STANDARD NINE

GEOGRAPHY

UNIT 1

Lithosphere – I Endogenetic Processes

Learning Objectives

- To know about the spheres of the Earth
- To illustrate the internal structure of the Earth
- To study the rock types and its cycle
- To explain the internal processes of the Earth
- To understand the processes of Earthquakes and volcanoes

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Introduction

The Earth is a unique planet of the Solar family. The Earth is composed of four spheres namely, the lithosphere, the atmosphere, the hydrosphere and the biosphere. This lesson focuses on the internal processes of the Earth. The sequence of lessons generally follows the spheres of the Earth system in a comprehensive manner.

Have you ever wondered what our Earth is made up of? Or what lies underneath the Earth's surface?

"The Earth can physically be described as a ball of rock (the lithosphere), partly covered by water (the hydrosphere) and wrapped in an envelope of air (the atmosphere). To these three physical zones it is convenient to add a biological zone which includes all the living organisms (the biosphere)."

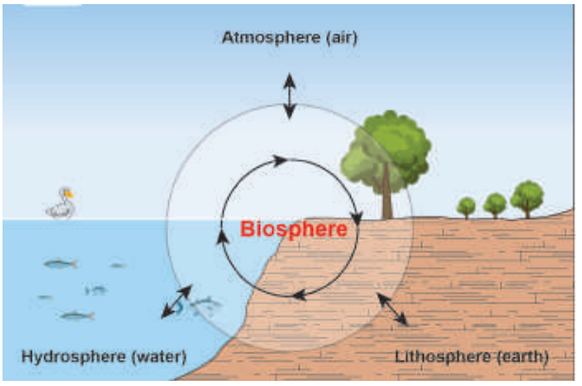
Arthur Holmes

1.1 Spheres of the Earth

Earth's surface is a vast area of 510 million sq.km, where four spheres of the Earth interact. The abiotic spheres are the lithosphere, atmosphere and hydrosphere. The biotic sphere is the biosphere. Together, these spheres constitute the planet, Earth.

1.2 Structure of the Earth

The outer surface and inner core of the Earth are totally different in their nature and structure. The structure of the Earth's interior is divided into three layers namely **the crust, the mantle and the core**.



Spheres of the Earth

The **lithosphere** is the solid outer part of the Earth.

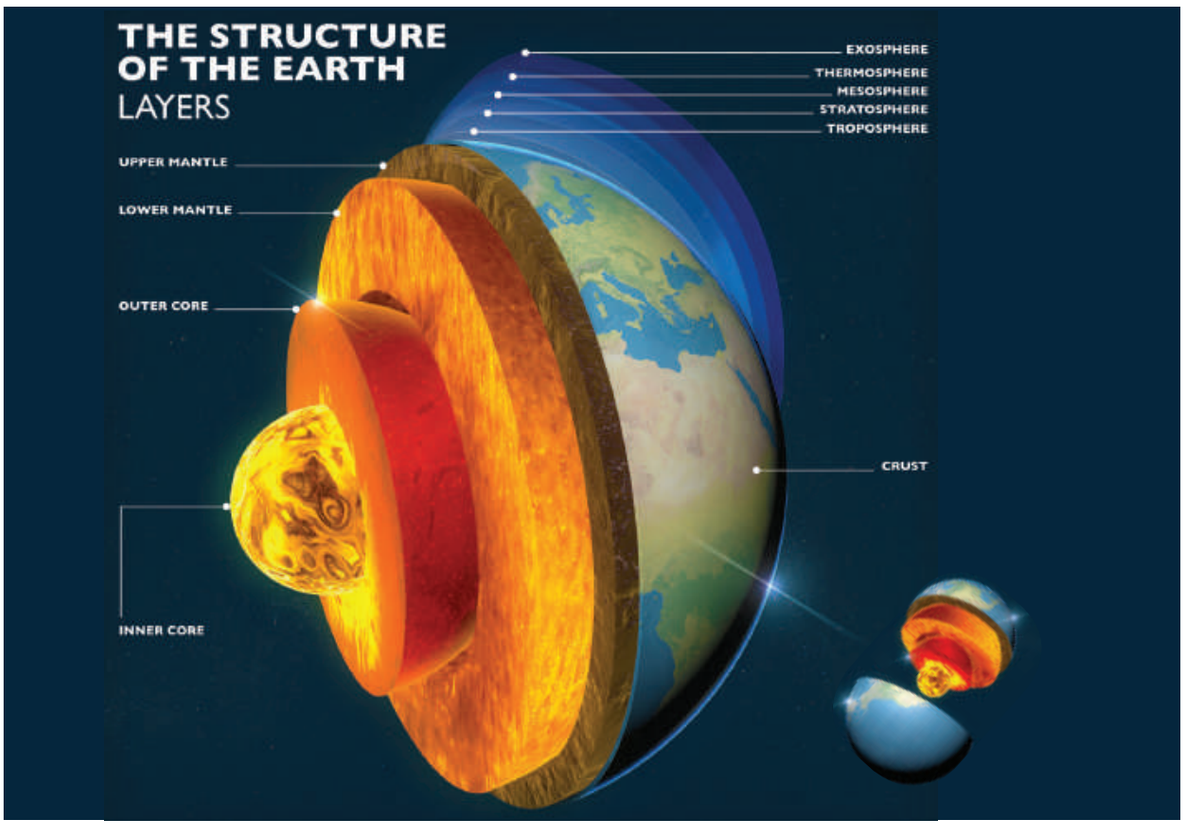
The **atmosphere** is a thin layer of gases that surrounds the Earth.

The **hydrosphere** is the watery part of the Earth's surface including oceans, rivers, lakes and water vapour

The **biosphere** is the layer of Earth where life exists.

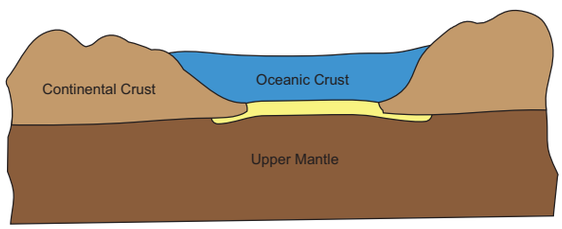
The terms **'lithosphere'** and **'crust'** are not the same. The lithosphere includes the crust and the uppermost part of the mantle.

All terrestrial planets have lithosphere. The lithospheres of Mercury, Venus, and Mars are much thicker and more rigid than that of the Earth.



Crust

Crust is the outer layer of the Earth, where we live. It is the skin of our Earth, which ranges between **5 to 30 km**. It is the solid and rigid layer of the Earth. The thickness of the crust is greater below the continents than the ocean floor. The crust is classified as **continental crust** and **oceanic crust.** The major elements of crust SIAL are Silica (**Si**) and Aluminium (**Al**) and SIMA (**Si** - Silica and **MA** - Magnesium)



Continental Crust is made up of SIAL and Oceanic Crust is made up of SIMA

Mantle

The interior part beneath the crust is called mantle, which is about 2,900 km thick. The major elements of the mantle are Silica (Si) and Magnesium (Mg) and hence it is also termed as SIMA. In the upper part of the mantle, the rock remains solid, whereas in the lower part of the mantle, rocks are in molten form. This molten rock inside the Earth is called 'magma'.

Core

The core is the innermost and hottest layer of the Earth which lies below the mantle. It is composed mainly of Nickel (Ni) and Iron (Fe). Hence it is called NIFE. The core is divided into Solid inner core and Liquid outer core. The presence of large quantities of iron in the core is responsible for the Earth's gravitational force. As the Earth rotates on its axis, the liquid outer core spins over the solid inner core and generates the Earth's magnetic field. This is responsible for the functioning of the magnetic compass. Due to high pressure, the materials in the inner core are unable to move and hence remain solid.

1.3 Rocks

The crust is a storehouse of rocks. An aggregate of minerals on the Earth's crust is called 'rock'. It may be hard and compact like 'granite' or soft as 'clay' or loose as 'sand'.

The Deepest Place ever reached by human technology vary from time to time. Till 2011 Kola Super Hole (12,262m) in Murmansk, Russia was the deepest place. But in 2012, Z-44 Chavyo Well (12,376m) broke the record, and is supposed to be 15 times the height of Burj Khalifa in Dubai.The exploration of Earth's interior continues.

Types of Rock

Based on formation, rocks are classified as:

- Igneous,
- Sedimentary and
- Metamorphic.

Fact

The ancient city of Petra in Jordan is an example of an entire city carved out of rocks. There are many specimens of magnificent rock-cut architecture in India, like the Ajanta and Ellora caves in Maharashtra, the Aihole and Badami temples in Karnataka, the Konark temple in Odisha and Mamallapuram in Tamil Nadu.

Igneous Rocks

The word 'igneous' is derived from the Latin word Ignis meaning 'Fire'. The interior of the Earth contains very hot molten material called 'Magma'. When the magma reaches the Earth's surface, it is referred to as 'Lava'. The lava on the surface cools down and gets solidified as rocks called igneous rocks. Granite and basalt are examples of such rocks. Igneous rocks are also called Primary or Mother rocks because all other rocks are directly or indirectly formed from them.

Sedimentary Rocks

These sedimentary rocks are named after the latin word 'sediment' meaning ' settle. Rivers, glaciers and winds carry bits of rock and soil and deposit them in layers. After a few million years, these deposits harden into compact rocks and are called Sedimentary rocks.

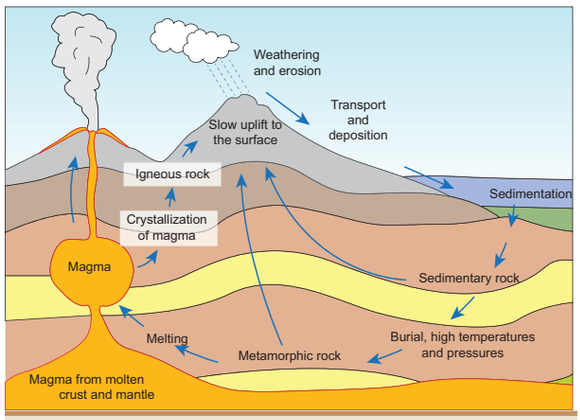
The bodies of plants and animals that fall on the deposits get embedded in the layers and form Fossils. Sandstone, limestone, chalk, gypsum, coal and conglomerate are examples of sedimentary rocks.

Metamorphic Rocks

The term 'metamorphic' is derived from the word 'metamorphosis', which means, 'change of form'. When igneous or sedimentary rocks are subjected to extreme heat and pressure, they undergo a complete change in their form and character .i.e., in course of time, granite may get transformed to gneiss, basalt to schist, limestone to marble and sandstone to quartzite.

Rock Cycle

The Rock cycle is a continuous process through which igneous, sedimentary and metamorphic rocks are transformed from one form to another.



Activity

Narrate the processes involved in the given rock cycle diagram in your own words.

1.4 Geomorphic Processes

The forces that act from the Earth's interior towards the Earth's surface are called **Internal processess** or **Endogenetic processes**. These forces build the landscape and create topographic relief.

The forces that act on the surface of the Earth due to natural agents like running water, glacier, wind, waves etc. are called **External processes** or **Exogenetic processes**. These external processes tear the landscape down into relatively low elevated plains and shapes the landform created by Endogenetic process.

Internal Processes

The internal processes generate heat and eject materials from deep below the Earth's crust. **Internal radioactivity** is the principal source of power for this process.

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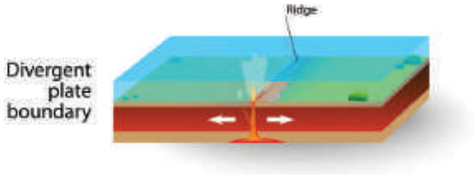
Plate Tectonics

The lithosphere is divided into a number of huge slabs of rocks called '**Tectonic plates**.' These tectonic plates are divided into major and minor plates. These plates float independently over the mantle. Collisions of these plates produce mountain ranges and other irregular surface features, both on land and the ocean floor. This phenomenon is called '**plate tectonics**'. The movement of tectonic plates is due to thermal energy from the mantle. Now we have a better understanding about the plate movements and its relation to Earthquake and volcanic activities.

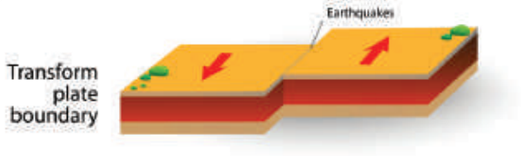
Types of Plate Boundaries

Convergent Boundary - Here the plate moves toward each other and sometimes, a plate sinks under another. The location where the sinking of a plate occurs is called a subduction zone (eg) Fold Mountain-Himalayas.

Divergent Boundary – Here the plates pull away from each other as magma pushes up from the mantle (eg) Mid Atlantic Ridge



Conservative/Transform Boundary – Here the plates slide horizontally past each other. (eg) San Andres Fault.



Movements of Continental Plates

Due to lateral compressional forces, the plates are forced to move upwards and downwards. This is called '**Folding**'. Mountains formed by folding are called fold mountains. The process of folding creates lofty mountain ranges such as the Himalayas and the Alps

According to plate tectonics, the plates are in constant motion with an average rate of few centimetres per year. The movement might seem slow, but over millions of years, the plates and the continents riding on them move a long way. For example, about 250 million years ago, the Indian Plate was a part of the **Gondwana land**, which comprised of modern Africa, Australia, Antarctica, and South America.

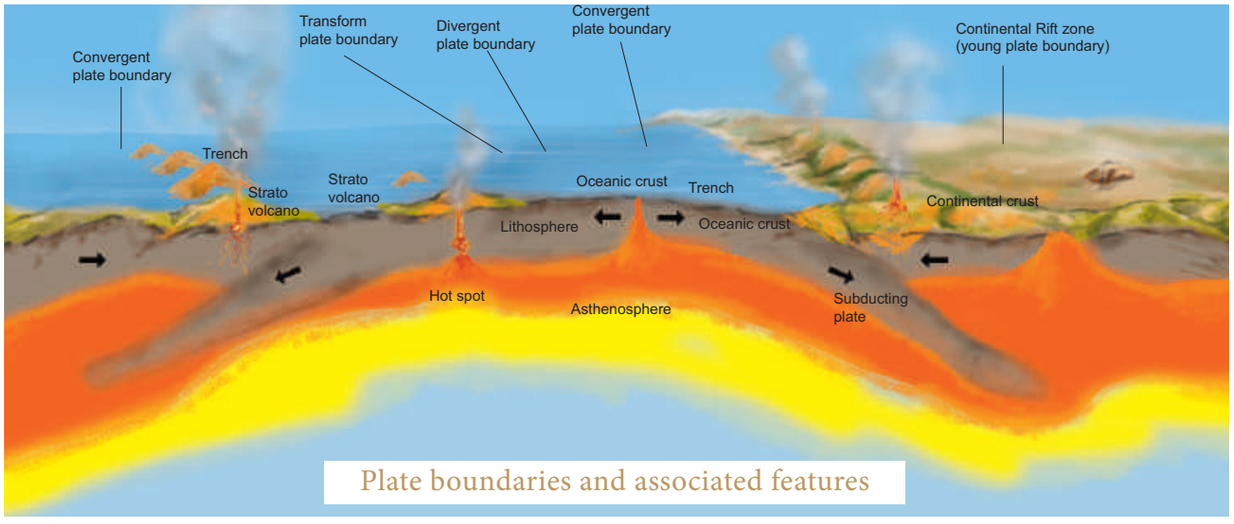
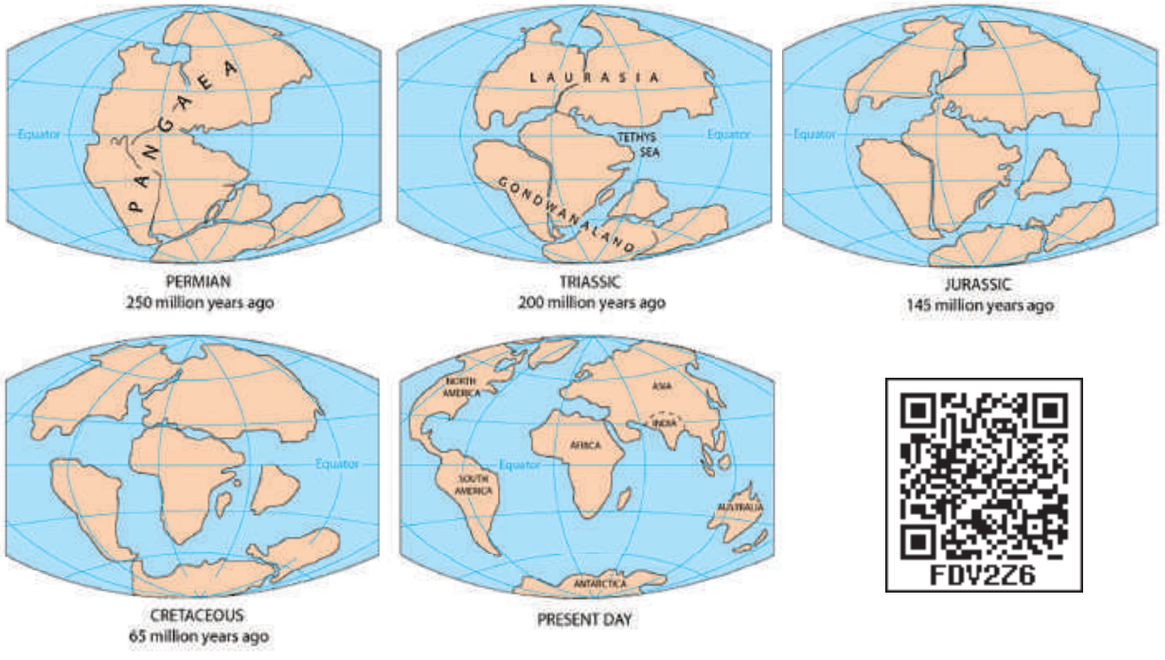


Plate boundaries and associated features



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Approximately 140 million years ago, the Indian plate broke away from the ancient super continent 'Gondwana' and began moving north and collided with Asia. The collision with the Eurasian Plate along the boundary between India and Nepal formed the **Orogenic** belt that created the Tibetan Plateau and the mighty Himalayan Mountains.

