate
- Demonstrate the use of weather instruments

8.1 Introduction

Weather and climate is important for life on earth. The day to day condition of atmosphere is known as weather, while climate is the average weather conditions for a long period of time. Temperature, rainfall, wind, humidity are important elements of weather and climate.

8.2 Difference between Weather and Climate

Weather and climate is differentiated based on the following characteristics:

Weather	Climate
• It is day-to-day state of atmospheric condition. • It changes frequently. • It affects small area. • It is determined by change in any one of the weather elements.	• It is the average weather conditions. • It does not change frequently. • It affects large area. • It is determined by the collective change of weather elements.

Learning Activity:

Write down the similarities of weather and climate.

8.3 Climate of Bhutan

Bhutan is a mountainous country with large difference in altitude. This difference in altitude and seasonal monsoon leads to variation in climatic zones. Climatic zones range from subtropical monsoon in the south to alpine with permanent snow in the north.

Climatic zones in Bhutan are broadly categorized as:

i) Sub-tropical Monsoon Climate

This zone extends from about 200 metres to 2000 metres above sea level. It stretches into the lower valleys of Inner Himalayas like fingers of a palm. The south-west monsoon winds blow from the tropical region in the Indian Ocean and the Bay of Bengal. This wind causes heavy rainfall from June to September making the foothills wet and humid. The total annual rainfall is usually above 2000 millimetres. The mean monthly temperature ranges from 15°C in winter to 30°C in summer. Rainfall and temperature vary from valley to valley. Frost and snow are hardly seen in this zone.

Most parts of Samtse, Chhukha, Sarpang and Samdrup Jongkhar in the foothills and the lower valleys of Wangdue Phodrang, Punakha, Trongsa, Trashigang, Mongar and Zhemgang dzongkhags lie in this zone.

Figure 8.1: Sub-tropical Monsoon

ii) The Temperate Climate

The temperate climatic zone lies between 2000 metres and 3000 metres. Winters are cold with mean temperature ranging from about 5°C to 15°C. Summers are warm with temperatures ranging from 15°C to 30°C.

The total annual rainfall varies from 1500 millimetres to 2000 millimetres. It is caused by south-west monsoon winds from June to September.

Thimphu, Paro, higher parts of Wangdue Phodrang, Trongsa, Mongar, Lhuentse and Trashigang and lower parts of Bumthang dzongkhags are in temperate climatic zone.

Figure 8.2: Bumthang, a place in Temperate Climate

iii) Sub-Alpine Climate

This zone lies between 3000 metres and 4000 metres above sea level and is marked by short summers and long winters. Mist, fog, cold winds and light rain are common during summer and snowfall and frost in winter. It is extremely cold in winter, so people and animals migrate to lower altitudes.

Figure 8.3: Sub-Alpine Climate

The mean annual temperature is around 8°C and the total annual rainfall varies from 1000 millimetres to 1500 millimetres.

Laya, Lingzhi, Lunana, Gogona, Busa Sephu, Dur, Ura, Merak and Sakteng are places located in this zone.

iv) The Alpine Climate

This zone is above 4000 metres. Alpine refers to vegetation or climatic conditions found on high mountain peaks. The permanent snow line starts at about 4800 metres above sea level. Beyond this line, the snow never melts. The mean temperature in this zone is 5.5°C and rainfall is less than 650 millimetres.

Snow laden wind called blizzards and occasional avalanches occur beyond the snowline. It is extremely cold even during summer because of its high elevation.

High mountain peaks like Jowo Durshing, Jumo Lhari, Jiwuchu Drakye, Masagang and Gangkar Puensum are in this climatic zone.

Figure 8.4:The Alpine Climate

Learning Activity:

1. Complete the table in ascending order (altitude)
2. Locate four major Climatic zones of Bhutan using Figure 8.5: Administrative Map of Bhutan.

Table 8.1: Climatic Zones

Sl.No.	Climatic zones	Places	Temperature	Rainfall
1.				
2.				
3.				
4.				

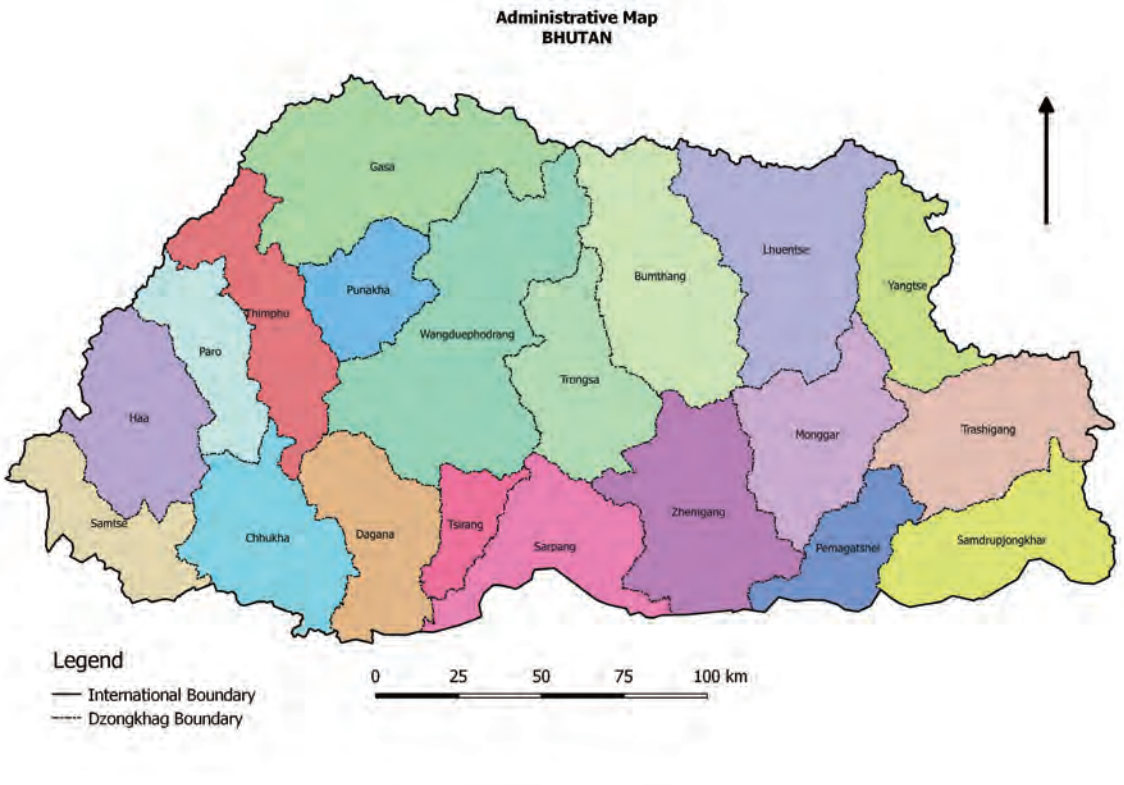

Figure 8.5: Administrative map

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8.4 Weather instruments and their uses

The study of earth's atmosphere and weather is called meteorology. It is becoming increasingly important for people working in the transport sector as well as for fishermen and farmers. Weather stations are built to collect data in order to forecast weather conditions. Following are some of the instruments used in a weather station:

Figure 8.6: Maximum and minimum thermometer.

i) Thermometer

Thermometer is an instrument that measures atmospheric temperature. When the temperature increases, it causes mercury in the thermometer to expand. Conversely, when the air gets colder, the mercury contract and travels back down. Temperature is measured in degrees of Fahrenheit, Celsius and Kelvin.

Figure 8.7: Barometer

ii) Barometer

Barometer is an instrument used to measure atmospheric pressure. The three types of barometer are aneroid, water and mercury. Aneroid barometer consists of a thin evacuated metal box, which alters in shape according to the pressure of atmosphere. This alteration is magnified by a mechanical arrangement of levers, which is indicated on a circular scale by means of movable pointers.

iii) Wind vane

Wind vane is also known as weather vane. It is used to find wind direction. A wind vane spins and points in the direction from which the wind is blowing. For example, if arrow points towards east, it means the wind is blowing from the east.

Figure 8.8: Wind Vane

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iv) Anemometer

Anemometer is a common weather instrument. It is used to measure speed of the wind. The anemometer has cups that spin in the wind to measure wind speed. The speed of the wind is measured by the number of times the cup turns in a fixed period. The number of spins is recorded in the small box attached at the base.

Figure 8.9: Anemometer

Figure 8.10: Rain Gauge

v) Rain Gauge

Rain gauge is an instrument used to measure rainfall. It consists of a funnel fitted into a glass vessel which holds the rain water. Rain gauge should be placed in an open area to avoid obstruction of the rain by trees and buildings. It should be kept slightly above the ground to prevent the splash drops from entering the funnel. Unit of measurement is millimetre or centimetre.

Learning Activity:

Look for weather instrument in science laboratory and demonstrate the use of these weather instruments.

Test yourself:

1. *What do you understand by the term weather? Mention four elements of weather.*
2. *Differentiate weather from climate.*
3. *Compare sub-tropical monsoon climate and sup-alpine climate with reference to altitude, rainfall and temperature.*
4. *What type of climate is found in the areas of high mountains peaks of our country?*
5. *Write down the uses of following weather instruments:*
6. *Thermometer*
7. *Anemometer*
8. *Rain gauge*
9. *Barometer*
10. *Wind vane*
11. *Hygrometer*

Chapter Nine
Natural Vegetation

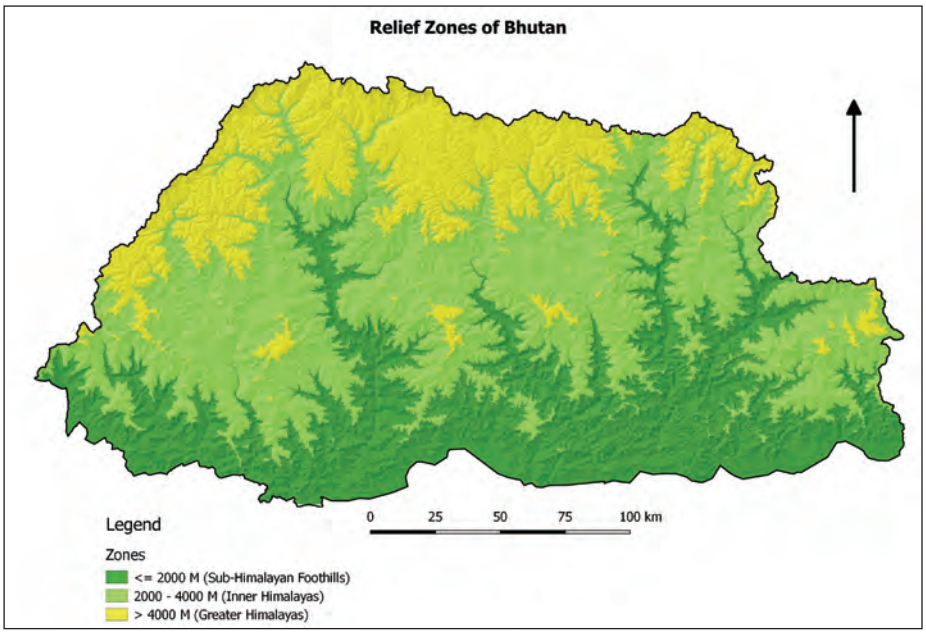
Learning Outcome(s):

- Explain natural vegetation
- Describe the types of forest in Bhutan

9.1 Introduction

One of the greatest gifts of nature to all forms of life on earth is natural vegetation. It supports life and provides resources for human activities. Natural vegetation refers to plants that grow naturally in a geographical region. Forest, Grassland and Desert are the three major types of natural vegetation. The growth of natural vegetation is affected by relief and climate and varies from place to place.

Relief refers to different landforms with their varying altitude. Vegetation varies with relief, nature of the land and soil. In Bhutan, the land rises from about 200 metres in the south to about 7000 metres in the north. The relief of Bhutan is divided into three zones. These are Sub-Himalayan Foothills, Inner Himalayas and Greater Himalayas.



Map 9.1: Relief Zones of Bhutan

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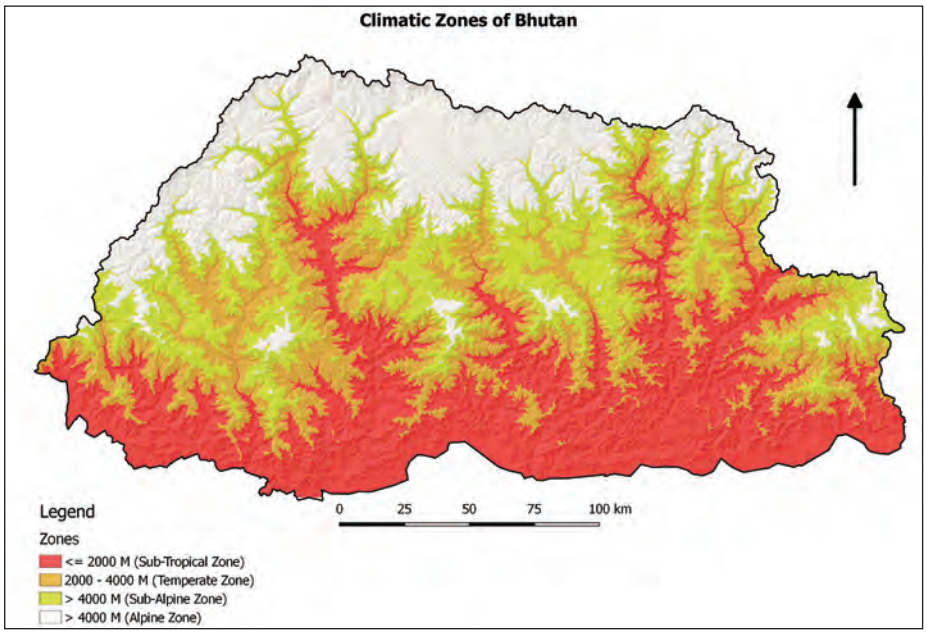
Climatic conditions influence the growth of vegetation. Temperature affects the character and extent of vegetation while rainfall and sunlight determines the growth of vegetation. Bhutan is divided into four climatic zones based on altitude and rainfall. Sub-Tropical, Temperate, Sub-Alpine and Alpine are the different climatic zones.



Map 9.2: Climatic Zones of Bhutan

9.2 Types of Natural Vegetation in Bhutan

One of Bhutan's significant natural resources is its rich natural vegetation. Bhutan's location in the eastern Himalayas with its varying altitude and climate supports diverse and rich forest growth. Bhutan's forest cover is above 60% of its total area. There are four major types of forest in Bhutan.

i) Sub-Tropical Forest

Sub-Tropical Forest lies in the Southern foothills ranging from 200 metres to 2000 metres above sea level. The region receives more than 3000 millimeter of rainfall in a year. Average temperature in winter is 15°C and in summer it is 30°C. Evergreen and warm broadleaved trees are found here. Golden Langur, Rhinoceros, Elephant, Water Buffalo and Swamp Deer are dominant wildlife.

ii) Cool Broadleaved Forest

Cool Broadleaved Forest lies within the altitude range of 2000 metres to 3000 metres above sea level. It receives more than 2000 millimetres of rainfall in a year. Average temperature is 11°C in winter and 24°C in summer. Mixture of deciduous and evergreen trees are found in this forest. Dense shrubs, climbers and parasitic plants are common in this forest. Animals like, Deer, Leopard, Wild Boar, Squirrel, Bear, Monkey and Antelope are found.