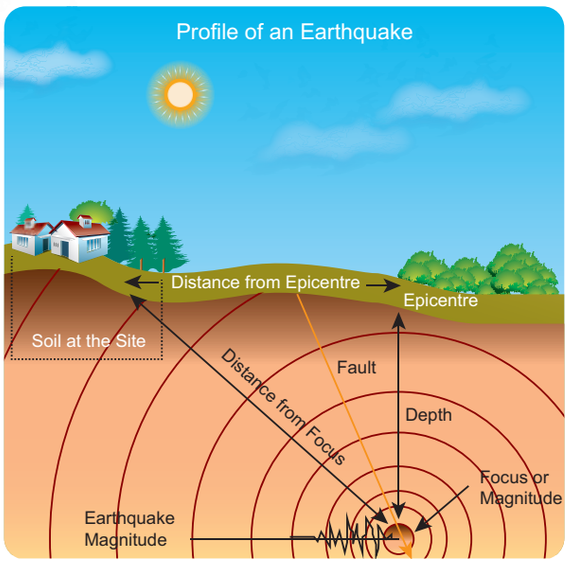
Activity

Here is a list of a few mountains.

- Ural Mountains, Andes Mountains, Vindhya Range, Alps mountains,
- Satpura range, Rocky Mountains, Sierra Nevada.
- Identify and Locate with help of atlas

Earthquake

Earthquakes are generally caused by the sudden vibrations in the Earth's crust, which spreads outward in all directions as waves from the source of disturbance. The point of origin of an Earthquake is called **'Focus' (Hypocenter)** which generates a series of elastic waves. **'Epicentre'** is a point on the Earth's surface that lies directly above the focus. The impact of the Earthquake is felt the most at the epicentre.



Seismic Waves

Earthquakes generate **seismic waves**. The nature, force and speed of these seismic waves depend on the nature of the medium through which it passes. Accordingly, there are three major types of waves.

Primary or P-waves are the fastest of all the Earthquake waves and the first to reach the epicentre. These waves pass through solids, liquids and gases, either through push or pull with an average velocity of 5.3km per second to 10.6 km per second.

Fact

C.F. Richter devised a scale to measure the magnitude of Earthquakes. This scale relates to the energy released at the epicentre and provides an estimation of the severity of an Earthquake. It is an open ended scale. The highest magnitude ever recorded is 9.5 on Richter scale (Bio-Bio, Chile in 1960).

Secondary or S-waves travel only through solids. These transverse waves shake the ground perpendicular to the direction in which they propagate. The average velocity of these waves is 1Km per second to 8 km per second.

Surface Waves (or) L-waves are similar to P-waves but they travel primarily along the ground surface. These waves travel comparatively slower and are the most destructive waves. The average velocity of these waves are 1 km per second to 5 km per second.

DO YOU KNOW?

The instrument which records the Earthquake waves is called 'seismograph' or 'seismometer'. The science that deals with Earthquakes is called 'seismology'.

Tsunami

The word 'Tsunami' is a Japanese term, meaning harbour waves. It is adopted to describe

large seismically generated sea waves caused by Earthquakes, submarine explosions and landslides. These waves travel at a great speed (more than 500 km per hour) and the length of the waves exceeds 600 km. These waves reach to a height of more than 15 m near the sea shore and are capable of causing destruction along the coastal area.

The 2004 Indian Ocean Earthquake that caused tsunami is the sixth-deadliest natural disaster which travelled at a speed of 600 km per hour with an estimated death toll of 2,80,000. The Earthquake which occurred near Indonesia at 00.58 hours took nearly 7 hours to reach Chennai.

DO YOU KNOW?

On 26 December 2004 a tsunami occurred in the Indian Ocean. It was the **result** of the Indio-Australian Plate **subducting** below the Eurasian Plate. It was caused by an Earthquake **measuring** a magnitude of above 9 in the Richter scale. The Earthquake caused the **seafloor** to **uplift**, displacing the seawater above.

Volcanoes

A volcano is a vent or an opening on the surface of the Earth crust, through which hot solid, liquid and gaseous materials (**Magma**) erupt out to the surface from the Earth's interior. Magma rises up and ejects on the surface as **Lava**. Volcanoes are also formed when plates move apart.

Volcanoes generally have the following major components. They are:

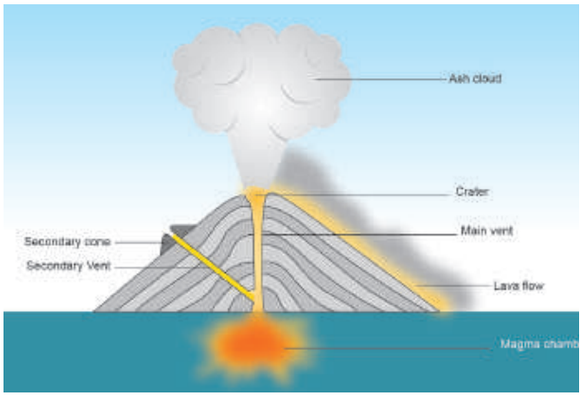
i. Magma chamber - a large pool of liquid rock found beneath the surface of the Earth
ii. Vents - an opening serving as an outlet for air, smoke, fumes, magma etc
iii. Volcanic cone - a landform built by the magma ejected from the vent in the shape of a cone.
iv. Crater - a bowl shaped depression found at the top of the volcano through which the magma flows out.

Based on the periodicity **of eruptions**, volcanoes are classified into

(i) Active volcano, (ii) Dormant volcano, (iii) Extinct volcano.

DO YOU KNOW?

The term 'volcano' is derived from the Latin term VULCAN, which is the name of Roman "God of Fire".



a. Active Volcano

Active volcanoes are those which constantly eject volcanic lava, gases and fragmented materials. (eg.) Mount St. Helens in the United States.

b. Dormant Volcano (or) Sleeping Volcano

Volcanoes that do not show any sign of volcanic activity for a long period of time are known as dormant volcanoes. Sometimes there may be a sudden explosion which may cause unimaginable loss to life and property (e.g.) Mt. Fuji , Japan

c. Extinct or Dead Volcano

When a volcano permanently stops its volcanic activity, then it is

called as extinct or dead volcano (e.g.) Mt. Kilimanjaro, Tanzania Tiruvannamalai - Tamilnadu

Activity

Take a bottle filled with soda. Give it a few shakes. Now twist the cap open. What do you observe?s

Volcanoes can also be classified based on their **structure and composition as** composite volcano, shield volcano and dome volcano

d. Composite Volcano

Composite volcano, also known as strata volcano, is a conical volcano built by many layers of hardened lava, pumice and volcanic ash. These are commonly found in the Pacific Ocean Eg. Mt. Fuji, Japan

e. Volcanic Dome

A lava dome or volcanic dome is roughly a circular mound formed due to the slow ejection of viscous lava from a volcano. As the lava is rich in silica with intense viscosity, it is prevented from flowing far from its vent. e.g. Parícutin, Mexico

Hots

Pacific Ring of Fire — Most seismically and volcanically active. Why?

f. Shield Volcano

Shield volcanoes are formed by intense viscous lava.

These are shallow depositions with gently sloping sides.

Hence the lava flows out in all directions to create a shield.

E.g., Mauna Loa, Hawaii

Distribution of Earthquakes and Volcanoes

Most Earthquakes and volcanic eruptions do not strike randomly, but occur along the plate boundaries. One such area is the ***Circum-Pacific Ring of Fire,*** where the Pacific Plate meets many surrounding plates. The Ring of Fire is the most seismically and volcanically active zone in the world. The other distinctive major belts are Mid-Oceanic Ridges ,Mid-Continental Belts and Alpine - Himalayan belt.

Effect Of Volcanoes

Constructive Effects

Volcanic materials enrich the soil fertility that promotes agricultural activities. The hot volcanic region helps in generating geothermal energy. Many dormant and active volcanoes are the most attractive tourist spots of the world. Most of the volcanic materials are used as building materials.

Destructive Effects

Volcanic eruption causes Earthquakes, flash floods, mud slide and rock fall. Lava can travel very far and burn, bury, or damage anything in its path. The large amount of dust and ash makes breathing hard and irritable. Volcanic eruptions can alter the weather conditions and disrupt transport (Iceland volcanic eruption) in and around the volcanic region.

Recap

- The spheres of the Earth are the lithosphere, atmosphere, hydrosphere and biosphere.
- Earth's interior is divided into three layers - Crust, Mantle and Core.
- Based on composition, the crust, mantle and core are referred to as SIAL, SIMA and NIFE respectively.
- The formation and deformation of landforms on the surface of the Earth are due to continuous internal and external processes.
- The lithosphere is composed of major and minor tectonic plates.
- Earthquake is the shaking or trembling of the Earth's crust.
- Earthquake and volcanoes are useful to understand the Earth's interior.

EXERCISE

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I Choose the correct answer

1. _____ is the rigid outer layer of the Earth.
   a. core b. mantle
   c. Crust d. inner core
2. _____ layer is made up of liquid iron
   a. Inner core b. Outer core
   c. Mantle d. Crust
3. Magma is found in the _____
   a. crust b. mantle
   c. core d. None of the above
4. Diastrophism is connected to
   a. volcanism b. earthquakes
   c. tectonics d. fold/fault
5. The movement of tectonic plates is induced by _____ energy.
   a. hydel b. thermal
   c. wave d. tidal
6. In the ancient period, Gondwanaland moved towards _____ direction.
   a. north b. south
   c. east d. west
7. Many million years ago , India was a part of the super continent _____
   a. Gondwana b. Laurasia
   c. Panthalasa d. Pangea.
8. The movement of plates that creates stress and tension in the rocks causing them to stretch and cracks result in _____.
   a. fold b. fault
   c. mountain d. earthquake
9. _____ refers to a bowl-shaped depression found at the top of the volcano.
   a. crater b. vent
   c. chamber d. volcanic cone
10. The point of origin of an Earthquake is called the _____
    a. epicentre b. focus
    c. seismic wave d. magnitude

II. Match the following

1. Endogenetic process — Seismograph
2. Mantle — Subduction Zone
3. Convergent boundaries — Volcanic
4. Earthquake — Pacific Ocean
5. Composite volcano — SIMA

III. Consider the given statements:

1. i. Mt. Fuji is a dormant volcano
   ii. Mt. Kilimanjaro is a dormant volcano
   iii Mt. Tanzania is a dormant volcano
   Which of the statement(s) is are true
   a. i is true b. ii is true
   c. iii is true d. I, ii, iii are true
2. **Statement:** Magma gushes out when it finds vents.
   Reason: Interior of the Earth contains compressed hot magma
   Which of the statement(s) is are true
   a. Statements & reason are true
   b. Statements is true, reason is false
   c. Statement is false reason is true
   d. Statement & reason are false
3. **Statement I:** Mountain ranges are formed by the collision of tectonic plates
   Statement II: The movement of tectonic plates is due to the thermal energy from the mantle
   a. Statement I is false II is true
   b. Statement I and II are false

c. Statement I is true II is false

d. Statement I and II are true

IV. Answer in brief:

1. Write a brief note on the various spheres of the Earth.
2. Mention the layers of the interior of the Earth.
3. Define Plate tectonics.
4. What is Tsunami?
5. What is a Volcano? Mention its major components.
6. What is an Earthquake and how it occurs?
7. What are seismic waves and mention its types?
8. Write about the Pacific Ring of fire.

V. Give Reasons for the following:

1. SIAL floats over SIMA.
2. Igneous rocks are also called Primary Rocks or Mother rocks.

VI. Distinguish between

1. Core and crust.
2. Epicentre and Hypocentre
3. Divergent and convergent boundaries.
4. Primary waves and Secondary waves.
5. Shield volcano and volcanic Dome.

VII. Write answers in a Paragraph

1. Describe the structure of the Earth.
2. Write a note on the internal and external processes of Earth.
3. How are volcanoes classified based on the periodicity of their eruptions?
4. Explain the effects of Volcanoes.

VIII. Map Skill

On the given outline map of the world, mark the following:

a. Pacific Ring of fire

b. Earthquake prone zones (any two)

c. Locate any two active volcanoes of the world.

d. Himalayas and Alps ranges

e. Rift valley of East Africa.

IX. HOTS

Consider the various sources of information related to the Earth's Interior. Classify the above as DIRECT & INDIRECT sources of information. Give reasons

- Seismic activity
- Earth 's magnetism
- Volcanoes
- Mined rocks
- Gravitational force
- Meteors

X. Life Skills

Imagine that you feel tremors or shocks in your locality. What will be your role in saving lives from destruction? List out the Do's and Don'ts.

UNIT 2

Lithosphere – II Exogenetic Processes

Learning Objectives

- To comprehend the various external processes of the Earth
- To study the different types of weathering and the resultant features
- To learn how the weathered materials are transported by movement
- To study about the erosional and depositional landform features associated with rivers, underground water, glaciers, winds and waves

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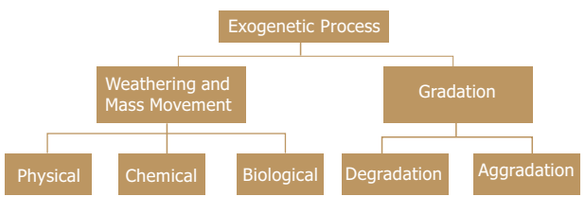
Introduction

The Earth is a dynamic system that undergoes various changes due to internal and external processes. The continuous interaction of these two processes controls the structure of the earth's surface. The external processes are the consequence of solar energy and gravitational forces, whereas the internal processes are an outcome of the earth's internal heat.



2.1 Weathering

Weathering is the breaking, disintegration and decomposition of materials of the earth's crust by their exposure to atmosphere.

There are three types of weathering

- Physical weathering,
- Chemical weathering and
- Biological weathering

Physical weathering

It is the breakdown of rocks without changing their chemical composition, through the action of physical forces. The constant freezing and thawing of rocks during the night and day leads to the expansion and contraction of rocks. Cracks are formed and disintegration occurs eventually. **Exfoliation, block disintegration, granular disintegration** etc., are the different types of weathering.

Exfoliation

The alternate heating and cooling on rounded rock surfaces leads to the peeling of rocks, layer by layer like an onion. This is called **exfoliation**. **sheeting** and **shattering** are the other forms of exfoliation.

Granular Disintegration:

Granular disintegration takes place in crystalline rocks where the grains of the rocks become loose and fall out. This is due to the action **of temperature** and **frost**.

Block Disintegration:

Repeated expansion and contraction of rocks during day and night respectively causes stress on the joints of the rocks which results in block disintegration

Hots

Is weathering a pre-requisite in the formation of soil?

Facts

The disintegrated rock materials, in due course of time, are weathered further, to form soil. Soil is a mixture of disintegrated rock material and decayed organic matter called humus.

Chemical Weathering

Disintegration and decomposition of rocks due to chemical reactions is called Chemical Weathering. This is predominantly high in the hot and humid regions such as the equatorial, tropical and sub tropical zones. Chemical weathering takes place through the processes of **oxidation, carbonation, solution,** and **hydration.** The agents of Chemical weathering are Oxygen, Carbon-dioxide, Hydrogen and water.

Oxidation

Oxygen in the atmosphere reacts with the iron found in rocks, thus leads to the formation of iron oxide.This process similar to the rusting of iron, pressure of air and water is known as oxidation, which results in the weakening of rocks.

Carbonation

Carbonation is the mixing of water with the atmospheric carbon-dioxide, forming carbonic acid. Carbonation is important in the formation of caves, in limestone region. When the carbonic acid reacts with the carbonate rocks, the rocks get disintegrated.

Solution

The process of dissolution of rock substances in water result in the loosening of the rock particles. This inturn breaks down the rocks.

Hydration

Absorption of water into the mineral structure, certain chemicals in the rock enlarge in size in humid conditions. These minerals found in the rock swell and this results in the development of cracks and the

rock wears down. This type of weathering is called hydration.

Biological Weathering

Biological weathering occurs due to the penetration and expansion of plant roots, earthworms, burrowing animals (rabbits, rats) and some human activities.

2.2 Gradation

Gradation is the process of levelling of the land by means of natural agents like rivers, ground water, winds, glaciers, and sea waves. These agents produce various gradational relief features in due course of time. Gradation takes place in two ways: **degradation** and **aggradation**

Gradation or Denudation is the levelling wearing down of the land surface by various natural agents.

Aggradation is building up of landforms due to natural agents.