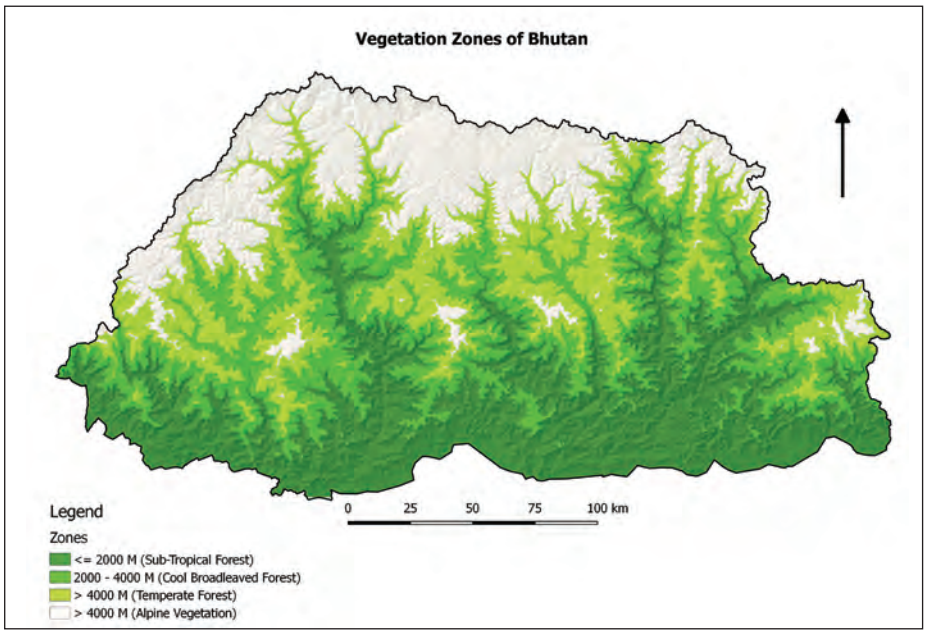
iii) Temperate Forest

Temperate Forest lies in the Inner Himalayas ranging from 3000 metres to 3800 metres above sea level. It receives 1500 millimetres to 2000 millimetres rainfall in a year. Average temperature in winter is 5°C and 20°C in summer. Mixed conifer like Blue Pine, Fir, Spruce, Hemlock and Larch are dominant trees. Takin and Musk Deer are found in this forest.

iv) Alpine Vegetation

Alpine Vegetation lies in the Greater Himalayas above 4000 metres. It receives rainfall below 750 millimetres in a year. The average temperature in summer is about 10°C and

remains below freezing point in winter. Alpine vegetation is marked by short bushes and scrubs. Grassland and meadow is common feature of this vegetation. It is also rich in medicinal plants and herbs. Snow Leopard, Blue Sheep, Bengal Tiger, Red Panda and Takin are found here.



Map 9.3: Types of Forest

Know More

1. According to the constitution of Bhutan, 60% of its total land must be under forest cover for all times to come.
2. There are 300 species of medicinal plants and 46 species of rhododendrons in Bhutan.
3. There are about 415 resident bird species and 16 of these are endangered.
4. 27 species of globally threatened mammals are found in Bhutan.
5. 11 species of cat family are found in Bhutan.
6. Tree line is found above 3800 metres.
7. Snow line is found above 5000 metres.

Learning Activity:

1. List names (local names) of plants and trees found in your locality.
2. Find out the names of plants and trees found in different regions and share it to the class.

9.3 Importance of Forest

Forest play a vital role in the ecosystem as it supports biosphere in various ways. It helps in maintaining water cycle, prevents soil erosion which preserves soil fertility. Thus, it helps to maintain ecological balance.

Forest provides resources for human survival. Population growth and development activities like construction of houses, roads and bridges causes degradation of forest. Therefore, it is important to manage forest for now and in the future.

Test Yourself:

1. *On an outline map of Bhutan, shade the vegetation zones.*
2. *Rainfall and temperature are important factors affecting vegetation. Which factor do you think would have affected the most? Why?*
3. *In which vegetation zone does your area fall? Why?*
4. *How do people use forest resources in your locality?*
5. *People are the biggest threat to forest. How would you save forest as a responsible citizen?*

Chapter Ten
Population

Learning Outcome(s):

- Explain human population
- Explain death rate, birth rate and natural change
- Draw a population density map of a given country/region

10.1 Introduction

What comes to your mind when you hear the word population? You are part of a population in your community. The school you go to has a population. The population of the school consists of you, your friends, teachers and other staff members.

The word population comes from the Latin word populous which means “people”. It refers to a group of people living in a particular area, such as a village, town, country, continent or the world. In other words, population is the total number of people living in a particular place and for a particular period of time. Population studies include some aspects like size, composition and change because these aspects differ from place to place and from time to time.

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10.2 Population Change

Population change is the difference in the number of people living in a place over a given period of time. Population either increases or decreases depending on the birth rate, death rate and migration. If the birth rate is higher than death rate, the population will increase. On other hand, population will decrease if the death rate is higher than the birth rate. The change in birth rate and death rate causes population to change.

Know More

Migration: It is the movement of people from one place to another.

Example
The population of a school in 2005 was 500 and in 2006 it was 510. So, the population change of the school is 10. (510 – 500 = 10).

Learning Activity:

Refer Population & Housing Census of Bhutan - National Statistics and find the change in population for the following Dzongkhags:

Dzongkhag	Population (2005)	Population (2017)	Population Change
Thimphu			
Trashigang			
Sarpang			
Trongsa			

i) Birth Rate

Birth rate is the total number of live births in a population of a thousand in a year. The number of live birth either increases or decreases due to factors such as medical facilities and literacy level of the population. It is calculated as:

Know More

Live birth is a birth at which a child is born alive.

$$\text{Birth rate} = \frac{\text{Number of live babies born in a year}}{\text{Total population}} \times 1000$$

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Example: *If there were 30 live born babies in a population of 5000 people, what would be the birth rate?*

Solution:

$$\text{Birth rate} = \frac{\text{Number of live babies born in a year}}{\text{Total population}} \times 1000$$

$$\text{Birth rate} = \frac{30}{5000} \times 1000$$

$$= 6 \text{ live births for every } 1000 \text{ population}$$

Learning Activity:

What would be the birth rate, if 40 live babies are born in a population of 10000?

ii) Death Rate

Death rate is the number of deaths in a population of a thousand in a year. It is affected by factors like disease, nutrition and lifestyle. Accordingly, the death rate of a place changes over time. It is calculated as:

$$\text{Death rate} = \frac{\text{Number of deaths in a year}}{\text{Total population}} \times 1000$$

Example: *If there were 50 deaths in a population of 5000, what would be the death rate?*

Solution:

$$\text{Death rate} = \frac{\text{Number of deaths in a year}}{\text{Total population}} \times 1000$$

$$\text{Death rate} = \frac{50}{5000} \times 1000$$

$$\text{Death rate} = 10 \text{ deaths for every } 1000 \text{ population}$$

Learning Activity:

What would be the death rate, if 20 people have died in a population of 7000?

iii) Natural Change in Population

The natural change in population is the difference between the birth rate and death rate of a place. This change leads to increase or decrease in population, based on how many people have been born or died, excluding migration.

Birth Rate – Death Rate = Natural Change

Example: *Birth rate of a place is 36 and death rate is 24. What will be the natural change of population?*

Solution:
Natural Change = Birth Rate – Death Rate
Natural Change = 36 – 24
= 12

10.3 Distribution of Population

The world population is unevenly distributed. In some areas there are more people while in other areas there are less people. The spread of people in a given area is known as population distribution. The population distribution changes continuously over time and area. This change is caused by climate, soil, resources and landforms.

In the population map of Bhutan, you will see some parts are densely populated, while other parts are moderately and sparsely populated.

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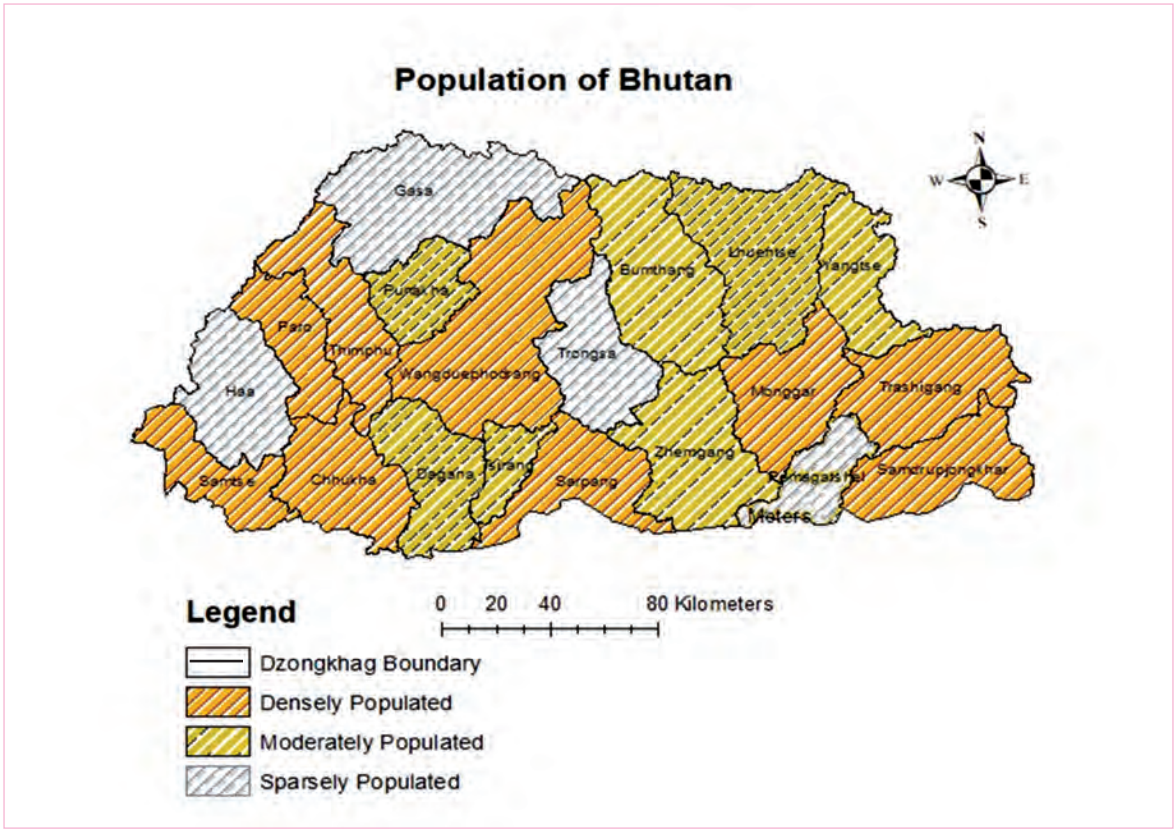


Figure 10.1: Distribution of population in Bhutan, 2005

i) Densely Populated

Places which are densely populated have many people. As shown in the map the most populated dzongkhag is Thimphu followed by Chhukha and Samtse. This is because the dzongkhags have economic opportunities like employment, fertile soil, better roads, communication and industries.

ii) Moderately Populated

The population is neither too high nor too low in moderately populated places. The soil is fertile, climate is favourable and resources are available. Some of the moderately populated dzongkhags are Wangdue Phodrang, Trashigang, Paro and Mongar.

iii) Sparsely Populated

In sparsely populated places, there are less people as the climate is too cold or too hot, resources are limited and it is usually located in steep terrain. Gasa, Haa and Pema Gatshel are the sparsely populated dzongkhags in the country.

Test yourself:

1. Write the factors affecting population distribution in column B.

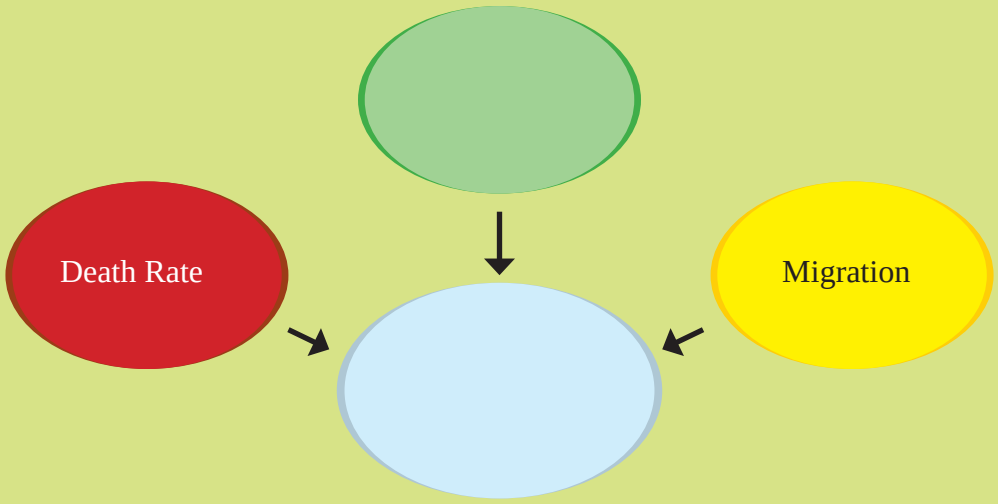
Column A	Column B
i. Sparsely populated	a.
ii. Densely populated	b.
iii. Moderately populated	c.

2. Study the population map of Bhutan and complete the activities:

i. Arrange the dzongkhags in ascending order as per size of population in the table:

Sl.No.	Dzongkhag	Size of the population
1.		

4. Complete the diagram:



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Chapter Eleven
Settlement

Learning Outcome(s):

- Describe the types of settlement
- Explain the patterns of settlement

11.1 Introduction

Shelter is a basic need of life. Humans have built houses and developed settlements to protect themselves against heat, cold, rain and wild animals. Settlements usually develop in areas where there is water, fertile soil, favourable climate and economic opportunities. The size and pattern of a settlement differs from one place to another and changes over time.

Settlement is a place where people live. It may be as small as a single house in a remote area or as large as a town. A settlement may be permanent or temporary. A temporary settlement is a place where people live for a short period of time. This type of settlement may become a permanent settlement over time.

Know More

Economic opportunities are those conditions that attract people like employment, transport and communication.

Learning Activity:

In the olden days, the location of human settlement was strongly influenced by natural environment. Discuss in groups and list down some reasons.

11.2 Types of Settlement

A settlement may be small and sparsely spaced or large and closely spaced. It is broadly classified as rural and urban settlement based on size and function.

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Figure 11.1: A Rural Settlement in Bhutan

Figure 11.2: An Urban Settlement in Bhutan

i) Rural Settlement

Rural settlement is a place where most of the people are engaged in agriculture, forestry and mining. Rural settlements generally have small size population and may have a few modern facilities. Most of the people in Bhutan live in rural areas. According to the Bhutan Living Standard Survey Report (2017), almost 64 percent of the total population live in rural areas.

ii) Urban Settlement

An urban settlement is a place where people are mostly engaged in manufacturing, business and services. Urban settlements are generally compact and larger in size. It is also characterised by tall buildings, many shops, better transport and communication facilities. As per the Bhutan Living Standard Survey Report (2017), 36 percent of the total population live in the urban areas.

11.3 Settlement Pattern

Settlement pattern refers to the shape of the settlement in a place. The settlement patterns are influenced by the surrounding landscape. Settlement patterns are generally classified as nucleated, linear and dispersed settlements.

i) Nucleated Settlement

In a nucleated settlement, the houses are built very close to each other. This pattern of settlement is generally found in river valleys and fertile plains. Factors like defence, agriculture and relief have affected the development of nucleated settlement.

In Bhutan, nucleated pattern is also found in places where there are no fertile soil and favourable climatic conditions. Ura in Bumthang, Merak and Sakteng in Trashigang are few examples of a nucleated settlement in Bhutan.

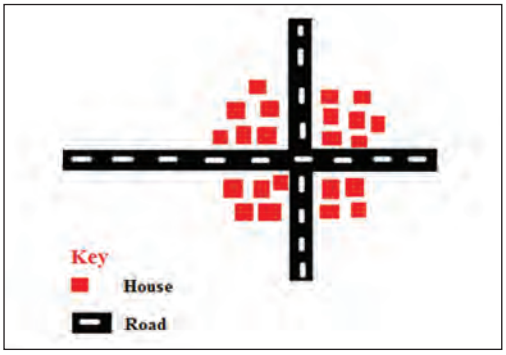

Figure 11.1: Nucleated Settlement

Figure 21.2: A nucleated settlement in Bhutan

ii) Dispersed Settlement

In dispersed settlement the houses are built far away from one another. There are usually farmlands in between the houses. This pattern is common in rural areas of Bhutan. The relief of an area affects this pattern of settlement.

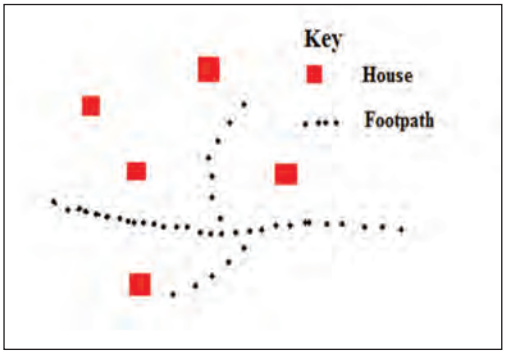

Figure 11.3: Dispersed Settlement

Figure 11.4: Dispersed Settlement in Bhutan

iii) Linear Settlement

Linear pattern of settlements are settlements where the houses are built in lines, along a river or a road. This pattern of settlement has developed as a result of road construction in Bhutan.