Degradation is eroding of land surface

Gradation = Erosion + Transportation + Deposition

Agents of Gradation

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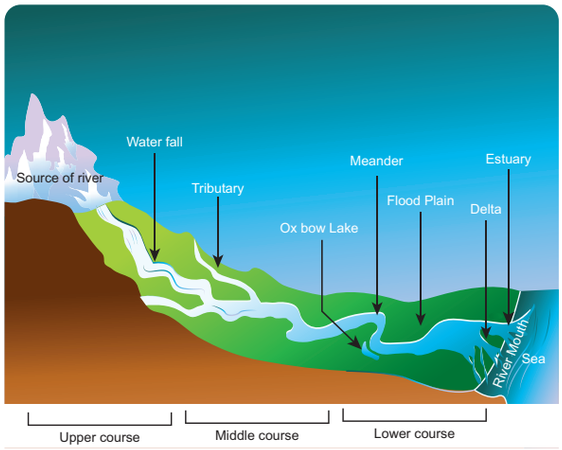
Running water (River) -(Fluvial Land forms)

The work of running water (rivers) is the most extensive among all the other agents of gradation. Rivers originate on higher landforms like, mountains, hills and plateaus that receive water from various sources like the rain, glaciers, springs, lakes, etc.The place where the river originates is called its source and where it joins the sea is known as its mouth.



Courses of River:

Rivers generally originate from mountains and end in a sea or lake. The whole path that a river flows through is called its course. The course of a river is divided into:

i. The upper course

ii. The middle course and

iii. The lower course

i. The Upper Course

Erosion is the most dominant action of river in the upper course. In this course, a river usually tumbles down the steep mountain slopes. The steep gradient increases the velocity and the river channel performs erosion with great force to widen and deepen its valley. The land features carved by a river in its upper course are **V-shaped valleys, gorges, canyons, rapids, pot holes, spurs, and waterfalls.**

ii. The Middle Course-

The river enters the plain in its middle course. The volume of water increases with the confluence of many tributaries and thus increases the load of the river. Thus, the predominant action of a river is **transportation**. Deposition also occurs due to the sudden decrease in velocity. The river in the middle course develops some typical landforms like **alluvial fans, flood plains, meanders, ox-bow lakes** etc.,

iii. The Lower course

The river, moving downstream across a broad, level plain is loaded with debris, brought down from its upper and middle courses. Large deposits of sediments are found at the level bed and the river, splits into a number of channels called distributaries. The main work of the river here is **deposition** and it develops typical landforms like **delta and estuary.**

- **Tributary** – Small streams that join the main river. Eg. River Bhavani
- **Distributary** – River channels that get separated from the main river. E.g., River Kollidam.

Erosional Landforms of River

Gorges and Canyons:

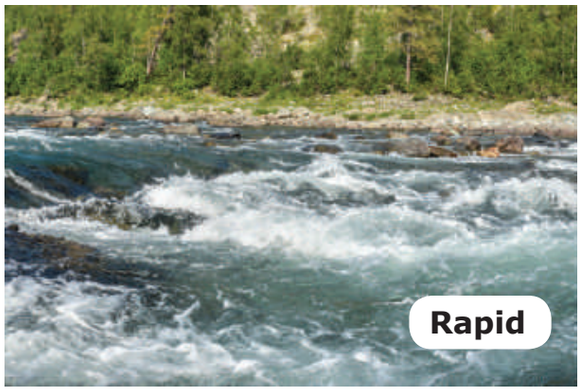
When the river flows through a mountainous region made up of hard rocks, it forms a valley with almost vertical sides called gorge. In India, deep gorges have been formed by Brahmaputra and Indus in the Himalayas.

A deep gorge with steep sides that runs for hundreds of kilometres is referred to as canyon e.g. Grand Canyon of the river Colorado in the U.S.A.

Waterfall

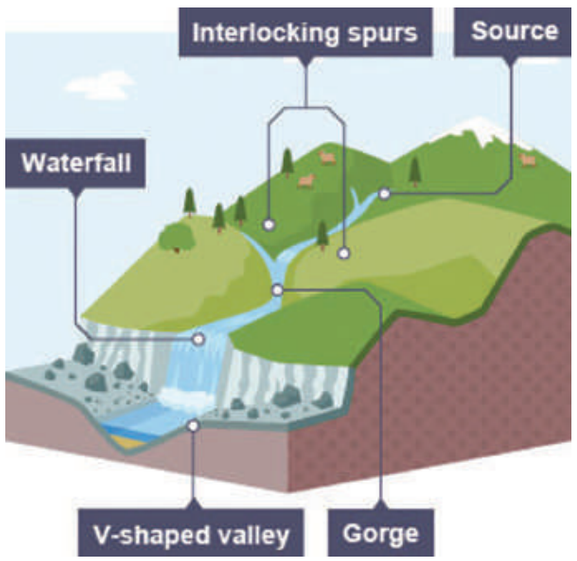
When a river flows in a region where hard rocks lie over soft rocks horizontally, the soft rocks get eroded quickly and the hard rocks projects outwards. Thus, the river falls vertically from a steep slope to form a **waterfall**. When the water falls with great force, it erodes the rock material beneath and creates a depression called a **plunge pool**. Shallow fast flowing water in a stream is called a **rapid** or **river jumps**

The highest waterfalls in the world is Angel falls (979 m) in Venezuela.



V-shaped valley

A 'V'- shaped valley is formed by the vertical erosion of the river where the valley is deepened and widened.



Pot hole

Due to the river action, cylindrical holes are drilled vertically in the river bed, with varying depth and diametre. These are called **pot holes**.

Meander

As the river loaded with debris flows slowly, it forms sweeping loops and bends. It is referred to as meanders.

Ox bow lake

Meanders in due course of time become almost a complete circle with narrow necks. This in turn gets abandoned and forms a lake. This is called an Ox-bow lake.

The world's largest oxbow lake is Lake Chicot is Arkansas of USA. Lake Kanwar in Bihar (India) is Asia's largest fresh water ox bow lake.

Depositional Landforms of River

Alluvial Fan

A fan shaped deposition made by the river at the foothills is called an alluvial plain

Flood Plain

Fine sediments are deposited on river banks when a river floods. These sediments make the region rich and fertile. This is called a flood plain. As the height of the river banks gets increases due to continuous deposition of a flooded river, levees are formed.

Estuary: Estuary is formed where the rives meets the sea. Deposition of silt by the river is not possible here in the estuaries like delta as if the waves keep on eroding the deposits. Ex. River Narmada and Tapti.

Delta

A triangular shaped low lying area formed by the river at its mouth is called delta.
Deltas have fine deposits of sediments enriched with minerals. Eg. Cauvery Delta, Tamil Nadu.

Facts

The Greek letter (△)pronounced delta closely resembles the triangular delta of the river Nile. The Ganga-Brahmaputra Delta is the largest delta in the world.

The world's best known geyser is the Old Faithful geyser in the Yellowstone National Park in Wyoming, U.S.A

As an agent of gradation, underground water creates distinct landforms in lime-stone regions called Karst Topography.

Karst Topography

Ground water is an active agent in limestone regions. Karst topography is formed due to the dissolution of soluble rocks such as limestone, dolomite and gypsum.

FEWL6R

Limestone topography of Western Slovenia extends for a distance of 480 km in length and 80 km in width which is termed as Karst in the Slavic language. The world's largest karst area is the Nullarbar located on the Great Australian Coast.

Karst regions are also found in Southern France, Spain, Mexico, Jamaica, Western Cuba, Central New Guinea, Sri Lanka and Myanmar.

Facts

Karst Areas in India

Guptadham caves - Western Bihar, Robert cave and Tapkeshwar temple - Uttarakhand. Pandav caves Pachmari - Madhya Pradesh, Kutumsar - Bastar district in Chattisgarh, Borra caves of Visakhapatnam - Andhra Pradesh

Erosional Landforms of Underground Water

Most of erosion takes place due to the process of solution. When rain water mixes with carbon-di- oxide and enters into a limestone region, it dissolves and destroys much of the limestone. As a result, landforms such as **Terra rossa, Lappies, sinkholes, swallow holes, dolines, uvalas, poljes, caves and caverns are formed**.

Terra Rossa (Italian term for Red soil)

Deposition of red clay soil on the surface of the Earth is due to the dissolution of limestone content in rocks. The redness of the soil is due to the presence of iron oxide.

Lappies

When the joints of limestone rocks are corrugated by groundwater, long furrows are formed and these are called LAPPIES.

Sinkhole

A funnel shaped depressions formed due to dissolution of limestone rock is called sinkholes. Their average depth ranges between three and nine meters

The World's deepest sinkhole is China's xianozhai Tienkang at 2172 feet. There are as many as 15000 Sinkholes in Illinois

Activity

Take a trough filled with sand. empty a portion of sand in the middle and fill it with sugar. Now level the sand over the sugar. Pour water into the trough and observe what happens. The sugar dissolves and forms a depression. This is similar to the formation of sinkhole.

Caves and Caverns

Caves and caverns are subterranean features of karst topography. Caves are hollows that are formed by the dissolution of limestone rocks when carbon di oxide in air turns into carbonic acid after its reaction with water. They vary in size and shape. Caverns are the caves with irregular floors. Eg. Guptadham caves in Western Bihar.

All types of deposits in the caves and caverns are collectively called **speleothems** which **includes travertines, tufa, dripstones**.

Swallow Holes, Uvalas, Dolines, Poljis are other erossional Features of karst regions predominant in other parts of the world.


cave

Facts

Cave insects lose their senses of sight and develop extraordinary long antenna to compensate the loss of sight

Depositional Landforms of Underground Water

It is interesting to know that a variety of depositional features are formed on the floor, ceiling and walls of the caves and caverns of the Karst Topography.

Stalactite, Stalagmite and Column

When the water containing dissolved calcite gradually drips from the ceiling of the caves, water evaporates and the remaining calcite hangs from the ceiling. Thus **Stalactites** are formed. When the calcite deposits rises upward like a pillar **Stalagmites** are formed. Sometimes, Stalactites and Stalagmites meet together to form **Columns or Pillars**.

Glaciers:

A Glacier is a large mass of ice that moves slowly over the land, from its place of accumulation. It is also known as 'River of ice'. The place of accumulation is called snowfield. **The height above which there is a permanent snow cover in the higher altitude or latitude is called snowline.** Higher the latitude, lower the snowline from sea level.

FF6H8E

Hots

Snowline of Alps is 2700 metre where as the snowline of Greenland is just 600 metre. Find out the reason.

Activity

Fake Snow

Materials needed:-Cup of Baking Soda, Shaving Cream

Method:-Pour one cup of baking soda,

Spray the shaving cream

The snow will start forming almost immediately..

The gradual transformation of snow into granular ice is called 'firn' or ' neve' and finally it becomes solid glacial ice.

Erosional Landforms of Glacier

Glaciers are powerful erosive agents. Some of the important erosional landforms are

Cirque, Aretes, Matterhorn, U-shaped valley, Hanging valley, Fiords etc., Most of these glacial features are predominantly seen in countries like Switzerland, Norway etc.,

Cirque

The glacier erodes the steep side walls of the mountain and forms a **bowl-shaped armchair like depression**, it is termed as Cirque

Arete

Aretes are narrow ridges formed when two cirque walls joined together back to back, and forms narrow knife like ridges.

Pyramidal Peak

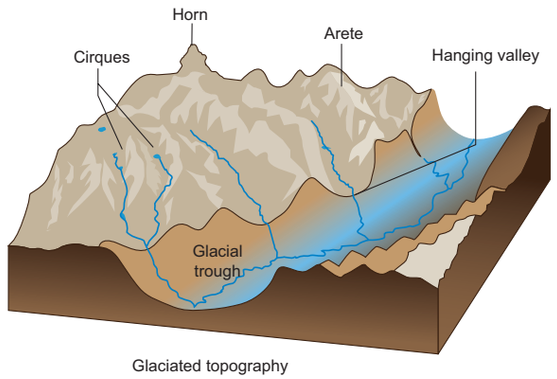
The pyramidal peaks formed when three or more cirques meet together (eg) **Matterhorns.**

U-Shaped Valley

When the glacier moves down along a river valley, the valley further gets eroded deep and wide to form a 'U' shaped valley.

Hanging Valley

These are valleys eroded by tributary glacier and that hangs over the main valley.



Glaciated topography

Fjord

Fjords are glacial valleys that are partly submerged in the sea.

Depositional Landforms of glacier

After getting eroded, fragments of rocks and boulders along with dirt form **glacial debris**. Glacial debris gets deposited in the low lying areas and form depositional features like **moraines, drumlins, eskers, kames and outwash plains**.

Moraine

Landforms formed by the glacial deposits of valley or continental glaciers are termed as moraines. They are of various shapes and sizes, like ground, terminal and lateral moraines etc

Drumlin(Basket of Egg Topography)

Drumlins are deposits of glacial moraines that resemble giant inverted teaspoons or half cut eggs.

Esker

Long narrow ridges composed of boulders gravel and sand deposited by streams of melting water which run parallel to a glacier are called eskers.

Outwash Plain

An outwash plain consists of glacial sediments deposited by the melting ice at the terminus of a glacier. It appears as an extensive accumulation of sand, gravel and silt.

Activity

Discuss in a small groups about the effects of global warming.

Wind

When air blows horizontally at or near the earth's surface is called wind. The erosional, transportational and depositional action of wind is predominant in arid regions. This is called as Aeolian Process.

Erosional Landforms of wind

Some of the erosional landforms of wind are mushroom rocks, Inselbergs and yardangs.

Mushroom Rock

Rocks are made up of hard and soft layers. When a rock's bottom is soft, the sand-laden winds blow against it and wear it down. By the constant wearing down action of the wind, the bottom gets eroded away to form a mushroom like structure. This is called a **mushroom or pedestal rock**. Such rocks are found near Jodhpur in Rajasthan.

Inselberg

Inselberg is a German term which means an **island mountain**. Certain hard rocks like igneous rocks are more resistant to wind action. Such **isolated residual hills** rising abruptly from their surroundings are termed as inselbergs. Eg. Uluru or Ayers Rock, Australia.

Yardang

In arid regions, certain rocks have hard and soft layers arranged vertically. When winds blow over these rocks, the soft layers get eroded leaving irregular crests. These are called yardangs.

Depositional Landforms of wind

Some of the depositional landforms are sand dunes, barchans and loess.

Sand Dune

In deserts, during sandstorms, wind carries loads of sand. When the speed of wind decreases, huge amount of sand gets deposited. These **mounds or hills of sand** are called sand dunes. There are different types of sand dunes.

Barchan

Barch are isolated, **crescent shaped sand dunes**. They have gentle slopes on the windward side and steep slopes on the leeward side.

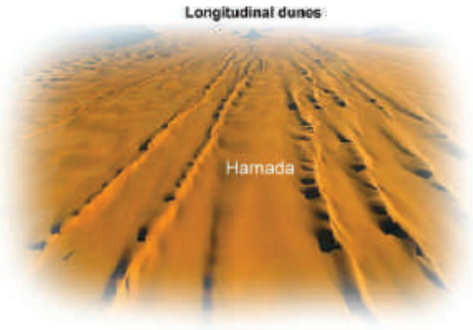
Transverse Dunes

Transverse dunes are asymmetrical in shape. They are formed by alternate slow and fast winds that blow from the same direction.

Longitudinal Dunes(Seif dunes)

Longitudinal dunes are long narrow ridges of sand, which extend in a direction

parallel to the prevailing winds. These dunes are called Seifs in Sahara



Loess

The term loess refers to the deposits of fine silt and porous sand over a vast region. Extensive loess deposits are found in Northern and Western China, the Pampas of Argentina, in Ukraine and in the Mississippi Valley of the United States.

DO YOU KNOW?

The thickest known deposit of loess is, 335 metre found in the loess plateau in China.

Wave

A steady up (crest) and down (trough) movement of surface water are called waves. Sea waves are the most powerful agents of gradation and their erosional, transportational and depositional processes are confined to a very narrow belt along coastal areas.

Erosional Land Forms of Waves

Some of the erosional landforms of sea waves are **sea cliff, sea cave, arch, stack, beach, bar and spit and wave cut platform**.

1. Sea Cliffs

Sea cliffs are steep rock faces formed when sea waves dash against them. The rocks get eroded to form steep vertical walls.

2. Sea Cave

Prolonged wave attack on the base of a cliff erodes rock materials, which result in the formation of **caves**.

3. Sea Arch

When two caves approach one another from either side of a headland and unite, they form an **arch**. (Eg.) Neil Island, Andaman and Nicobar.

4. Sea Stack

Further erosion by waves ultimately leads to the total collapse of the arch. The seaward portion of the headland will remain as a pillar of rock known as **stack**. Eg the Old man of Hoy in Scotland.

5. Wave Cut Platforms

Flat surface found at the foot of sea cliffs are called as wave cut platforms. Wave cut platform is also referred as wave cut benches terrace.

Depositional Landforms of Waves

Beach

Sand and gravel are moved and deposited by waves along the shore to form **beaches**. This is the most dominant and constructive work of the sea. (Eg.) Juhu beach along Mumbai coast, Puri beach in Odisha and Marina beach in Chennai.

Bar

A bar is an elongated deposit of sand, shingle or mud found in the sea, almost parallel to the shoreline.

Spit

A spit is a ridge or embankment of sediment, attached to the land on one end and terminating in open water on the other end. Spits are common at the mouth of estuaries. Eg. Kakinada spit

Recap

- Levelling of uneven landform is called gradation.
- Weathering is the breaking down of the rocks.
- Physical, chemical and biological are the three types of weathering.
- Running water, glacier, underground water, wind and waves are agents of weathering.
- Soil is the weathered materials covering the earth's surface insitu.

EXERCISE

FFFDA2

I. Choose the best answer:

1. The disintegration or decomposition of rocks is generally called as
   a. weathering b. erosion
   c. transportation d. deposition
2. The process of the levelling up of land by means of natural agents.
   a. aggradation b. degradation
   c. gradation d. none
3. _____ is seen in the lower course of the river.
   a. Rapids b. Alluvial fan
   c. Delta d. Gorges
4. Karst topography is formed due to the action of
   a. Glacier b. Wind
   c. Sea waves d. Ground water.
5. Which one of the following is not a depositional feature of a glacier?
   a. cirque b. Moraines
   c. Drumlins d. Eskers
6. Deposits of fine silt blown by wind is called as
   a. Loess b. Barchans
   c. Hamada d. Ripples
7. Stacks are formed by _____
   a. Wave erosion
   b. River erosion
   c. Glacial erosion
   d. Wind deposion
8. _____ erosion is responsible for the formation of cirque
   a. wind b. glacial
   c. river d. underground water.
9. Which one of the following is a second order land form?
   a. Asia b. Deccan Plateau
   c. Kulu valley d.Marina Beach.

II. Match the following:

1. Distributaries – glacial action
2. Mushroom rock – action of sea wave
3. Eskers – Lower course of river
4. Stalactites – Aeolian process
5. Cliff – karst topography

III. Consider the given statements and choose the right option given below

1. (i). 'I' Shaped valley is an erosional feature of the river
   (ii) 'U' Shaped valley is an erosional feature of the glacier

(iii) 'V' Shaped valley is an erosional feature of the glacier

a. i, ii & iii are right

b. i & ii are right

c. i & iii are right

d. only I is right

2. **Statement I:** Running water is an important agent of gradation

Statement II: The work of the river depends on the slop of land on which if flows

a. Statement I is false II is true

b. Statement I and II are false

c. Statement I is true II is false

d. Statement I and II are true

3. **Statement:** Limestone regions have less underground water.

Reason: Water does not percolate through limestone

a. The statement is right reason is wrong.

b. The statement is wrong Reason is right.

c. The statement and reason are wrong.

d. The statement and reason are right.

IV. Answer in brief:

1. Define weathering.
2. What do you mean by biological weathering?
3. Mention the three courses of a river with any two land forms associated to each course.
4. What are ox-bow lakes?
5. How does a sea cave differ from a sea arch?
6. List out any four karst topographical areas found in India.
7. What do you mean by a hanging valley?
8. Define: a) Moraine b) Drumlin c) Esker.
9. Mention the various features formed by wind erosion.
10. What is a wave cut platform?

V. Give Reasons:

1. Chemical weathering is predominant in hot and humid zones.
2. Silt deposits are less at estuaries than deltas.
3. The snow line is at the sea level in Polar regions.
4. Wind can possibly erode the rocks from all sides.
5. In limestone regions, surface drainage is rarely found.

VI. Distinguish between:

1. Physical and chemical weathering.
2. Delta and Estuary
3. Stalactite and stalagmite.
4. Longitudinal and Transverse sand dunes.
5. Inselbergs and yardangs
6. Spit and bar.

VII. Answer in Paragraph:

1. Write a note on weathering classify and explain.
2. Explain the erosional landforms formed by underground water.
3. What is a glacier? Explain its types.
4. Describe the depositional work of winds.

VIII. Map Skill:

On the given outline map of the world, mark the following.

1. Any two deltas
2. A Karst region
3. Any two hot and cold deserts

IX HOTS

1. Is wind the only gradational agent in the desert?

2. Underground water is more common in limestone areas than surface run off. Why?

3. The river channels in the lower course are wider than the upper course.

X. Give geographical terms for the following:

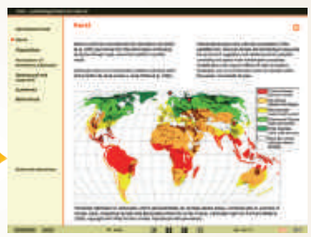
a. Chemical alternation of carbonate rocks on lime stone region.
b. Flat surfaces near cliffs.
c. Erosion + Transportation = Deposition
d. The bottom line of a snow field.

INTERNET RESOURCES

ICT CORNER

Karst Topography

Through this activity you will explore **Karst formation.**



Steps

- Use the URL to reach '**Karst Topography**' page. Allow flash player to play, if it asks.
- Click '**Next**' button in the bottom of the page to proceed to the next page and explore the animation.
- Select '**Dissolution**' option from the left and explore.
- Use the arrow keys to move forward and backward to the animation.

Website URL:

http://folk.uio.no/hanakrem/svalex/E-learning/Karst/

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UNIT 3

Atmosphere

Learning Objectives

- To understand the composition and structure of atmosphere
- To differentiate weather and climate
- To correlate the factors influencing weather and climate
- To recognize the classification of Clouds, wind and rainfall

FFP9BP

Introduction

Earth is a unique planet where life is found. Can you imagine life on the earth without air? No. The air is essential for the survival of all forms of life. The blanket of air that surrounds the Earth is called the atmosphere. It is held close to the earth by gravitational attraction.

3.1 Composition of the Atmosphere

Atmosphere is a mixture of gases, water vapour and dust particles in different proportions. **Nitrogen (78%) and Oxygen (21%)** are permanent gases of the atmosphere. They constitute 99% of the total composition and their percentages always remain the same without any change. The remaining one percentage is occupied by Argon (0.93%), Carbon-di-oxide, (0.03%), Neon (0.0018%), Helium (0.0005%), Ozone (0.00006%) and Hydrogen (0.00005%). Krypton, Xenon and Methane are also present in trace. Water vapour (0 - 0.4%) is also found in the atmosphere, which plays an important role in predicting weather phenomenon. The other solid particles present in the atmosphere includes dust particles, salt particles, pollen grains, smoke, soot, volcanic ashes etc.,.

Fact

In 1772 CE Daniel Rutherford discovered Nitrogen in atmosphere. In 1774 Joseph priestly discovered oxygen in atmosphere

Oxygen is most important for living organisms. CO_2 absorbs heat and keeps the atmosphere warm by insulation and radiation. Nitrogen acts as a diluent and is chemically inactive. Ozone helps in protecting the earth from harmful ultra violet radiation. The solid particles in the atmosphere acts as nuclei on which water vapour condense to form precipitation.

3.2 Structure of the Atmosphere

The atmosphere is thick near the earth surface and thins out until it eventually merges with space. The five atmospheric layers are: Troposphere, stratosphere, Mesosphere, Thermosphere and Exosphere.

Troposphere

The lowest layer of the atmosphere is the troposphere. The Greek word 'tropos' means 'turn' or change. The layer extends up to 8 kms

at the poles and up to 18 kms at the Equator. The temperature decreases with increasing height. Almost all weather phenomenon take place in this layer. Hence it is called **weather making layer.** The upper limit of the troposphere is called as tropopause.

Stratosphere

Stratosphere lies above the troposphere. It extends to a height of about 50km above earth surface. Since this layer is a concentration of ozone molecules, it is also referred as **ozonosphere**. The temperature increases with increase in height in this layer. Large jet planes normally fly here. The upper limit of the stratosphere is called as stratopause.

Mesosphere

Mesosphere extends between 50km and 80km. The temperature decreases with increasing height. Radio waves transmitted from earth are reflected back to earth from this layer. Most of the meteors nearing the earth, get burned here. The upper most limit of the mesosphere is the mesopause.

Thermosphere

Thermosphere exists above the mesosphere. It extends to about 600 km. The composition of gases in the lower thermosphere is more or less uniform, hence it is called "Homosphere". The upper portion of the thermosphere has uneven composition of gases and hence it is referred as "Heterosphere". Here the temperature increases with increasing height. Ionosphere is a layer of the thermosphere that contains Ions and free electrons.

Fact

Magnetosphere lies beyond the exosphere. It is the earth's magnetic belt, where proton and electrons, coming out from the sun are trapped by the earth. The magnetic field extends to around 64,000 km above the Earth.

Exosphere

The uppermost layer of the atmosphere is called exosphere. This layer is extremely rarefied with gases and gradually merges with the outer space. This zone is characterized by **aurora Australis** and **aurora borealis.**

Auroras are cosmic glowing lights produced by a stream of electrons discharged from the Sun's surface due to magnetic storms that are seen as unique multicoloured fireworks hanging in the polar sky during midnight

3.3 Weather and Climate

Weather and climate are the terms that are related to the atmospheric conditions. Weather denotes the way the atmosphere behaves every day and climate reveals the average of weather conditions over relatively long periods of time. The difference between the two may be clearly understood with the following table.

Hots

Why is Troposphere called as weather making layer?

There are many factors that influence weather and climate.

- Distance from the equator
- Altitude
- Nearness to the sea
- Nature of the prevailing winds
- Mountain barrier
- Cloud cover
- Ocean currents
- Natural vegetation

Distance from the Equator

The sun's rays fall vertically on the equator. The rays are inclined on the regions

away from the equator and near the poles due to the spherical shape of the earth. The vertical rays heat up the earth more than the inclined rays. Thus, the places near the equator are warmer than the places which are far away from the equator.

Activity

Connect the following places with their latitudes and the temperature observed

Weather		Climate	
Partly sunny 	1. Weather is the study of atmospheric conditions for short duration over small areas.	1. Climate is the study of the average weather condition observed over a long period of time for a larger area.	Warm Climate 
Windy 	2. The weather changes very often ; hour to hour and day to day	2. Climate is more or less permanent and remains the same always.	Monsoon 
Rainy 	3. A place can experience different types of weather conditions in a day. Eg. A day with hot morning can have a rainy noon.	3. A place can experience almost the same type of climate	Wet climate 
Chilly 	4. Weather data is collected every day in the observatories	4. Climate is average of the weather data.	Extreme Climate 
Stormy 	5. Study of weather is called Meteorology	5. Study of climate is called Climatology	cyclone 

City	Latitude	Temperature [In August]
Kanyakumari – Tamil Nadu		
Delhi-India		
Moscow – Russia		

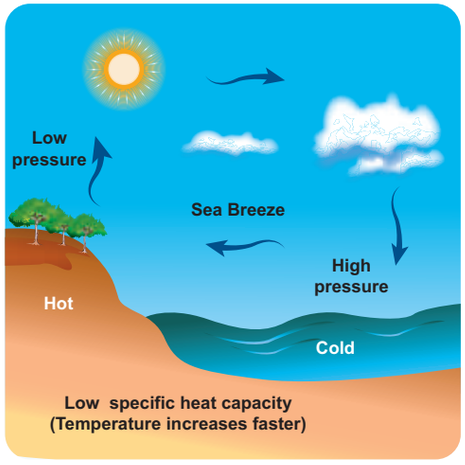
Altitude: Altitude refers to the height above mean sea level. The temperature decreases at the rate of **6.5°C per km of height.** This is called **Normal lapse rate**. So, places at the higher altitude have a lower temperature.

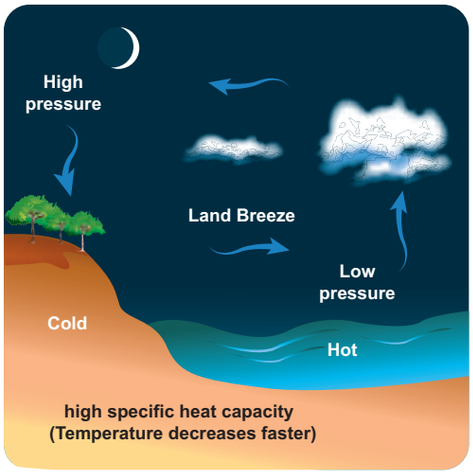
Activity

Connect the following places with Altitude and the temperature

City	Altitude (height)	Tempera-ture [In May]
Madurai-Tamilnadu		
Uthagamandalam – Tamilnadu		
Simla -Himachal Pradesh		

Nearness to the sea:





The climate of a place, varies according to its nearness to the sea. Places near the coast experience equable climate due to the influence of the winds from the sea. Places located inland, far from the sea, does not experience the moderating influence of the sea, such places experience a continental type of climate.

Fact

During the day, the land masses get heated more rapidly than the oceans. Heated air ascends and this causes low pressure on the adjoining ocean. Therefore, the wind blows from ocean to land in the afternoon. This is called sea breeze. **Sea breeze** helps in reducing the temperature of the coastal region especially during the summer season.

During the night, the land cools more rapidly than the ocean. Cold air sinks and forms high pressure. The wind blows from land to sea during the night, this is called **land breeze**.

Nature of the Prevailing Winds

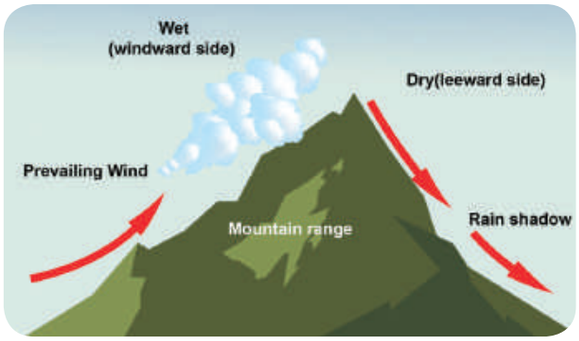
The wind changes the climate of a place based on, from where they blow. When wind blows from a warm region, it makes the place warm and cold, when blows from a colder region. The on-shore winds cause rainfall making the place cool whereas the off-shore winds bring dry weather.

Mountains barriers

The location of the mountains influence the climate of a place. The mountain chains act as natural barrier for the wind. Sometimes they prevent the entry of cold winds into the country or the escape of monsoon winds, thus having a great influence over the climate.

The windward is the side of a mountain which faces the prevailing wind. It receives heavy rainfall.

The **leeward side** of the mountain is the side sheltered from the wind. It receives very less rainfall.



Cloud Cover

Clouds reflect a large amount of radiation from the sun. This prevents the entry of heat to the earth's surface. So, in areas generally of cloudless sky like the deserts, temperature is very high. On the other hand under cloudy sky, the temperature is low.

Ocean currents

The warm ocean currents raise the temperature of the nearby coastal areas, while the cold current lower the temperature of a place.

Natural vegetation

The trees release water vapour into the air and makes it cool. Thus forest areas have lower range of temperature throughout the year in contrast to non-forested areas.

3.4 Winds

The horizontal movement of air along the surface of the earth is called the "**Wind**" while the vertical movement of air is a called an "**Air Current**". The winds always blow from a high pressure area to a low pressure area. Wind is mostly named after the direction from which it blows. For example, the wind blowing from the east is known as the easterly wind or easterlies.

An "**anemometer**" records **wind speed** while a "**wind vane**" measures the **direction of the wind**. The unit of measurement is **kilometre per hour or knots**

Anemometer

Wind vane

Types of Winds

Winds are generally classified into the following four major types:

- Planetary winds
- Periodic winds
- Variable wind
- Local wind

Planetary winds:

The winds which constantly blow in the same direction throughout the year are called the Planetary winds. They are also called as permanent winds or the prevailing winds. These winds include **Trade winds, Westerlies** and **Polar Easterlies**

Trade Winds

Trade winds blow from the subtropical high pressure belt to the Equatorial low pressure belt in both the hemispheres. They blow with great regularity, force and in a constant direction throughout the year. These winds were very helpful to traders who depended on the winds while sailing in the seas. And so, they are named as Trade winds.

Activity

Find the correlation between the Trade Winds and the location of prominent deserts like Sahara, Atacama etc.

Westerlies

Westerlies are the permanent winds that blow from the tropical high pressure belt to the sub polar low pressure belt in both the hemispheres. They blow from South West to North East in the northern hemisphere and North West to South East in the southern

hemisphere. The velocity of westerlies become so vigorous and fast to be called **Roaring Forties** at 40^0, **Furious Fifties** at 50^0 and **Screaming Sixties** at 60^0 latitudes.

Polar Easterlies:

Polar easterlies are cold and dry polar winds that blow from the polar high pressure belt to the sub polar low pressure belt. These are weak winds blowing from North East direction in the Northern Hemisphere and South East direction in the Southern Hemisphere.

Fact

G.G.Coriolis

The rotation of the Earth causes deflection of winds from their original path, called the "Coriolis effect". Winds are deflected to the right in the northen hemisphere and to the left in the southern hemisphere which is known as "Ferrel's law". This was profounded by William Ferrel. He used "Coriolis force" named after G.G Coriolis (1792-1843) for proving Ferrel's Law

Periodic winds

The periodic winds are the seasonal winds that change their direction periodically. These winds are caused by the differential heating of land and ocean.

Winds which reverse their direction with the change of seasons are called monsoons. Tropical Monsoon winds of Indian subcontinent is a best example.

Variable wind

Cyclones

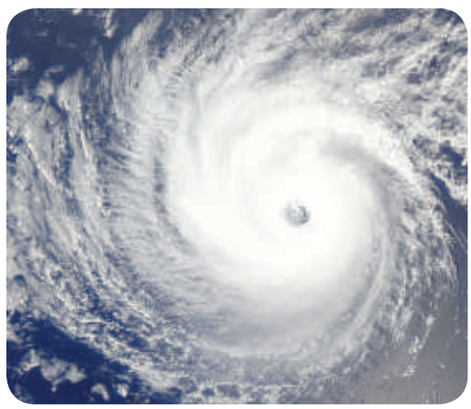
The term cyclone is a Greek word meaning "**coil of a snake**". Cyclones are centres of low pressure where, winds from the surrounding high pressure area converge towards the centre in a spiral form. Due to the rotation of the earth, the cyclonic winds in the northern hemisphere move in anti clock wise direction, where as they move in clockwise direction in the southern hemisphere.