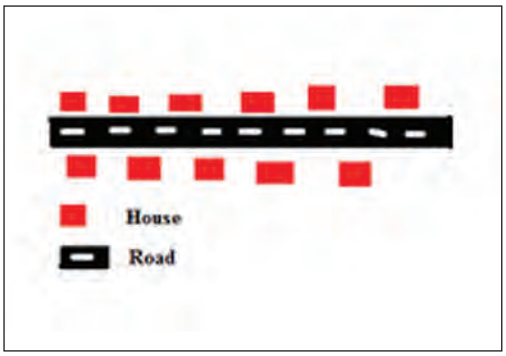

Figure 11.5: Linear settlement

Figure 11.6: Linear Settlement in Bhutan

Test Yourself

1. *Draw diagrams of patterns of settlements and describe them.*
2. *Identify the pattern of settlement in the area you live. Give reasons to support your answer.*
3. *Which settlement pattern would you prefer to live in future and why?*
4. *How is a linear settlement different from a dispersed pattern of settlement?*
5. *Study the pictures below and list the characteristics found in each type of settlement.*

Settlement A

Settlement B

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Chapter Twelve
Environment

Learning Outcome(s):

- Explain ecosystem and food chain
- Explain human interactions with the environment
- State some ways to combat environmental problems

12.1 Introduction

The word environment is derived from the French word “Environ” which means “surrounding”. Environment is everything that surrounds us. There are natural and human made environment. Natural environment includes living and non-living components of the earth. Living components of the environment consists of plants and animals and non-living components include air, water and land.

Know More

Protected areas in Bhutan were initiated in the 1960s. Today, the country has ten protected areas comprising five national parks, four wildlife sanctuaries and one nature reserve.

Biological Corridors in Bhutan were introduced in 1999 to connect all protected areas into a single uninterrupted area to enable movement of wildlife.

Environment affects our daily lives. The food we eat, the place where we live, and the kinds of house we live in are all influenced by the environment. On the other hand, environment is also affected by human activities. Increasing population and their activities has resulted in rapid destruction of the natural environment.

Bhutan has a rich natural environment with a large variety of plants and animals. It has more than 60 percent of the total land under forest cover of which 51.4 percent is under protected areas and biological corridors.

12.2 Ecosystem

A living organism cannot exist by itself. It has to depend on other living and non-living things to survive. The interaction of an organism with other organisms and the environment is the ecosystem. Living and non-living things interact to produce food and transfer energy. For example, a deer survives feeding on plants, and plants need air, water and sunlight to grow. When plants and animals die they go back to the soil in the form of soil nutrients which is again used by plants for their growth.

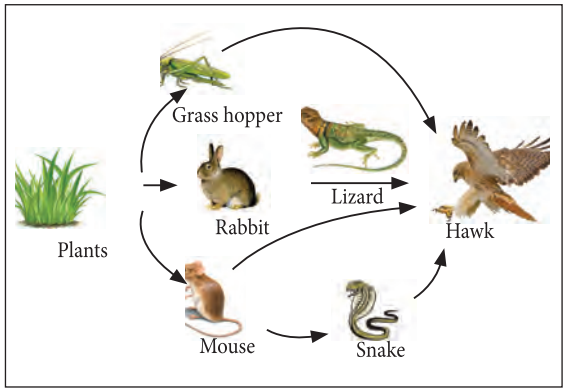

Figure 12.1: Grassland Ecosystem

Some types of ecosystems are land, river, forest and desert.

Know More

Photosynthesisis a process in which plants make their own food using the energy from the sun, water and carbon dioxide.

12.3 Food Chain

All living organisms need to feed on some type of food for survival. Plants make their own food through a process called photosynthesis. Since they make or produce their own food they are called producers. Organisms which do not make their own food are called consumers. The consumers consume either a producer or another consumer. Animals that consume only plants are called herbivores while carnivores are those animals that feed on flesh. On the other hand, omnivores are those animals that consume both plants and animals.

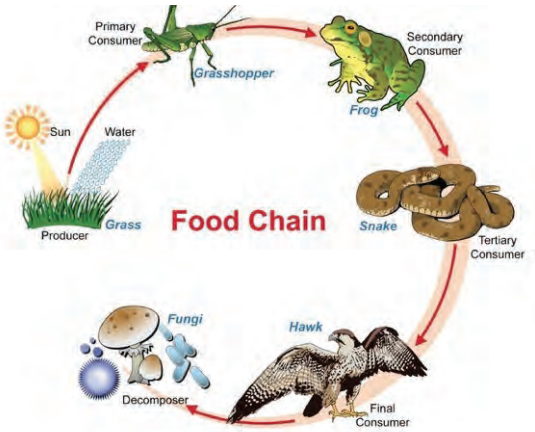

Figure 12.2: Food Chain

Food chain is a transfer of energy from one living organism to another.

In figure, the energy is transferred from grass to grasshopper and then from frog to hawk.

12.4 Importance of Natural Environment

People cannot survive without the four main elements of the environment –sunlight, soil, water and air. Figure 12.3 shows different ways in which people depend on natural environment.

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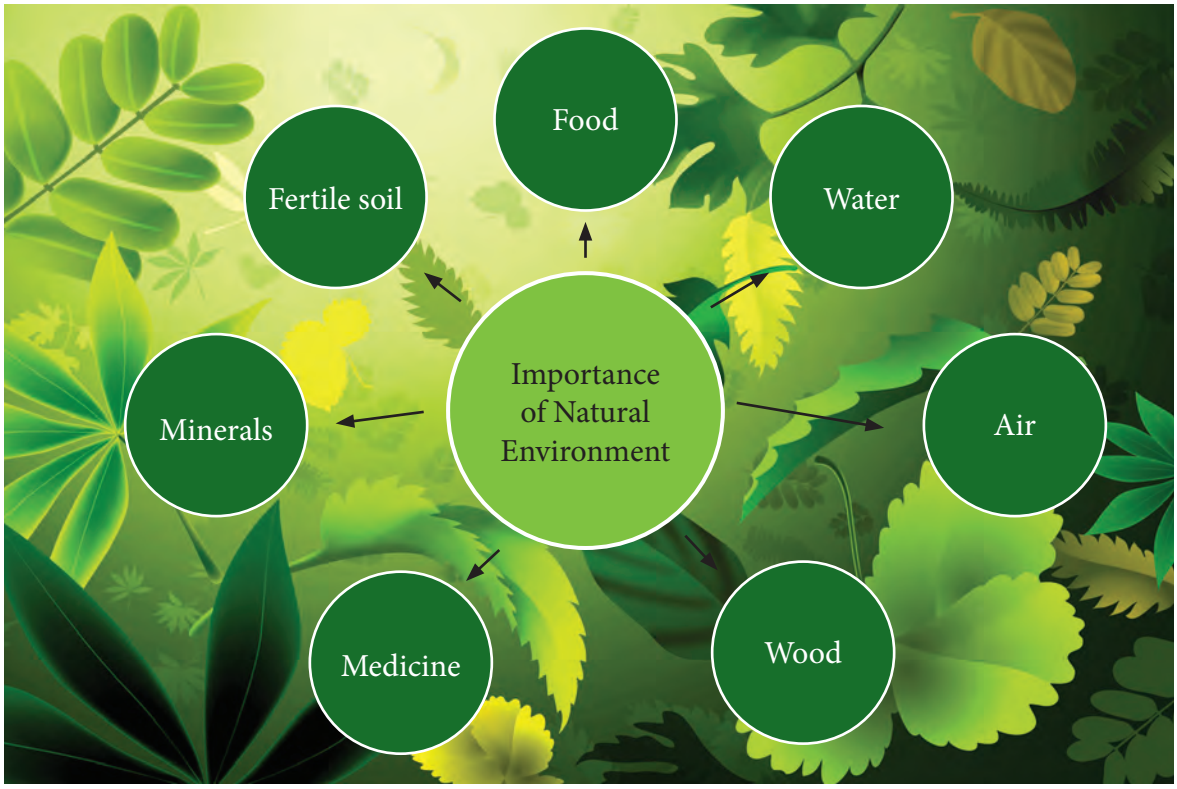

Figure 12.3: Importance of natural environment

Learning Activity:

Using figure 12.3, arrange the use of environment in order of importance (most to least). Give reasons.

12.5 Human Impacts on natural environment

Human interactions have caused many changes to the natural environment. Some of these changes are:

i) Soil erosion

Soil is increasingly exposed to rain, wind, and running water due to deforestation and overgrazing. This has led to increase in soil erosion.

ii) Pollution

Use of chemical fertilizers, increase in number of vehicles, and growth of industries have led to land, water, and air pollution.

iii) Depletion of natural resources

The ever increasing population has caused over utilization of natural resources like minerals, forest, soil, water and other resources.