Cyclones can be classified into

Tropical cyclones
Temperate cyclones
Extra tropical cyclones

Tropical cyclones:

Tropical cyclones are known as '**cyclones**' in Indian ocean, '**typhoons**' in the western pacific ocean, '**hurricanes**' in the Atlantic and eastern Pacific ocean, '**baguios**' in Phillipines and '**willy willy**' in Australia, **Taifu** in japan. Tropical cyclones often cause heavy loss of life and property on the coasts and become weak after reaching the landmasses.



Fact

Super Cyclone

A violent cyclone that hit Odisha, on Friday, **29 October 1999**, was one of the most devastating and strongest storm to hit the Indian coast. Winds of up to 260 kph raged for over 36 hours. The winds caused a seven-metre tidal wave that swept more than 20 km inland and brought massive destruction and death to a number of coastal districts in the state of Odisha. It is estimated that more than 10 million people in 12 coastal belt districts were affected by the cyclone. More than 10,000 people lost their lives.

DO YOU KNOW?

Deliberations for naming cyclones in the Indian ocean region began in 2000 and a formula was agreed upon in 2004. Eight countries in the region Bangladesh, India, Maldives, Myanmar, Oman, Pakistan, Srilanka, and Thailand contributed a set of names which our assigned sequentially whenever a cyclonic storm develops.

Temperate cyclones:

Temperate cyclones are formed along a front where hot and cold air masses meet in mid-latitudes between 35° and 65°N and S. Temperate cyclones do not become weak like the tropical cyclones on reaching the land. Temperate cyclone commonly occurs over the North Atlantic Ocean, North West Europe, Mediterranean basin. Mediterranean basin's temperate cyclones extend up to Russia and India in winter. In India it is as called western disturbances.

A front is the boundary separating warm and cold air masses. One type of airmass is usually denser than the other, with different temperatures and humidity. This meeting of airmass causes rain, snowfall, hail storm, thunder storm, lightining cold days, hot days, and windy days.

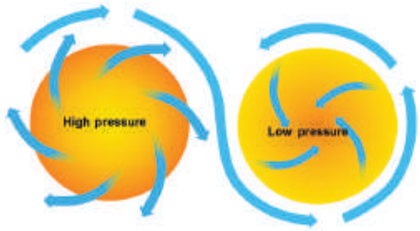
Extra tropical cyclones:

Extra tropical cyclones occur in the latitudes between 30° and 60° in both the hemispheres. They are also called as **mid-latitude cyclones**. They collect energy from temperature differences which are found in higher latitudes. Extra tropical cyclones produce mild showers to heavy gales, thunderstorms, blizzards, and tornadoes.

Hots

Cuddalore and Nagapattinam are always affected by cyclones. Why?

Anticyclone and Cyclone



Anticyclones:

Anticyclones are the opposite of cyclones. Here an area of high pressure region is found in the centre surrounded by low pressure on all sides. The wind from the high pressure region move outwards to the low pressure regions in a spiral form. Anticyclones are often accompanied by cold and heat waves.

Local Winds:

Local winds are the winds that blow only in a particular locality for a short period of time, The effect of these local winds are experienced only in that particular area.

Such as land and sea breeze, mountain and valley breeze. They are mostly seasonal and have local names like....

- Foehn (Alps-Europe)
- Sirocco (North coast of Africa)
- Chinook (Rockies-North America)
- Loo (Thar Desert- India)
- Mistral (Mediterranean sea in France)
- Bora (Mediterranean sea in Italy)

3.5 Clouds

According to their height, clouds are classified into the following types

- High clouds (6-20km Height)
- Middle clouds (2.5km-6km Height)
- Low clouds (ground surface to 25km height)

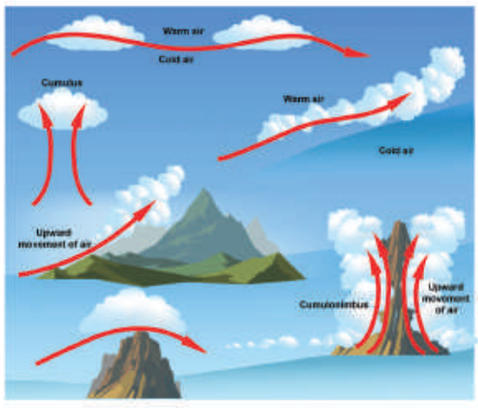
These major types of clouds are further divided into different types on the basis of shape and structure.

High clouds

Cirrus: Detached clouds in the form of white delicate fibrous silky filaments formed at the high sky (8000 meters to 12000 meters) are called Cirrus clouds. These clouds have Ice crystals and are dry and do not give rainfall.

Cirro-cumulus: White patched, sheet or layer like clouds composed of ice crystals.

Cirro-stratus: Smooth milky transparent whitish clouds composed of tiny ice crystals.



DO YOU KNOW?

During sunset cirrus clouds look colourful hence they are called as "Mare's Tails".

Middle clouds

Alto-stratus: Thin sheets of grey or blue coloured clouds in uniform appearance. consisting of frozen water droplets

Alto-cumulus: clouds fitted closely together in parallel bands, called as 'Sheep clouds' or wool pack clouds.

Nimbo stratus: These are clouds of dark colour very close to the ground surface associated with rain, snow or sleet.

DO YOU KNOW?

The only sphere which contains all clouds in the atmosphere is troposphere

Low clouds

Strato-cumulus:- Grey or whitish layer of non-fibrous low clouds found in rounded patches at an height of 2500 to 3000 metres, associated with fair or clear weather

Stratus:- Dense, low lying fog-like clouds associated with rain or snow

Cumulus:- Dome-shaped with a flat base often resembling a cauliflower, associated with fair weather

Cumulo-nimbus:- Fluffy thick towering thunderstorm cloud capable of producing heavy rain, snow, hailstorm or tornadoes

Precipitation

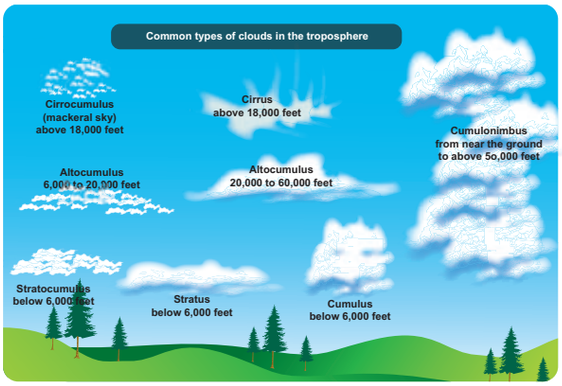
Falling down of condensed water vapour in different forms is called Precipitation. When the dew point is reached in the cloud water droplets become saturated and start to fall. Hence, they fall on the earth as Precipitation.

The climatic conditions/ factors influencing the forms of precipitation mainly are:

- Temperature.
- Altitude
- Cloud type.
- Atmospheric conditions.
- Precipitation process.

The main forms of precipitation include **drizzle, rain, sleet, snow, hail etc.**

Drizzle



Falling of numerous uniform minute droplets of water with diameter of less than 0.5 mm is called drizzle from low clouds. Sometimes drizzles are combined with fog and hence reduce visibility.

Rain

Rain is the most widespread and important form of precipitation in places having temperature above the freezing point. It occurs only when there is abundant moisture in the air. The diameter of a rain drop is more than 5mm.

Sleet

Sleet refers to a precipitation, in the form of pellets made up of transparent and translucent ice. This precipitation is a mixture of snow and rain

Snow

Snow is formed when condensation occurs below freezing point. It is the precipitation of opaque and semi opaque ice crystals. When these ice crystals collide and stick together, it becomes snowflakes.

Hails

Hails are chunks of ice (greater than 2cm in diameter) falling from the sky, during a rainstorm or thunderstorm. **Hailstones** are a form of solid precipitation where small pieces of ice fall downwards. These are destructive and dreaded forms of solid precipitation because they destroy agricultural crops and human lives.

Fact

Any thunderstorm which is associated with fall of hail stones is known as hailstorm. Hailstorm is one of the most feared weather phenomenon because it has the potential to destroy plant, trees, crops, animals and human life.

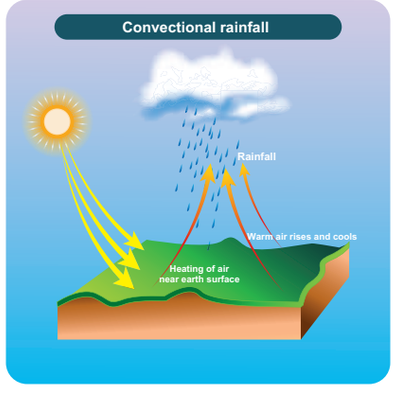
3.6 Rainfall

Rainfall is the most predominant type of Precipitation. Moisture laden air masses raise upwards, forms clouds and bring rainfall. Based on the mechanisms of raising the air, there are three types of rainfall.

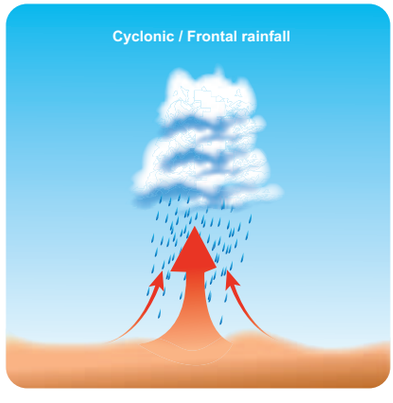
1. Convectional rainfall
2. Frontal or cyclonic rainfall
3. Orographic rainfall.

1. Convectional rainfall (or) 4'o' Clock rainfall

Earth surface is intensely heated through solar radiation during the day time. When the air near the earth surface is heated, it rises and expands. This heating results is the formation of **convectional air currents**. Thus the ascending moist air cools, condenses and results in convectional rainfall. **Convectional rainfall** occurs regularly in the equatorial region in the evenings. It is also experienced in tropical, sub-tropical and temperate regions in the summer months and on warmer days.

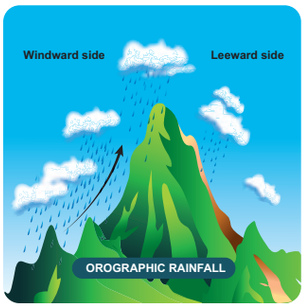


2. Cyclonic rainfall (or) Frontal



Cyclonic precipitation occurs during cyclones when air masses are made to converge and move upward so that adiabatic cooling occurs. Cyclonic rainfall occurs in tropical as well as temperate regions. When warm and cold air masses converge, condensation and precipitation takes place on the boundary between warm and cold air masses called as Frontal rainfall.

3.Orographic rainfall (or) Relief rainfall



Orographic rainfall, also called relief rainfall, is caused when air is forced to rise against a high mountain. The mountain barriers lying across the direction of air flow, forces the moisture laden air to rise along the mountain slope. This results in the cooling of the air, which leads to the formation of clouds and rain.

This rainfall is called Orographic rainfall. The side of the mountain facing the wind is called the **windward side** and receives heavy rainfall. It is called the rainfed region. The other side of the mountain that does not face the wind is called the **leeward side** and receives less rainfall becomes rain shadow region.

DO YOU KNOW?

Mawsynram is the wettest place of India as it is located in the windward side of the Purvachal hills, whereas Shillong lies on the leeward side and thus receives less rainfall. This is the same, in the case of Mumbai and Pune.

3.7 Humidity

Humidity is an important aspect of the atmosphere because it affects both weather and climate. The amount of water vapour present in the atmosphere is referred to as humidity. Humidity of the atmosphere is high when it has large quantities of water vapour. The amount of water vapour in the atmosphere is called absolute humidity.

DO YOU KNOW?

When the relative humidity of the air is 100%, the air is said to be saturated. Saturated air will not absorb any more water vapour.

The temperature at which air gets saturated is called **dew point**.

Humidity of the atmosphere is measured by the wet and dry bulb thermometer also called the **Hygrometer**

Absolute humidity is expressed in terms of grams of water vapour present per cubic metre of air. Relative humidity is expressed in percentage.

Recap

- Atmosphere is a thin layer of gases that surrounds the earth.
- The major gases in the atmosphere are Nitrogen (78%) and oxygen (21%)
- Five Layers of the atmosphere are Troposphere, stratosphere, mesosphere, thermosphere and exosphere
- Atmosphere gets heated through conduction.
- Wind is the horizontal movement of air
- Wind blows from high pressure belt to low pressure belt.
- The 4 types of winds are permanent (planetary), periodic, local and variable winds.
- Cyclone is an area of low pressure surrounded by high pressure
- Anticyclone is an area of high pressure area surrounded by low pressure.
- Clouds: A visible mass of Condensed water vapour floating in the air
- All precipitation occurs from clouds
- According to height clouds are classified into High clouds, Middle clouds and low-clouds
- The main forms of precipitation are drizzle, rain, snow, sleet, hail etc.

EXERCISE

J1WER6

I. Choose The Best Answers:

1. _____is the most important gas for the survival of living organisms.
   a. Helium b. carbon-di-oxide
   c. oxygen d. methane
2. The lowest layer of the atmosphere is _____
   a. Troposphere b. Stratosphere
   c. Exosphere d. Mesosphere
3. _____ reflects radio waves.
   a. Exosphere b. Ionosphere
   c. Mesosphere d. Stratosphere
4. The average global surface temperature is _____
   a. 12°c b. 13°c
   c. 14°c d. 15°c
5. The process of change of state of water from gaseous to liquid state is called ___
   a. Precipitation b. evaporation
   c. transpiration d. condensation.
6. The _____ is the chief energy source of the Earth.
   a. Sun b. Moon
   c. Stars d. Clouds.
7. All types of clouds are found in the _____
   a. Troposphere b. Ionosphere
   c. Mesosphere d. Exosphere
8. _____ clouds are called 'Sheep clouds'
   a. Alto-cumulus b. Alto-Stratus
   c. Nimbo - stratus d. Cirro-stratus.
9. The Monsoons are _____
   a. Prevailing winds
   b. Periodic winds
   c. local winds
   d. none of the above.
10. Dew in the form of ice crystals is called _____
    a. frost b. fog
    c. mist d. sleet.
11. _____ is called the eye of the storm/ cyclone.
    a. Pressure b. wind
    c. cyclones d. snow.
12. The vertical movement of air is called
    a. Wind b. storm
    c. Air current d. drift.

II. Match the following:

1. Meteorology — wind speed
2. Climatology — direction of wind
3. Anemometer — cirrus
4. Wind Vane — study of climate
5. Mare's Tail — study of weather
6. Leeward side — Australia
7. Willy willy — rain shadow region

III. Answer the following Briefly:

1. Define atmosphere
2. Name the different atmospheric layers
3. Mention the factors that affect the climate?
4. Write short note on Lapse rate.
5. What are the processes responsible for heating the atmosphere?
6. Mention the Planetary wind system of the earth.
7. Write short note on:
   a. Trade winds.
   b. Roaring Forties
8. How are clouds formed?
9. What are the different types of rainfall?
10. What is Precipitation? What are the different forms of precipitation?
11. Write short notes on:
    a. drizzle b. rain
    c. sleet d. snow
    e. heat
12. How are Cyclones classified?

IV. Give reason:

1. Cyclones cause huge loss of life and property.
2. Cloudy days are warmer than cloudless days.
3. Fog is dangerous for traffic.
4. Convectional rainfall is also called 4'0 clock rain.
5. Polar Easterlies are cold and dry. Why it is so?

V. Distinguish between the following:

1. Weather and climate
2. Land breeze and sea breeze
3. Windward side and Leeward side.
4. Tropical cyclone and Temperate cyclones.

VI. Paragraph Questions:

1. Write a paragraph about the structure of the atmosphere.
2. Explain the different types of Permanent winds.
3. How are clouds classified? Explain them.
4. How are cyclones formed? How are they classified?
5. Explain the different forms of precipitation

VII. Activity:

1. **Preparing chart of** clouds at various atmospheric layers.
2. **Collecting Proverbs** clouds and rain related Proverbs
3. **Poem on** 'clouds', 'rain'
4. **Report writing** observe the clouds for a week. Write your report about the shape and colours ofclouds.
5. **Working models** a) Rain Gauge b)Wind vane
6. **Preparing bar diagram**

   Collect the **data of temperature** of Kanyakumari, Delhi, Allahabad, and Itanagar for a day.Also collect the data of **rainfall received** by Jaisalmer (Rajasthan), Mawsynram (Meghalaya), Nagapattinam, Coimbatore for a day.
7. **Become a budding Meterologist:**

   Record the local weather condition of your place for a week.

ICT CORNER Melting point

Through this activity you will observe the land forms formed by glaciers.

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Steps

1. Use the URL to download the '**Glaciers**' flash file.
2. Select the '**Glacier type**' from bottom and change them using arrows to see the different land forms affected by it.
3. Select '**Anatomy of Glaciers**' from top of the page and animate the activity to observe the glacier formation.
4. Select '**Glacier Erosion**' and press '**Move Glacier**' button to observe erosion made by glaciers.

UNIT 4

Hydrosphere

Learning Objectives

- To understand the importance of water
- To know about fresh water
- To know about the relief features of the ocean floor
- To recognize the movements of ocean water
- To understand marine resources and the need for conservation

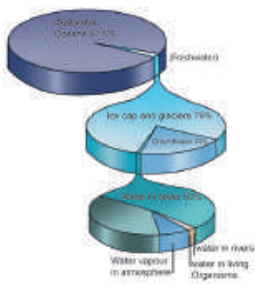
BXIH3C

Introduction

We know that, our planet Earth consists of **four spheres**. They are the **Lithosphere**, **Atmosphere, Hydrosphere** and **Biosphere**. In the earlier chapters, we have studied about the Lithosphere and Atmosphere. We shall now learn the other two spheres namely the Hydrosphere and the Biosphere.