Learning Activity:

Find at least five impacts of human activities on natural environment from the word puzzle.

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

12.6 Measures to reduce environmental problems

People depend on natural resources for their livelihood. The extensive use of resources creates imbalance in the environment. This imbalance gives rise to various environmental problems. Therefore, it is the responsibility of people to take necessary measures to overcome these problems.

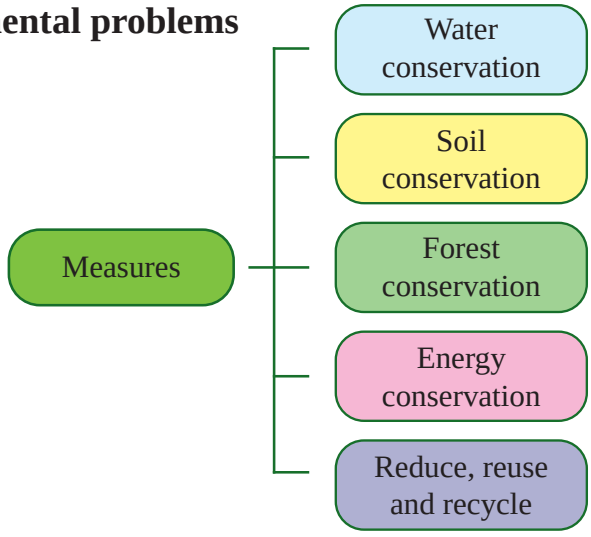

Figure 12.4: Measures to reduce environmental problems

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i) Water Conservation

Water conservation refers to reducing the usage of water and recycling of waste-water for different purposes like domestic use, industries, and agriculture. Minimizing the use of water helps to preserve water for plants and animals.

Know More

Reduce: Minimizing the production of waste.
Reuse: making use of already used products so that limited waste is thrown away.
Recycle: using waste to produce new things.

ii) Forest Conservation

Forest conservation is the practice of planning and maintaining forested areas for the benefit of present and future generations. According to the constitution of Bhutan, 60 percent of its total land must be under forest cover for all times to come. Forest is a source of air, water, food and shelter for people and animals.

iii) Energy Conservation

Conserving energy means efficient use of energy. Less use of energy helps to save money and the environment. Energy generation requires the use of precious natural resources like coal, oil or gas. Therefore, reducing energy use helps to preserve these resources for present and future use.

iv) Reduce, Reuse and Recycle

The changing lifestyle of people in the society is increasing the consumption of resources. This results in increasing amount of garbage which is a serious concern. Reduce, reuse and recycle minimize the amount of waste people generate.

Test yourself:

1. Study the figure and answer the questions.

Planet A

Planet B

i. How is Planet A different from Planet B?
ii. On which planet would you prefer to live? Give reasons to support your answer.

2. Choose the correct answer

i. Which one of the following is not the advantage of having trees? Conservation of natural environment is:

A) Proper use of water *C) Proper use of land*
B) Overuse of environment *D) Proper use of environment*

ii. Which one of the following materials cannot be reused?

A) Paint *C) Bottle*
B) Paper *D) Tin*

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Chapter Thirteen
Natural Resources

Learning Outcome(s):

- Discuss the types of resources
- Explain the sustainable use of resources

13.1 Introduction

The earth is a source of natural resources. Natural resource is anything that people use which comes from natural environment. For example, trees are used for shelter, animals for food and clothing, plants for medicines, minerals and fossil fuels for power, transportation, heating and cooling.

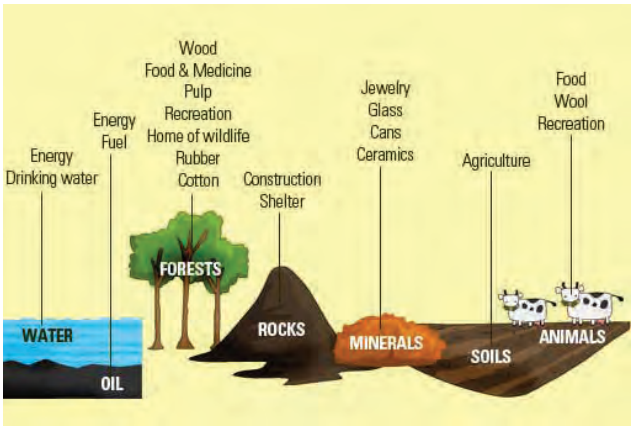

Figure 13.1: Natural Resources

The increasing need for natural resources results in over use of resources. Therefore, proper use of natural resources is important to meet the needs of the future.

13.2 Types of Natural Resources

Natural resources are broadly classified as Renewable and Non-renewable Resources.

Renewable resources are resources that are replenished by the environment over a short periods of time. This types of resources are used again and again as it renews itself. Non-renewable resources relate to a natural resource, such as petroleum or a mineral ore, that cannot be replaced once it has been extracted or procured.

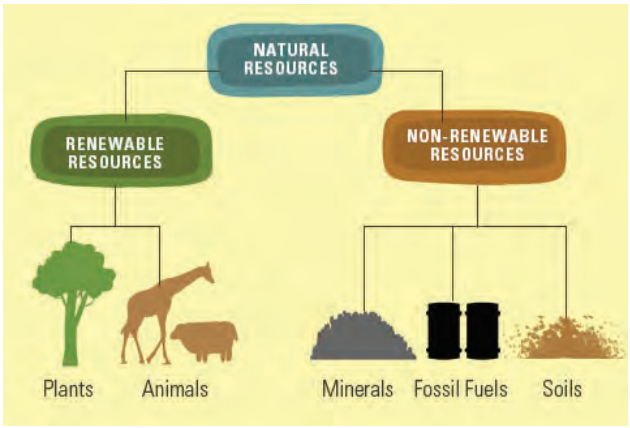

Figure 13.2: Types of Natural Resources

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Soil, water, forest and minerals are some examples of natural resources.

i) Soil Resources

Soil is a basic natural resource supporting all forms of life. Fertile soils are the basis of all civilization and human habitations.

Soil supports the growth of plants, provides habitat for organisms and acts as filter for surface water. The fertility of the soil changes over time.

ii) Water Resources

Water is an essential resource. It is the lifeblood of the environment, essential for the survival of all living things. People settled in places that had adequate water. Water is used for various purposes as shown in figure 13.3.

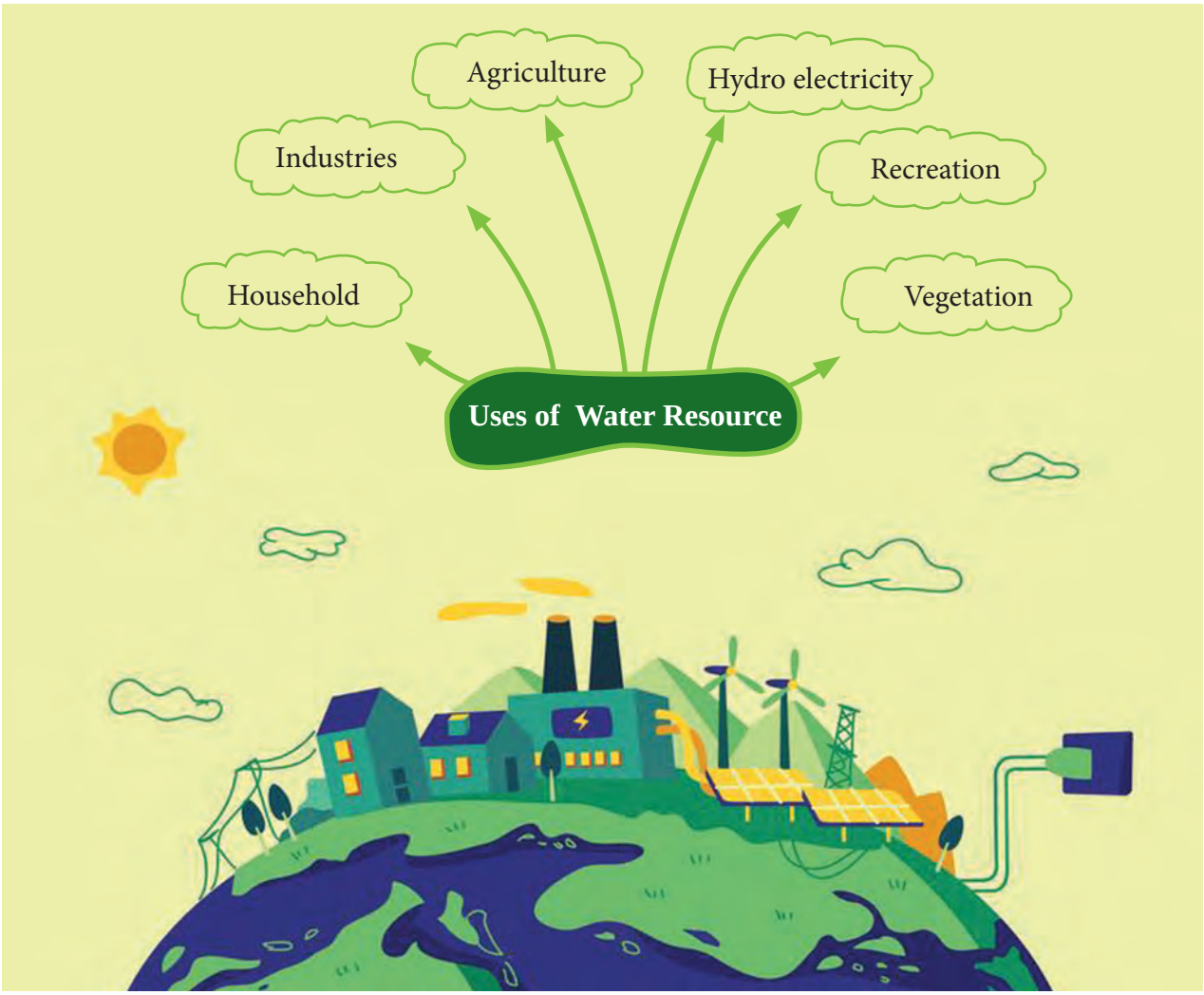

Figure 13.3: Use of Water Resource

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iii) Forest Resources

Forest is a valuable and renewable natural resource. It helps to maintain diversity of plants and animals. Forest helps to control the climate of an area and maintains balance in the ecosystem.

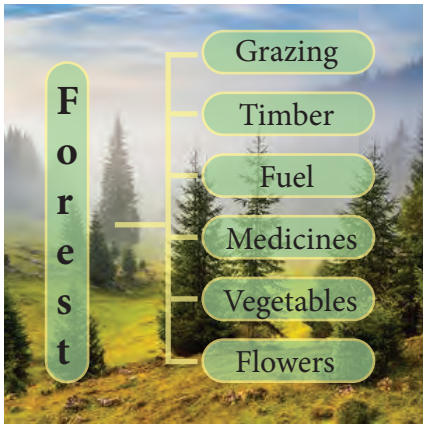

Figure 13.4: uses of Forest Resources

13.3 Mineral Resources

Minerals are naturally occurring inorganic substances. Different minerals are used for different purposes. Minerals are used as raw materials for making new things. These are non-renewable resources and are limited in nature. It is important to use these resources properly.

Learning Activity:

Discuss uses of minerals and fill in the table. An example is done for you.

Mineral	Uses
Copper	*It is used in making coins, jewellery and plumbing.*
Gold	
Aluminium	
Iron	
Dolomite	
Gypsum	
Limestone	

13.4 Sustainable use of resources

The earth has limited natural resources. These resources will exhaust if not used properly and it will be difficult for people to survive. Therefore, it is important to use the natural resources in a sustainable manner. Sustainable use of resources means using resources to meet the needs of present and future generations. Living sustainably helps in the sustainable use of resources.

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Ways to promote sustainable use of resources are as follows:

Figure 13.4: sustainable use of resources

Learning Activity:

Discuss and fill in the table.

Sl.No.	Living sustainably	Describe the ways to live sustainably
1	Reduce household energy use	
2	Use local products	
3	Buy reusable products	
4	Plant trees	
5	Recycle waste	
6	Resell and donate old items	
7	Save water	
8	Reduce dependence on cars	
9	Buy products with less packaging	
10	choose renewable energy	

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Test yourself:

1. *Write the uses of the resources given in the pictures*

Resource	Uses	Resource	Uses
	_____ _____ _____ _____		_____ _____ _____ _____
	_____ _____ _____ _____		_____ _____ _____ _____
	_____ _____ _____ _____		_____ _____ _____ _____

2. *Write True or False.*
   - *i. All natural resources are created by people.*
   - *ii. The source for all human made resources is natural resource.*
   - *iii. All natural resources on this earth will never get exhausted.*

3. *Arrange the letters to form words that would show the different ways to conserve forest resource.*
   - *i. STAREAFFOTION*
   - *ii. FORETIONRESTA*
   - *iii. TIONANAL RKPA*

4. *The increase in human population has led to increase in the rate of soil erosion. Design a poster to create awareness on soil protection.*

5. *Rain water harvesting is one of the ways to conserve water. Find out what is rain water harvesting and explain how it helps in conservation of water.*

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Chapter Fourteen
Hazard and Disaster

Learning Outcome(s):

- Discuss potential hazards and disasters
- Suggest measures to reduce disasters
- Exhibit life-saving skills during disaster

14.1 Introduction

The word 'Hazard' is derived from the French word 'hasard' meaning 'chance'. Hazards are events that have potential to cause harm to human lives and properties. Natural and human induced are the two types of hazards. Natural events like earthquake, flood, fire and windstorm are examples of natural hazards. Human induced hazards are fire, weak structures and road accidents. It is important to know the risks of hazards and prepare to take precautions.

The term Disaster is derived from the French word "Desastre" which is a combination of two words "Des" meaning bad and "aster" meaning star.
A hazardous event that causes damage to lives and properties is called disaster. Disaster has always affected people and will continue as long as life exists on earth.

Since Bhutan is located in the young fold mountains it is vulnerable to disasters like earthquakes, fire and Glacial Lake Outburst Floods (GLOF).

14.2 Types of Disaster

Disasters are broadly classified into two types: natural and human induced disasters.

Figure 14.1: Types of Disaster

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i) Natural Disasters

Natural disasters occur as a result of natural forces of climate and movements of the earth. They are beyond the control of humans. Some examples of natural disasters are earthquakes, volcanic eruptions, landslide, windstorm and flashfloods.

a) Earthquake

An earthquake is the shaking of earth's surface. It is a powerful natural force, which affects the life of people and property.

Bhutan is located in the Himalayan region where there is high risk of earthquake. It has experienced severe earthquakes, which has claimed lives and damaged properties.

Figure 14.2: Aftermath of Earthquake

b) Flood

A flood is an overflow of water on land which is usually dry. It results from continuous rainfall causing the water level to increase and overflow. Floods claim thousands of lives every year and make millions homeless.

Floods generally occur in monsoon season. Places located along the river valleys and plains in Bhutan experience more floods. Rivers of Sarpang, Phuntsholing and Samtse flood frequently.

Figure 14.3: Flood in Sarpang

c) Windstorm

A windstorm is marked by strong wind with little or no rain. A windstorm can cause damage to property and harm people.

It has become more frequent and widespread in Bhutan. Windstorms in the past have affected many dzongkhags and destroyed houses and crops.

Figure 14.4: Effect of windstorm

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ii) Human Induced Disasters

This disaster results from various human activities. Human intent, negligence, error and failure in technology lead to loss of lives and properties. War, accident, and fire are few examples of human induced disasters.

a) Fire

Fire is a human induced disaster that destroys almost everything. It is caused by careless behaviour and is some times a deliberate act.

House fire and forest fire are the most common examples of human induced disasters in Bhutan.

Figure 14.5: Dzong on fire

Figure 14.6: Forest Fire

Test yourself:

1. Choose the correct answer

i. Which one of the following sentence best describes flood?

A. Excess water *C. Heavy rainfall*

B. Overflow of water *D. Deep water*

ii. A natural disaster is _____ event.

A. An Expected *C.an Unexpected*

B. Planned *D. Schedule*

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iii. *Which disaster is not common in Bhutan?*

a. Earthquake *c. Volcano*

b. Flood *d. Windstorm*

2. *Solve the riddle*

a. *I have the ability to shake the earth anytime. I can cause the buildings to collapse and harm people. Who am I?*

b. *Sometimes I am gentle and sometimes I am strong. I remove roofs of houses and destroy crops when I am strong. Who am I?*

c. *I am very helpful to people because of my heat. If you are not careful with me, I can destroy your houses. Who am I?*

3. *Answer the following questions.*

i. *How do you think human induced disaster is different from natural disaster?*

ii. *Identify a common disaster in the place where you live and explain it.*

Learning Activity:

In groups, look around the classroom and list potential hazards and discuss measures to reduce disaster.