4.1 Hydrosphere

One of the most indispensable natural resources on earth is water. The Earth is also called the **Blue planet**, as it holds water in abundance and thus stands unique among all other planets. Hydrosphere consists of water in various forms found on the earth. Over 97% of the water on the Earth's surface is confined to oceans. Less than 3% of water is held on land as glaciers, ice caps, groundwater, rivers, lakes, and also as the water vapour in air.



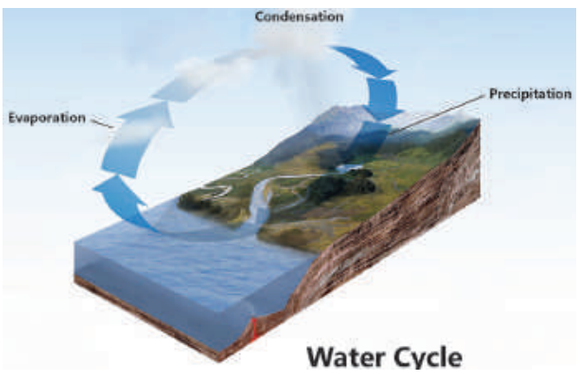
Global Distribution of Water Resource

4.2 Hydrological Cycle

BXSD4Z

The Earth's water is not static. It is always in motion. This continuous movement of water on, above and below the earth's surface is called the Hydrological Cycle. The **three major processes** involved in the water cycle are **evaporation, condensation and precipitation**. Water changes its form constantly i.e. Ice, water and water vapour. This process happens in the blink of an eye or even over millions of years.

Water resources of the Earth can be broadly divided into **fresh water** and **salt water.**



Water Cycle

4.3 Fresh Water

Rain water is considered to be the purest form of water, as it contains very less proportion of salts when compared to the oceans and seas. Hence it is called fresh water. A major part of fresh water is found in the frozen state in the form of ice caps and glaciers. Around 1% of it is found in the liquid state as rivers, streams, lakes, ponds etc. Surface water may also penetrate through porous rocks and gets collected beneath the Earth's surface. This is called groundwater.

Fact

Finland is known as the land of thousand lakes. There are 1,87,888 lakes in Finland.

Water table is a level below the ground, where water is found collected beneath the Earth's surface.

Aquifers are porous rock strata filled with water, found below the earth's surface.

4.4 Oceans

The continents and oceans are however, not evenly distributed in the northern and the southern hemispheres. The northern hemisphere holds 61% of land whereas the southern hemisphere holds 81% of water. It is because of this pattern of land and water distribution, the **northern hemisphere** is called as the **land hemisphere** and the **southern hemisphere** is called as the **water hemisphere.**

Hots

- **71% of the earth is covered by water, but very little can be used by humans. Why?**
- **The oceans are salty. Why?**

Oceans and seas are considered as resource bowl of the earth because of the immense availability of food, minerals etc., Present distribution of the world's oceans and major seas are illustrated in the map.

Sylvia Earle is a famous American oceanographer . She was named as the first, 'Hero for the Planet' by Time magazine for her efforts towards marine life protections.

Jacques-Yves Cousteau (1910-1997) was a famous French Ocean explorer, who conducted extensive under-sea investigations .

He belonged to the information service of the French Navy, and was sent on missions to Shanghai and Japan (1935–1938) and in the USSR (1939).

Honours

- **Cross of War 1939–1945 (1945)**
- **U.S. Presidential Medal of Freedom (1985)**

4.4.1 Relief Of The Ocean Floor

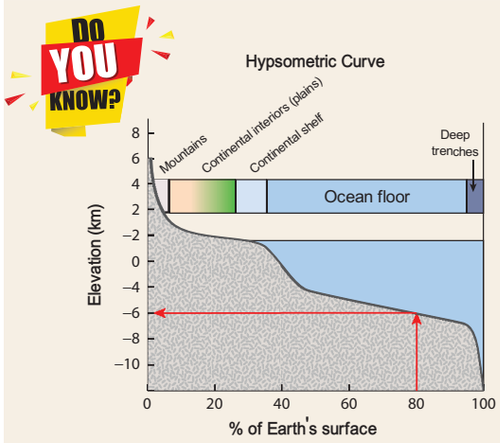
The ocean basins are **characterised by the following major relief features:**

BY296M

(A) Continental shelf
(B) Continental slope
(C) Continental rise
(D) Deep sea plain or Abyssal plain
(E) Oceanic deep
(F) Oceanic ridge

(A) Continental Shelf

A shallow and gently sloping platform extending out from the adjoining continental land mass into the sea is called Continental Shelf. It is almost a uniform zone of sea bed with a gentle gradient.



A Hypsometric Curve is a graphic representation which shows the height of a certain place found on land and the height of ocean features at sea.

'Hypso' means height in Greek.

The continental shelf is of great significance for the following reasons:

- They are shallower, thus enables sunlight to penetrate through the water. This encourages abundant growth of grass, sea weeds and plankton. Hence these zones become the **richest fishing grounds** in the world. Eg. The **Grand Banks of Newfoundland**.
- The continental shelves have extensive deposits of minerals and mineral fuels. Hence, this zone becomes accessible for oil drilling and mining activities. E.g. Mumbai High in Arabian Sea.

Geo Connect

ONGC: Oil and Natural Gas Corporation is India's largest oil and gas exploration and production company. Its latest estimate is that about 20 million tons of oil reserves are found west of Mumbai High off shore.

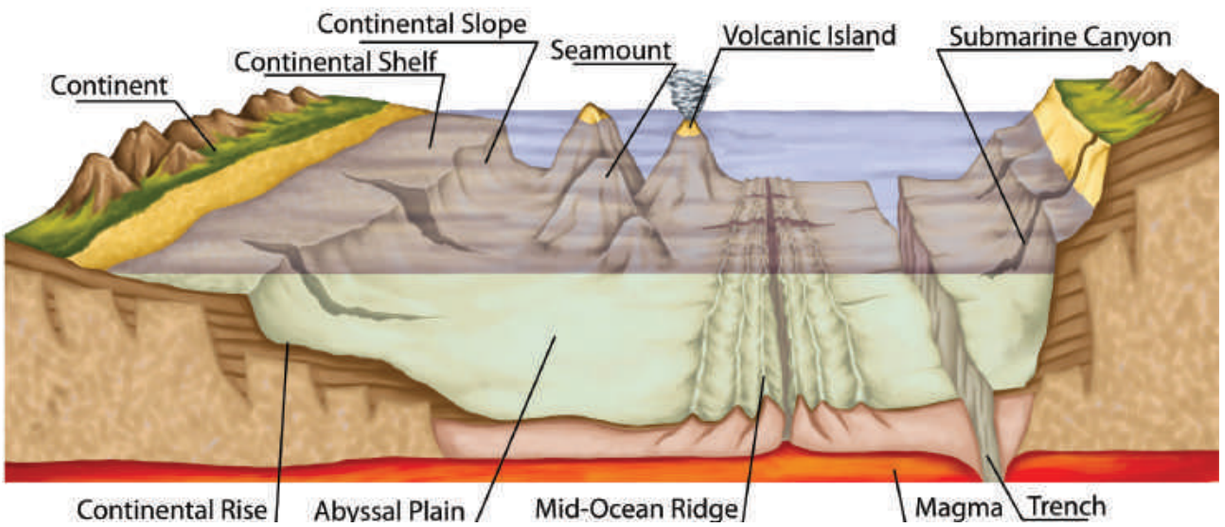
(B) Continental Slope

A steep slope which descends from the edge of the continental shelf to the deep ocean-bed is called continental slope. It forms a boundary between the Continental Crust and the oceanic crust. This zone is free from deposits as they are steep. The most important characteristic of continental slope is the **presence of deep canyons and trenches.** Due to the low penetration of sunlight, the slope has nearly freezing temperature. Hence aquatic life has very slow rate of metabolism.

(C) Continental Rise

At the base of the continental slope is a gently sloping layer of sediments which merge into the deep-sea floor. This underwater feature found between continental slope and abyssal plains is called the continental rise. It **consists of submarine fans** which are similar to the alluvial fans found on land.

Major Relief Features of the Ocean



(D) Deep Sea Plains or Abyssal Plains

The deep sea plains or abyssal plains are underwater plains found on the deep ocean floor. These plains extend from continental rise to the mid oceanic ridges. The gradient of the slope is very gentle and it appears as a uniform flat and featureless plain. These plains are usually covered by the thick layer of sediments composed of clay, silt and sand, brought by the rivers. These are often characterized by features like abyssal hills, sea mounts, guyots, coral, atoll etc.

BYB58A

DO YOU KNOW?

Abyssal plains in the Atlantic and Indian Oceans tend to be extensive than the Pacific Ocean because, majority of the world's largest rivers empty their sediments into either Atlantic or Indian Ocean. E.g. Amazon, Ganga and Brahmaputra rivers.

(E) Oceanic Deeps

Trenches are the deepest part of the oceans and occupy about 7% of the total relief of the ocean floor. The ocean temperature in the trench is slightly cooler than the freezing temperature. As they are sediment free, most **trenches** are V-shaped with steep sides. **Epicentre of the great earthquakes** are all found in the trenches.

DO YOU KNOW?

Dragon Hole is the deepest known underwater sink hole in the world. The local fishermen call it the 'eye' of the South China Sea.

(F) Oceanic Ridge

Oceanic ridge is a continuous submarine mountain chain. They are made of young basaltic rock formed when two tectonic plates moves apart. The mid-ocean ridge is probably the most extensive single feature of the earth's topography. Two of the most well known mid-ocean ridges are the Mid-Atlantic Ridge and the East Pacific Ridge. The Mid-Atlantic Ridge is the largest unbroken oceanic ridge.

DO YOU KNOW?

Fathoms ⇨ A nautical measurement of the depth of water in the ocean.

Isobath ⇨ An imaginary line on a map joining the points of equal depths.

Isohaline ⇨ An imaginary line on a map joining the points of equal salinity in oceans.

Mid Atlantic Ridge

4.4.2 Movement of the Ocean Water

The ocean water is dynamic. Temperature, salinity, density, external forces of the sun, moon and the winds keep the ocean waters in movement, both horizontally and vertically. Waves and currents are in **horizontal motion** while tides have **vertical motion.**

(A) Waves

Of all the movements of the oceans, sea waves are considered to be the strongest. Sea waves are ripples on water caused when winds blow over

the sea. The height of these waves depends on the speed of wind, its duration and the direction from which they blow. Sometimes waves are also caused by tremors felt on the ocean floor. Such waves are quite destructive and called **Tsunami**.

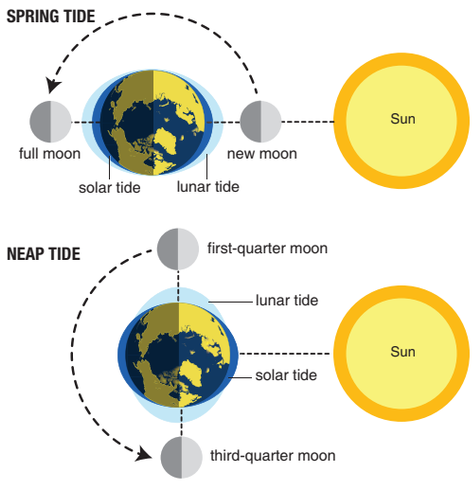
The energy of the falling wave water is used to turn hydro turbines to generate power. Wave energy power plants have been installed at Vizhinjam in Kerala coast and Andaman and Nicobar islands of India.

(B) Tides

The periodic rise and fall of sea water due to the gravitational pull of the sun and moon on earth are called tides. They are classified broadly into **Spring tides** and **Neap tides.**

When **the Sun, Moon and Earth are aligned in the same line**, the collective gravitation pull of the sun and moon on earth's water strengthens to form a high tide known as **spring tide**. Such tides always occur on **full moon** and **new moon days**.

TYPES OF TIDES



When **the sun and the moon are at right angles**, their gravitational forces work against each other, causing a low tide called **neap tide**. A neap tide occurs between two spring tides i.e., twice a month, when **the first and last quarter moon appears**.

Potential tidal energy zones of India are the Gulf of Khambhat, Gulf of Kutch and Sundarbans.

MARITIME BORDERS

Maritime boundary of most the Countries is fixed to be 12 nautical miles from the baseline. This was fixed by the U.N. Convention on the Law of the sea 2013 where as Jordan and Palau have 3 nautical miles as their maritime boundary and Benin, Republic of Congo, EI Salvador, Peru and Somalia have 200 nautical miles.

(C) Ocean Currents

The movement of oceanic water on the surface and at the depths in a definite direction is called ocean current. Ocean currents are in **clockwise motion in the northern hemisphere** and in the **anti-clockwise motion in the southern hemisphere.**

The factors that generate ocean currents are:

- Earth's rotation
- Prevailing winds and
- Differences in temperature and salinity of ocean water.

On the basis of temperature, ocean currents are classified as **warm currents** and **cold currents**. The movement of ocean currents from the low latitudes (tropical zones) towards high latitudes (temperate and polar zones) is called warm current. Eg. Gulf Stream in Atlantic Ocean, North Equatorial Current in Pacific Ocean.

***NIO* (National Institute of Oceanography) was established in 1st January 1966. The headquarters of NIO is located at Dona Paula, Goa. It Conducts research and observations to understand oceanic features, Ocean engineering, marine Archaeology etc.**

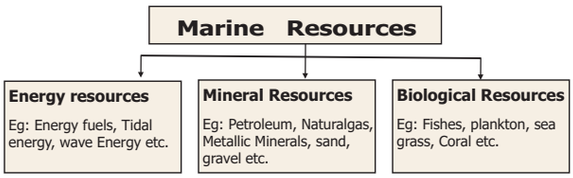
4.5 Marine Resources

The biotic and abiotic resources found in the oceanic water and at the bottoms are called marine resources. The ocean's resources play a vital role in sustaining the needs of society. A diverse array of marine organisms is used for food, medicine, cosmetics, and a wealth of industrial applications. The world's demand for energy, minerals and water have become increasingly dependent on non-living marine resources.

BYK19X

Hots

- What will happen if the seas and oceans contain only fresh water?



4.5.1 Conservation Of Marine Resources

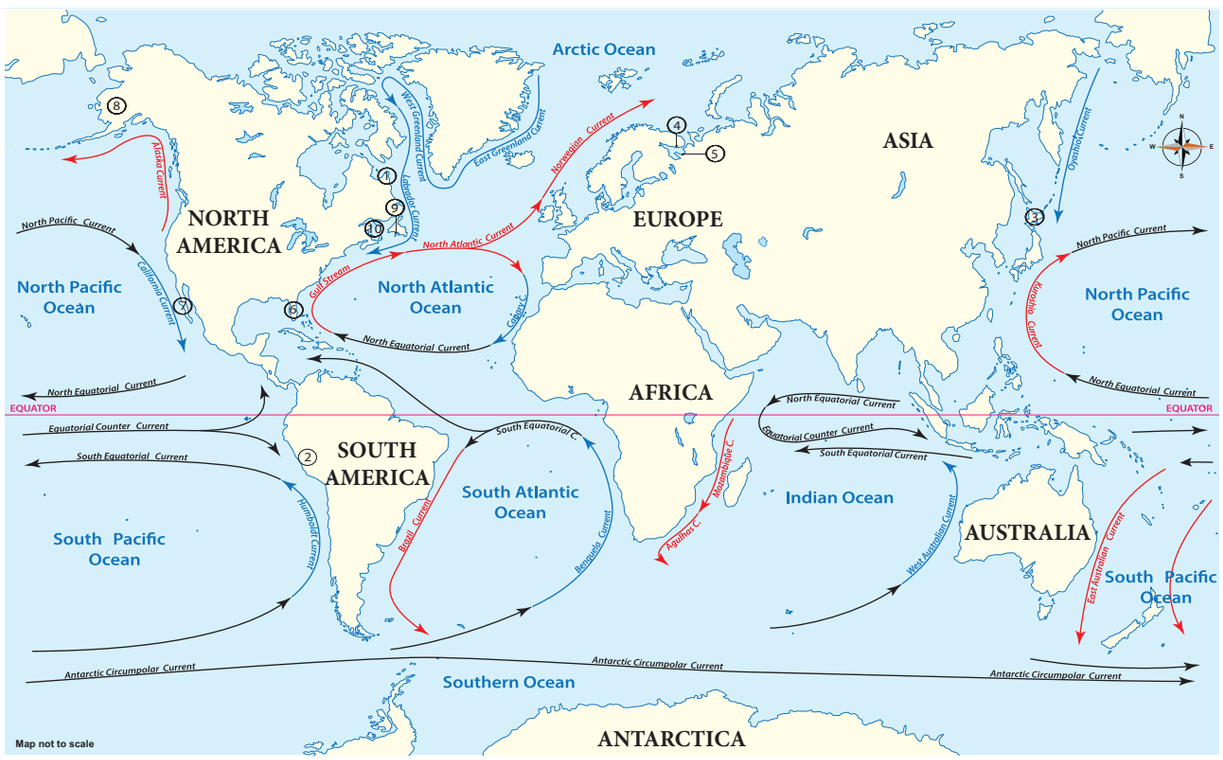
Oceans are the life blood of planet earth and mankind. The humankind depends on the marine resources for its survival. They are also essential for the economic prosperity, social well-being and quality of life. Oceans have extensive deposits of oil reserves. Besides a major fishing ground, it helps in generating non-conventional energy, development of many ports and harbours for trade activities. Coastal tourism also attracts people around the world, thereby contributing to the economy of many countries.