Disaster Preparedness Tips

1. ***Identify the potential hazards that are present in your area.***
2. ***Prepare a disaster plan. It should start with having somewhere safe to go and discuss who can guide well with the plan.***
3. ***Have good communications and evacuation plan.***
4. ***Practice the steps that are needed to disconnect home gas, water, and electricity.***
5. ***Make sure to regularly check safety devices at home and schools such as smoke alarm and fire extinguishers.***
   Keep the First Aid box readily available
6. ***Keep a record of emergency numbers:***
   i. Fire - 110
   ii. Traffic Police - 111
   iii. Ambulance - 112
   iv. Police - 113
   v. DDM/National Emergency Operation Center - 233

Assessment

Assessment Matrix: Broad assessment based on Knowledge, Skills and Values and Attitudes (KSA)

Assessment type	**Formative assessment**			**Continuous Summative Assessment**			**Summative Assessment**	
Domains	**Knowledge**	**Skills (process)**	**Values & Attitude**	**Knowledge**	**Skills**	**Values & Attitude**	**KSA Term I**	**KSA Term II**
Techniques	Self and peer assessment, quiz, debate, homework, classwork, class interaction	Map work, case study, sketching, drawing, making models, using instruments	Field work, group work, self and peer assessment, interaction, case analysis, resolving social and environmental issues, moral dilemma	Homework, class work, project work and test	Project work, map work, test, models, field work, case study, sketching, drawing, making	Field work, group work, test, interaction, case analysis, resolving social and environmental issues, moral dilemma	exams	exams
Assessment tools	Question & answer, checklist, rating scale, rubrics	Question & answer, checklist, rating scale, rubrics	Question & answer, checklist, rating scale, rubrics	Question & answer, checklist, rating scale, rubrics	Question & answer, checklist, rating scale, rubrics	Question & answer, checklist, rating scale, rubrics	CBT-MCQs, completion, matching, true/false, short answer, essays	CBT-MCQs, completion, matching, true or false, short answer, essays
Frequency	Maintain either checklist/ rating scale/ rubrics for each chapter	Maintain either checklist/ rating scale/ rubrics for each chapter	Maintain either checklist/ rating scale/ rubrics for each chapter	Minimum two homework and two classwork to be graded for each term	One Project (different types)	Maintain either checklist/ rating scale/ rubrics for relevant content	Once a term	Once a term
Weighting				**Term I**	**Term II**		**30**	**50**
				HW, CW and Test- 10	HW,CW, Test and PW- 10			

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Criteria for project and field work

Name	Criteria					Total (20)
	Content (4)	Presentation(4)	Language (4)	Process (4)	Originality and creativity (4)	

Rubrics for project and field work

Criteria	Marking range				Scores
	4	3	2	1	
Content	Information presented is relevant, accurate and in logical order.	Information presented is substantially relevant, accurate and in logical order.	Information presented is to some extent relevant, accurate and in logical order.	Information presented is not relevant, accurate and in logical order.	
Presentation	Exceptionally clear and precise expression of ideas, transfer of ideas into product with appropriate illustrations.	Clear and precise expression of ideas, transfer of ideas into product with appropriate illustrations.	Little expression of ideas, transfer of ideas into product with appropriate illustrations.	No clear and precise expression of ideas, transfer of ideas into product with appropriate illustrations.	
Process	Proper planning with regular consultations.	Partial planning with some consultations.	Little planning with little consultations.	No proper planning and consultations.	
Language	Language without grammatical error.	Language with few grammatical errors.	Language with few grammatical errors.	Language full of errors.	
Originality and creativity	Display of original and creative ideas.	Partial display of original and creative ideas.	Little display of original and creative ideas.	No display of original and creative ideas.	
				Total score	

Teachers may use the above rubric for assessing project and field work.

Sample rating scale for Affective domain:

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Name	Criteria										Teacher's comments
	Participation in learning activities	Respect for others views	Curiosity for exploration	Responsibility	Empathy for others	Punctuality	Honesty	Intellectual drive	Concern for environment	Collaboration	

Note: The above parameters to be rated as: A-Outstanding, **B**- Very Good, **C**- Good, **D**-Fair and **E**- Need improvement. This rating scale is to be used at least once a term to assess the development of values and attitudes.

Criteria for Home work

Name	Criteria					Total Marks
	Completion (4)	Accuracy (4)	Presentation (4)	Creativity and originality (4)	Timely submission (4)	20

Rubrics for Homework

Criteria	Marking range				Score
	4	3	2	1	
Completion	100% complete	75% complete	50% complete	25% complete	
Accuracy	100% correct	75% correct	50% correct	25% correct	
Presentation	Work is crystal clear and legible	Work is clear and legible	Poor clarity and less legible	Not clear and illegible	
Originality & Creativity	Display of original and creative ideas.	Partial display of original and creative ideas.	Little display of original and creative ideas.	No display of original and creative ideas.	
Timely submission	Work submitted on time	Work submitted one day late	Work submitted two days late	Work submitted three days late	

Note: Homework as per the requirement

Criteria for Class work

Name	Criteria					Total Marks
	Participation (4)	Follow instructions (4)	Completion (4)	Quality of work (4)	Behaviour (4)	20

Rubrics for Class Work

Criteria	Marking Range				Score
	4	3	2	1	
Participation	Participates voluntarily all the time	Participates voluntarily most of the time	Participates voluntarily sometimes	Participates only when asked	
Follow instructions	Follow instructions accurately all the time	Follow instructions accurately most of the time	Follow instructions sometimes	Follow instructions rarely	
Timely Completion	Completes task always on time	Completes most of the task on time	Completes some of the task on time	Rarely completes task on time	
Quality of work	Demonstrates full knowledge with full explanation and elaboration	Demonstrates knowledge but fails to elaborate	Does not fully understand but answers basic questions	Does not understand and answers rarely	
Behaviour	Always demonstrates positive attitude and behaviour	Demonstrates positive attitude and behaviour most of the time	Demonstrates positive attitude and behaviour sometimes	Rarely demonstrates positive attitude and behaviour	

Note: Classwork as per the requirement

Sample rating scale for self and peer assessment

Sl.	Items	Rating Scale			Remarks
		Very Good	Good	Fair	
1	Participation- Actively participates in all class activities				
2	Time management and responsibility- Accepts fair share of work and completes timely				
3	Adaptability- Displays a wide range of skills in tasks, readily accepts suggestions				

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4	Problem solving- Solves problem when faced with challenges				
5	Communication skills- Listens and communicates effectively				
6	General team skills- Exhibits positive attitude, encourages and motivates team				
7	Creativity and originality- Initiates new ideas and develops materials				

Weighting and period allocation

Sl. No.	Strand	Strand wise weighting	Chapters	Weighting (%)	Period Allocation	Time (min)	Remarks
1.	**Time and Space**	10	1. Nature and Scope of Geography	2	4	160	4
			2. The Earth in the solar system	3	4	160	
			3. Latitude and Longitude	5	8	320	
2.	**Physical Environment**	47	4. River systems	8	12	480	14
			5. Landforms	8	8	320	
			6. Rocks and Minerals	9	12	480	
			7. Atmosphere	6	8	320	
			8. Weather and Climate	8	8	320	
			9. Natural Vegetation	8	8	320	
3.	**People and Environment**	43	10. Population	9	12	480	12
			11. Settlement	7	4	160	
			12. Environment	9	12	480	
			13. Natural Resources	9	12	480	
			14. Hazard and Disaster	9	8	320	
		100%		**100%**	**120**	**4800**	**30 weeks**

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Question pattern for term examinations

1.	**Limited choice**	**:(40 Marks-compulsory questions)**
i.	MCQ	:25 Marks
ii.	Alternative response	:5 Marks
iii.	Matching	:5 Marks
iv.	Completion	:5 Marks
2.	**Open ended**	**: (50 Marks)**
i.	Short answer type	:20 Marks- compulsory
ii.	Essay type	:30 Marks- attempt three sets out of a total five sets of questions.
3.	**Map work (Bhutan, World map)**	**:10 Marks (World map- Continents, Countries and Oceans)**
	Total Marks	**:100 Marks**

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