DISTRIBUTION OF MAJOR OCEAN CURRENTS AND EFFECTS

Ocean	Name of the Current	Effects
South Atlantic Ocean	Benguela Current [Cold]	Leads to foggy conditions along the coast of Namibia. Helped in the development of Namibian & Kalahari deserts
North Atlantic Ocean	Canaries [Cold]	Influences the extension of Sahara Desert
	Gulf Stream [Warm]	Its confluence with the Labrador current produces heavy fog along the coast of Newfoundland, obstacles the navigation. Hence, Newfoundland is one of the major fishing grounds of the world.
	North Atlantic Drift [Warm]	It keeps the ports at higher latitudes ice-free throughout the year. Eg. Port of Rorvik (Norway), Murmansk and Severodvinsk (Russia)
	Labrador [Cold]	Its confluence with Gulf Stream creates fog and hinders navigation.
South Pacific Ocean	Peruvian / Humboldt Current [Cold]	Helped in the desertification of the Atacama desert. El-Nino effects the weather in western & S. America. It also affects timely arrival of Indian monsoon

North Pacific Ocean	Kuroshio Current [Warm]	It plays a vital role in carrying large amount of heat to the adjacent land areas and forms cloud cover that cause rainfall.
	Oyashio / Kurile Current [Cold]	Its confluence with the Kuroshio current produces heavy fogs around Hokkaido, which become potential hazards for navigation. Hence, Hokkaido acts as the major fishing ground of the world.
	Alaska Current [Warm]	Keeps the seaports of Alaska open throughout the year.
	California Current [Cold]	Leads to foggy conditions along the coast of California. It helped in the development of Arizona & Sonata deserts.
Indian Ocean	West Australian Current [Cold]	Leads to foggy conditions along the western coast of Australia. It helped in the genesis of west Australian desert.

Major Ocean Currents of the World



1. Labrador
2. Peru
3. Hokkaido
4. Port Murmansk
5. Port Severodvinsk
6. Florida
7. California
8. Alaska
9. Newfoundland
10. Grandbank

Warm current
Cold current

The Great Barrier Reef

The Great Barrier reef is the world's largest coral reef system composed of 2,900 individual reefs and 900 islands stretching for about 2,000 kilometres. It covers an area of about 3,50,000 km. The reef is located in the Coral sea, off the coast of Queensland,Australia. The Great Barrier Reef can be seen from the outer space. This sprawling coral reef system is one of the most biologically diverse places on the planet.Coral reefs are built by billions of tiny organisms, known as Coral polyps.CNN labelled it as one of the seven natural wonders of the world.

Recap

- Hydrosphere, the third sphere of Earth, is a collection of all forms of water on the earth.
- Hydrological cycle is the continuous movement of water on Earth.
- Water is available on Earth as fresh and salt water. Over 97% of the water on the Earth's surface is confined to oceans.
- The five major oceans of the world are the Pacific, the Atlantic, the Indian, the Southern and the Arctic ocean.
- The major relief of the ocean floor are continental shelf, continental slope, continental rise, abyssal plains, ocean deeps and ocean ridges.
- Marine resources are nothing but the biotic and abiotic resources found in the oceans.
- Oceans are the lifelines of Earth and mankind. Hence, they need to be conserved.

The Gangetic Dolphin was declared the National Aquatic Animal in 2010. This has become an endangered species. Are the Dolphins really at risk? If so, list out the reasons.

EXERCISE

BYTWBK

I Choose the correct answer

1. The Sunda Trench lies in the _____ ocean.
   a) Atlantic b) Pacific
   c) Indian d) Antarctic
2. The temperature of the ocean waters generally_____ at greater depth.
   a) increases
   b) decreases
   c) remains constant
   d) none of the above
3. Ocean currents are produced due to _____
   a) due to rotation of earth
   b) due to variation in temperature
   c) due to earth's movement
   d) all the above
4. Consider the following statements.
   1. Most of the fishing grounds occur in areas where the continental shelf is wide.
   2. Fishing is well developed in warm tropical waters.
   3. Mixing of warm and cold currents facilitates plant nutrients for fish.

5. Inland fishing became significant in India.

a) 1 and 2 are correct.
b) 1 and 3 are correct.
c) 2,3 and 4 are correct.
d) 1,2 and 3 are correct

6. The oceanic ridge comes into existence due to

a) convergence of tectonic plates
b) divergence of tectonic plates
c) lateral movements of plates
d) stearing of plates.

7. Which of the following indicates the correct sequence of the topography beneath the surface of the sea?

a) Continental shelf-Continental slope-Sea plain-Sea trench.
b) Continental slope-Continental shelf-Sea plain-Sea trench.
c) Sea plain-Continental slope-Continental shelf-Sea trench.
d) Continental slope-Sea plain-Continental shelf-Sea trench.

8. Which of the following is not correctly matched?

a) Gulf Stream - Pacific Ocean
b) Labrador current - North Atlantic Ocean
c) Canary current - Mediterranean sea
d) Mozambique current - Indian Ocean.

9. The amount of planktons to be found in the ocean is determined by

1. Depth of the water.
2. Ocean currents.
3. Temperature and Salinity.
4. Length of day and night.

a) 1 and 2 are correct
b) 1,2 and 3 are correct
c) 1,3 and 4 are correct
d) All are correct.

II. Questions are of Assertion(A), Reason (R) type.

a) Both A and R are correct and R explains A.
b) Both A and R are correct but R does not explain A.
c) A is correct but R is false.
d) A is false but R is correct

1. **Assertion (A):** Oceans are always shown in blue in maps.

Reason(R): It indicates the natural colour of the oceans.

2. **Assertion(A):** Flat topped seamounts are known as Guyots.

Reason(R): All guyot features are of volcanic origin.

3. **Assertion(A):** Submarine canyons are deep gorges on the ocean floor.

Reason(R): They are mainly restricted to continental shelf, slope and rise

4. **Assertion (A):** Atolls are more common in the Atlantic ocean.

Reason(R): The marine population at the depth is less.

III. Match the following:

1.	Mariana trench	-	Decreases salinity in the oceans
2.	Great Barrier Reef	-	Along the coast of Japan
3.	Sargasso sea	-	Deepest point in the Pacific
4.	Spring tides	-	Australia
5.	Heavy rains	-	Second order landform
6.	Kuroshio current	-	North Atlantic Ocean
7.	Continental slope	-	On full and new moon days

IV. Answer the following in brief:

1. What do you mean by the term Hydrosphere?
2. What is hydrological cycle?
3. Mention the various relief features of ocean floor
4. What are the factors that generate the ocean currents?
5. Write a brief note on sea waves.

V. Give reasons for the following:

1. The northern hemisphere and the southern hemisphere are called land and water hemispheres respectively.
2. Continental shelf provides good fishing ground.

VI. Distinguish the following:

1. Spring tide and Neap tide.
2. Abyssal plains and Ocean deeps.

VII. Answer in a paragraph:

1. Write a paragraph on the origin of oceans.
2. Write a note on continental shelf and continental slope.
3. What do you mean by ocean currents? Explain its types.
4. Explain the influences of the marine resources on mankind.

ICT CORNER

Geography - Hydrosphere

Let us know the names of the earth's spheres by using memory cards

Steps

Step 1: Open the Browser type the URL Link given below (or) Scan the QR Code.

Step 2: You see the Earth's Spheres cards.

Step 3: Click the cards and choose correct Spheres and Examples

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UNIT 5

Biosphere

Learning Objectives

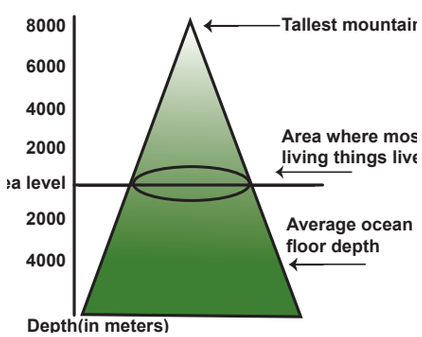
- To understand the scope and meaning of biosphere
- To understand the meaning of ecosystem, its components, functions and biodiversity
- To understand the major biomes of the world
- To know the need for conservation of biomes

BZ3SD8

Introduction

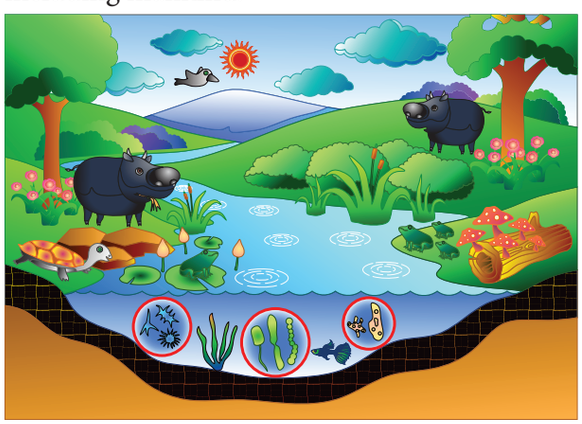
Biosphere, the fourth sphere of the Earth, is a life supporting layer that exists on the earth's surface. This layer on earth encompasses the Lithosphere, Hydrosphere and Atmosphere. It includes flora and fauna that thrive on or near the earth's surface. The vertical range of the biosphere is approximately 20 km, which is measured from the ocean floor to the troposphere. However, most plants and animals live in a very narrow section for about 1 km above and below the Mean Sea Level (MSL). Biosphere is made up of different ecosystems and biomes. All living things, large or small, are grouped into ***species***.The area in which an animal, plant or micro organism lives is called its **habitat**. A wide variety of plants and animals live in a particular habitat known as ***biodiversity.***

VERTICAL RANGE OF BIOSPHERE ON EARTH



5.1 Ecosystem

An ecosystem is a community, where all living organisms live and interact with one another and also with their non-living environment such as land, soil, air, water etc. Ecosystems range in size from the smallest units (Eg: bark of a tree) that can sustain life to the global ecosystem or ecosphere. (Eg: Cropland, Pond ecosystem, Forest ecosystem, Desert ecosystem etc.). Biosphere harbours all ecosystems on the earth and sustains life forms including mankind.



Activity

Narrate the forest ecosystem in your own words.

DO YOU KNOW?

- The branch of science that deals about ecosystem is called ***Ecology.***
- A person who studies ecology is referred to as an ***Ecologist.***

5.1.1 Components of Ecosystem

An ecosystem consists of three basic components, namely

A) Abiotic components
B) Biotic components and
C) Energy component

BZCNEV

A) Abiotic Components

Abiotic components include the non-living, inorganic, physical and chemical factors in the environment. Eg. Land, Air ,Water, Calcium, Iron etc.

B) Biotic Components

Biotic components include plants, animals and micro organisms. Biotic components can be classified into three categories :

- **Producers** are self nourishing components of the ecosystem. Hence they are called **Autotrophs**. They are found both on land and water. Eg. Plants, Algae, Bacteria etc.
- **Consumers** are those that depend on producers, directly or indirectly. Hence they are called **Heterotrophs**.

The common category of consumers are:

- **Primary consumers** depend on producers for their food. They are exclusively herbivores. Eg. zebra, goat etc.
- **Secondary consumers** are small carnivores i.e., they consume herbivores. Eg. lion, snake etc.
- **Tertiary consumers** are top carnivores that prey on both herbivores and carnivores. Eg. owl, crocodile etc.
- **Decomposers** are some organisms that are incapable of preparing its own food. They live on dead and decaying plants and animals. Hence they are called **Saprotrophs**. Eg. fungus, mushrooms etc.

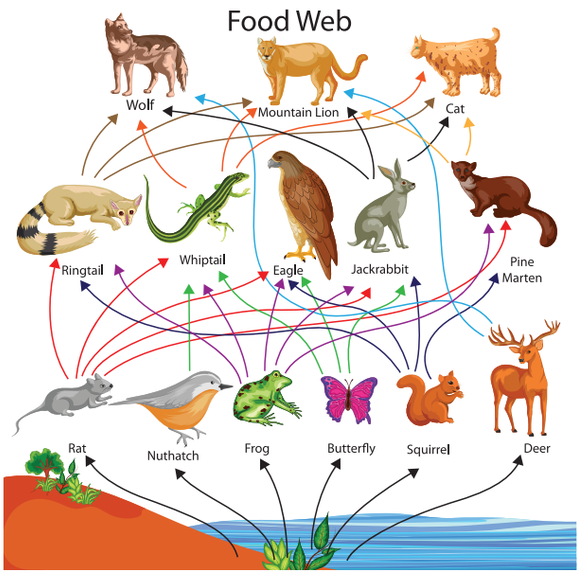
Activity

Find the etymology of Herbivores, carnivores, omnivores and scavengers using dictionary.

C) Energy Components

All organisms in the biosphere use energy to work and convert one form of energy into another. The Sun is the ultimate source of energy for the biosphere as a whole. The solar energy gets transformed into other forms of energy through the various components in the ecosystem. The producers, consumers and the decomposers contribute a lot to the energy flow in an ecosystem.

5.1.2 Functions of an ecosystem



The living organisms form an interacting set of flora and fauna which are organized into trophic levels, food chains and food webs. The functioning of an ecosystem depends on the pattern of the energy flow, as it helps in the distribution and circulation of the organic and inorganic matter within an ecosystem. Energy flow generally takes place in a hierarchical order in an ecosystem through various levels. These levels are called **trophic levels**.

The chain of transformation of energy from one group of organisms to another, through various trophic levels is called **a food chain**. A system of interlocking and interdependent food chains is called a **food web**.

5.2 Biodiversity

Biodiversity or biological diversity refers to a wide variety of living organisms (plants, animals and other micro organisms) which live in a habitat. It is highly influenced by topography, climate as well as human activities. It represents the strength of the biological resources of a place on earth. In biodiversity, each species, no matter how big or small, has an important role to play in the ecosystem. It maintains the ecological balance and facilitates social benefits such as tourism, education, research etc. over an area.

5.2.1 Loss of biodiversity

The extinction of species (flora and fauna) due to human and natural influences is called **loss of biodiversity**.

A healthy eco system provides clean water, pure water, enriched soil, food, raw materials, medicines etc. Hence stable biosphere has to be conserved.

5.3 Biomes

A biome is a geographically extensive ecosystem where all flora and fauna are found collectively. It is the total assemblage of plant and animal life interacting within the biosphere. Biomes are defined by abiotic factors like, relief, climate, soils and vegetation. They are classified into two broad categories, **terrestrial biomes** and **aquatic biomes**.

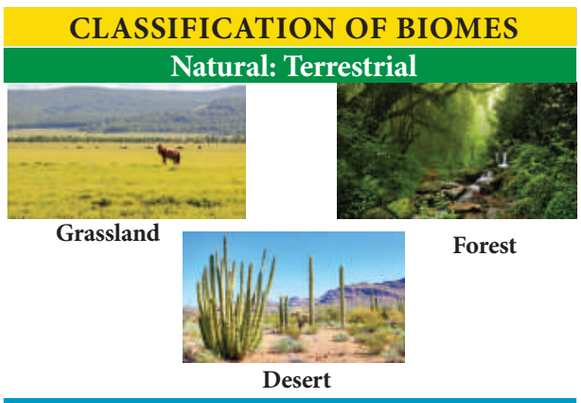
- An ecological region that has lost more than 70% of its original habitat is considered a ***hotspot.***
- Hotspots in India are the Himalayas, Western Ghats, Indo Burma Region and Sundaland.
- There are 34 areas around the world which are qualified as biodiversity ***hotspots***

5.3.1 Terrestrial Biomes

Terrestrial biomes is a group of living organisms that live and interact with one another on land. They are mainly determined by temperature and rainfall. Some of the major terrestrial biomes of the world are

A. Tropical Forest Biomes
B. Tropical Savanna Biomes
C. Desert Biomes
D. Temperate Grassland Biomes
E. Tundra Biomes

BZLJGI



A. Tropical Forest Biomes

The tropical forest biome is comprised of several sub-biomes, including evergreen rainforest, seasonal deciduous forest etc.

Tropical forests have the highest biodiversity and primary productivity of any of the terrestrial biomes. The **Amazon basin, Congo basin** and **Indonesian islands** are the major regions of this biome. These regions have very dense forests and so have great economic importance. Human

settlements are found scattered here. They sustain their livelihood through food gathering, fishing, lumbering and shifting cultivation. Due to the humid nature of this biome, the people get afflicted to tropical diseases like malaria, yellow fever etc. The chief trees found here are **rubber, bamboo, ebony,** etc. Bats, pheasants, jaguars, elephants, monkeys etc. are the important birds and animals found here.

The U.S. National Cancer Institute has identified about 70% of the plants used for treating cancer. Which are found only in rain forests. Eg. Lapacho.

B. Tropical Savanna (Grasslands) Biomes

Tropical grasslands are generally found between tropical forests and deserts. Tropical Savanna biomes are found between 10° to 20° N and S latitudes. These grasslands are generally flat and are found in the Sahel, south of Sahara in East Africa and in Australia. This biome is generally hot and dry and experiences moderate to low rainfall. So, the grass which grow here are tall and sharp. Hence the chief occupation of the people found here is herding. The primitive people living here are **nomadic**.

The common animals found here are the lion, leopard, tiger, deer, zebra, giraffe etc. Flora such as **Rhodes grass, red oats grass, lemon grass** etc. are found in this biome.

Of late, parts of the Savanna grasslands are being converted into farmlands, which pose a great threat to the wide range of fauna. For Eg. The population of the big cats like cheetah, lion etc. are dwindling drastically.

C. Desert Biomes

Deserts are usually found on the western margins of the continents between 20° and 30° N and S latitudes. The annual rainfall is less than 25 cm in these regions. Due to the lack of rainfall and arid conditions, these regions do not possess any vegetation but have special vegetation type called **Xerophytes**. As the soil is sandy and saline, deserts remain agriculturally unproductive. Drought resistant thorny scrubs and bushes, palms are found here.

Tribal people who live here practice food gathering and hunting. They move their temporary settlements frequently in search of pastures. Transportation becomes very difficult here and is carried on by camels. Reptiles like snakes, lizards, scorpions etc., are most commonly found here.

An oasis is a fertile fresh water source found in deserts and semi-arid regions. Oases are fed by springs. Crops like date palms, figs, citrus fruits, maize etc. are cultivated near these oases.

D. Temperate Grassland Biomes

Temperate Grasslands are usually found in the interior of the continents and are characterized by large seasonal temperature variations, with warm summer and cold winter. The type of grassland in these regions strongly depends upon precipitation. **Higher precipitation** leads to **tall** and soft grass and **lower precipitation** leads to **short** and soft grass. These regions favour wheat cultivation. Extensive mechanised agriculture is practised due to lack of farm labour. Pastoral industry

becomes the main occupation, thereby facilitating slaughtering of animals, packing of raw and processed meat, dairy products etc. The common birds and animals are grass hopper, wolf, bison, prairie dog etc.

Temperate grasslands are called differently in different parts of the world.
Prairies -- North America
Steppes -- Eurasia
Pampas -- Argentina and Uruguay
Veld -- South Africa
Downs -- Australia
Canterburg -- Newzealand
Manchurian -- China

E. Tundra Biomes

These vast lowlands are found where the ground remains frozen. Greenland, Arctic and Antarctic regions and Northern parts of Asia, Canada and Europe fall in this biome. These regions are also called **Barren lands**. This biome experiences long severe winter and short cool summer. Due to the prevailing of low temperature and short growing seasons, the net primary productivity is very low in tundra. People are nomadic. Hunting and fishing are their major occupations. The population here is extremely sparse and the harsh environment makes them change their settlement frequently. They live in igloos in winter and in tents during summer. Arctic moss, Arctic willow, lichens etc. grow here. Fauna like the polar bear, wolverine, reindeer, snowy owl are found here.

5.3.2 Aquatic Biomes

Aquatic biome is a group of living organisms that live and interact with one another and its aquatic environment for nutrients and shelter. Like terrestrial biomes, aquatic biomes are influenced by a series of abiotic factors.It is broadly classified as **fresh water biomes and marine biomes.**

A. Fresh water Biomes:

It comprises lakes, ponds, rivers, streams, wetlands etc. It is influenced by various abiotic components such as the volume of water, water flow, composition of oxygen, temperature, etc. Humans rely on freshwater biomes for drinking water, crop irrigation, sanitation and industry. Water lily, lotus, duck weeds etc. are the common plants found here. Trout, salmon, turtles, crocodiles etc. are the animals found here.

B. Marine Biomes:

They are the largest aquatic biomes on earth. They are continuous bodies of salt water and provide a wide range of habitats for marine plants and animals. Coral reefs are a second kind of marine biomes within the ocean. Estuaries, coastal areas where salt water and fresh water mix, form a third unique marine biome. As water provides maximum mobility to marine organisms, nutrients are circulated more quickly and efficiently here than the terrestrial biomes. Apart from animals, plants such as kelp, algae, phytoplankton etc. also grow in water. Aquatic biomes are not only important for plants and animals, but also for humans. Humans use aquatic biomes for water, food and leisure activities.

Some of the threats and issues to aquatic biomes are overfishing, pollution and rise in sea level.

5.3.3 Conservation

The biosphere extends from the deep ocean trenches to lush rain forests. People play an important role in maintaining the flow of energy in the biosphere. At the same time, the primary cause of today's loss of biodiversity is habitat alteration caused by human activities. The ever increasing population results in over exploitation of biological resources. This has an adverse impact on flora and fauna on earth. There are places on earth that are both biologically rich and deeply threatened. Hence it is man's duty to conserve and care for the earth and make it a better place to live in.

- A Biosphere Reserve is a special ecosystem or specialized environment with flora and fauna that require protection and nurturing. **There are 18 Biosphere Reserves in India**.

Recap

- The biosphere is a thin layer on, above and beneath the earth where life exists.
- The place on earth where living organisms live and interact with one another and with their physical environment is called an ecosystem.
- The three major components of ecosystem are biotic components, abiotic components and energy flow.
- Biotic components are classified into producers, consumers and decomposers.
- The functioning of the ecosystem depends on the energy flow through various levels called trophic levels.
- The wide variety of living organisms that are found on the planet is called biodiversity.
- The extinction of such biological diversity due to human influences or nature is called loss of bio diversity.
- The geographically extensive ecosystem where living organisms are collectively found is termed as biome.
- Biomes are broadly classified as terrestrial and aquatic biomes.
- Biosphere has to be conserved, as it is considered to be an asset to planet earth.

EXERCISE

BZVFI6

I. Choose the correct answer

1. The coldest biome on Earth is
   a) Tundra b) Taiga
   c) Desert d) Oceans
2. This is the smallest unit of biosphere.
   a) Ecosystems b) Biome
   c) Environment
   d) None of the above
3. Nutrients are recycled in the atmosphere with the help of certain micro organisms, referred to as
   a) Producers
   b) Decomposers
   c) Consumers
   d) None of the above
4. To which climatic conditions are Xerophytic plants specifically adapted to?
   a) Saline and sandy
   b) Limited moisture availability
   c) Cold temperature
   d) Humid

5. Why is the usage of rainforest biomes for large scale agriculture unsustainable?

a) because it is too wet.

b) because the temperature is too warm.

c) because the soil is too thin.

d) because the soil is poor.

Questions 6 – 8 are assertion type questions. Directions:

a) Both assertion (A) and reason(R) are true; R explains A

b) Both assertion(A) and reason(R) are true; R does not explain A

c) A is true; R is false

d) Both A and R are false

6. **A:** Heterotrophs do not produce their own food.

   R: They depend on autotrophs for their nourishment.

7. **A:** Hotspots are the regions characterised by numerous endemic plants and animal species living in a vulnerable environment.

   R: To manage and focus on conservation work more effectively, researchers identified hotspots.

8. **A:** The number of gorillas in Africa has plummeted by 60% in the past twenty years.

   R: Non intervention of human beings in the forest areas.

II. Fill In The Blanks

1. An area where animals, plants and micro organisms live and interact with one another is known as _____
2. _____ are also called Heterotrophs.
3. _____ is a system of interlocking and independent food chains.
4. _____ is an extensive large ecosystem.
5. The vegetative type commonly found in desert biomes is called _____
6. _____ is an aquatic biome that is found where fresh water and salt water mix.

III. Answer the following in brief:

1. What is Biosphere?
2. What is an ecosystem?
3. What does the term 'biodiversity' mean?
4. What is meant by loss of biodiversity?
5. Mention the various terrestrial biomes.

IV. Give reasons for the following:

1. Producers are also called autotrophs.
2. Biosphere provides a stable ecosystem.

V. Distinguish between the following:

1. Producers and Decomposers.
2. Terrestrial biomes and Aquatic biomes.
3. Tropical vegetation and Desert vegetation
4. Savannas and Tundra

VI. Answer the following in a paragraph:

1. Explain the various components of ecosystem.
2. Write a paragraph on the functions of an ecosystem.
3. Explain about the aquatic biomes on Earth.

VII. Find out the dates for the following:

1. World Wild Life Day . . ..
2. International Day of Forest . . . . . .
3. World Water Day. . . . . .
4. Earth Day . . . . . .
5. World Environment Day June 5th
6. World Oceans Day . . . . . .

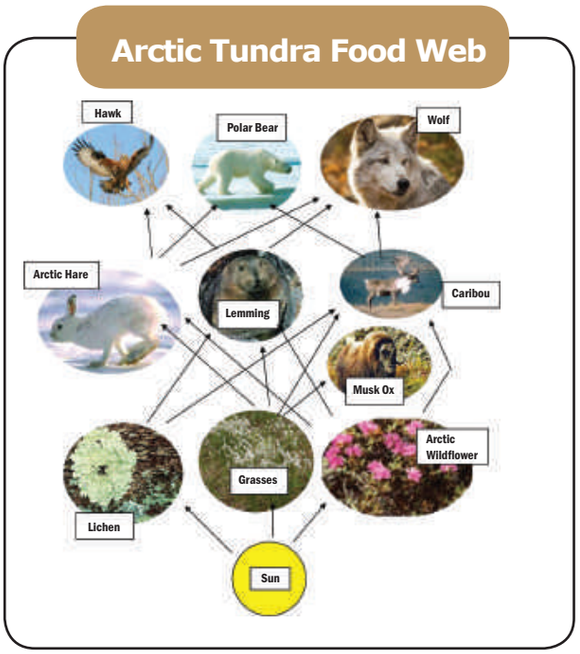
VIII. Map Study

Locate the following on the world outline map.

1. Priairies
2. Downs
3. Tundra Biomes
4. Equatorial Biomes

IX. Picture Study

Narrate the given food web of Arctic Tundra in your own words.



REFERENCE BOOKS

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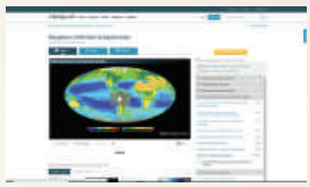
2. *Physical Geography* by Dr. Savindra Singh Edition: 2015, Pravalika Publications, Allahabad, India.
3. *Essential Environmental Studies* S.P. Misra and S.N.Pandey Second Edition, Ane books Pvt. Ltd., New Delhi, India.
4. *Environmental Geography* by Dr. Savindra Singh Edition: 2015, Pravalika Publications, Allahabad, India.

INTERNET RESOURCES

ICT CORNER

Geography -Biosphere

Let as know 'Biosphere' with the help of videos



Steps

Step 1: Open the Browser type the URL Link given below (or) Scan the QR Code.

Step 2: Register as a student or teacher with your email id.

Step 3: Select the option Video and see the Biosphere video.

Step 4: Select the option Quiz and choose the correct answer.

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UNIT 6

Man and Environment

Learning objectives

- To know the components of environment
- To understand the various features of human-environment interaction
- To know various settlement patterns
- To know the different economic activities of man
- To understand the environmental effects of human behaviour

GJF5YS

Introduction

Environment is a set of relationships between man and nature. Man has survived through the ages, dwelling within his surrounding called the environment. The word 'environment' is derived from the French word 'environ' meaning encircled or surrounded. Environment includes both living (biotic) and non living (abiotic) components.

6.1 Man and Environment

Early man depended entirely on nature for food, clothing and shelter. Man has enjoyed a dominant position over the other living organisms around him because of his erect posture, hands and intelligence. From the paleolithic period to the neolithic period, man has invented and developed the wheel, fire, tools and patterns of agriculture and housing to his comfort, which led him to improve the standard of living making himself technologically advanced. Thus, modern man modified the environment where he multiplied in numbers to increase population and has always extended his territories, leading to the exploitation of natural resources.

DO YOU KNOW?

The **Stockholm Conference**, 1972, declared man as both a creator and moulder of his environment. 'The Earth Summit', formally known as the United Nations Conference on Environment and Development (UNCED) was held in Rio de Janeiro in 1992.

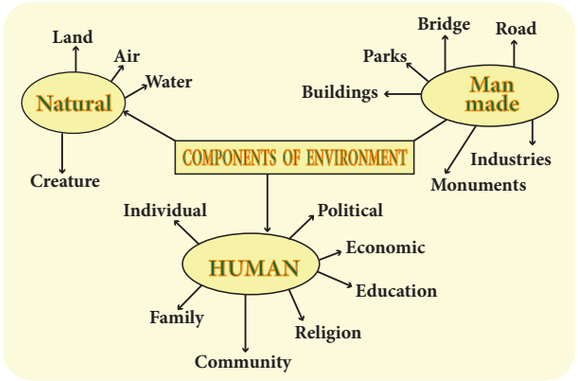
Classification of Environment:

Environment is generally classified as

(a) Natural environment

(b) Human environment and

(c) Man made environment



(a) Natural environment

Earlier, we have learnt about the natural components of environment such as lithosphere, atmosphere, hydrosphere and biosphere. In this chapter, we will study about the human and man-made components in a detailed manner.

(b) Human Environment

Human environment is defined as the interaction between man as an individual, with his family, occupation and society. It is also related to various cultural aspects such as education, religion, economics and politics.

(c) Man-made environment

Man-made environment has been created by man himself for the purpose of fulfilling his needs and to make his life more convenient and easy. For example, building, transport, park, industrie, monument, etc. To bring an equilibrium between man and the environment, man has to study the distribution of population, availability of resources, development in technology, alternate means of fulfilling the increasing demand created by the growing population and other man-made features.

6.2 Population

Can you imagine a world without human beings? Humanbeings are important to develop the economy and society. The Latin word 'populus' means 'people'. Population is the total number of people living together in a particular place at the given point of time.

GJP21F

What is Demography?

In ancient Greek, 'demos' means people and 'graphis' means study of measurement. So, 'Demography' is the statistical study of human population.

6.2.1 Population Growth

'It is easy to add but difficult to maintain'
Population is a dynamic phenomenon where the number, distribution and composition are constantly changing. Human population increases as babies are born and decreases as people die. For most of human history, births have only slightly exceeded deaths every year. As a result, human population grow slowly. About the time of Industrial Revolution, it began to increase rapidly.

Natural increase of population is the difference between the birth rate and death rate. In fact population is always increasing but only in very rare cases it may decrease through natural or man-made disasters such as famine, landslides, earthquakes, tsunami, epidemics, extreme weather conditions and war.

Population change refers to an increase or decrease in the population of an area influenced by the number of **births, deaths and migration**. The population of the world doubled from 500 million in 1650 to 1000 million in1850.The **projected population for 2025 and 2050 is about 8 billion and 9 billion respectively**.

Population growth refers to an **increase** in the number of people who reside in a particular area during a particular period.

Census

Census is an official enumeration of population carried out periodically. It records information about the characteristics of population such as age, sex, literacy and occupation. Different countries of the world conduct census every 5 to 10 years as recommended by the United Nations. The first known census was undertaken nearly six thousand years ago by the Babylonians in 3800 BC (BCE). Denmark was the first country in the modern world to conduct a census. In **India, the first census was carried out in the year 1872.** Censuses have been conducted regularly every tenth year **since 1881**. The Indian Census is the most comprehensive source of demographic, social and economic data. Have you ever seen a census report? Check in your library.

Population increases when there are more births and immigration. It decreases when there are more deaths and emigration. Population growth, can be calculated as

The **black death** is estimated to have killed 30 - 60 percent of Europe's total population during the 14th century. The dominant explanation for black death is attributed to the outbreak of plague.

6.2.2 Distribution of Population

Population distribution refers to the way in which people are spread out across the earth's surface.

The world population is not uniformly distributed, owing to the following factors.

a). Physical Factors

Physical factors include temperature, rainfall, soil, relief, water, natural vegetation, distribution of minerals and availability of energy resources.

b). Historical Factors

Regions with historical importance (river valley civilizations), war and constant invasions fall under historical factors responsible for population distribution.

c). Economic Factors

Educational institutions, employment opportunities, manufacturing industries, luxurious amenities, trade and commerce and other facilities encourage dense population in an area.

The World Population Day is observed on 11th July every year. It seeks to raise awareness of global population issues. The United Nations Development Programme started celebrating this event from the year 1989.

6.2.3 Density of Population

Density of population refers to the number of people living per square kilometre. An area is said to be sparsely populated when it has a large area with less number of people. Similarly, smaller the area with a large number of people, it is said to be densely populated.

$$\text{Population Density} = \frac{\text{Total Population}}{\text{Total land area}}$$

The world's population density is divided into three main groups.

- Areas of high density (above 50 people per sq.km) - East Asia, South Asia, North West Europe & Eastern North America.
- Areas of moderate density (10 to 50 people per sq.km) - The sub tropical regions like Angola, Congo, Nigeria and Zambia in Africa.
- Areas of low density (less than 10 people per sq.km) - Central Africa, Western Australia, Northern Russia, Canada, etc…

Activity

The population data of the five most densely populated districts of Tamil Nadu is given below. (Findout the population density and their rank)

District	Area (square km)	Population (2011 census)	Population Density	Rank
Chennai	178.2	46,46,732		
Kanchipuram	7857	39,98,252		
Vellore	6077	39,36,331		
Thiruvallur	3424	37,28,104		
Salem	5205	34,82,056		

Over population and Under Population

Over population is a condition when a country has more people than its resources to sustain. Under Population is a condition where there are too few people to develop the economic potential of a nation fully.

DO YOU KNOW?

'India has an official population policy implemented in 1952. India was the first country to announce such a policy. The main objective of this policy was to slow down the rate of population growth, through promotion of various birth control measures.

6.3 Human Settlements

A settlement can be described as any temporary or permanent unit area where people live, work and lead an organized life. It may be a city, town, village or other agglomeration of buildings. During the early days, man preferred tree branches, caves, pits or even rock cuts as his shelter. As days passed by, man slowly learnt the art of domesticating animals and cultivating food crops. The evolution of farming took place along four major river basins i.e. the Nile, Indus, Hwang Ho, Euphrates - Tigris. Man built huts and mud houses. Slowly settlements came into existence. A settlement generally consisted of a cluster of houses, places of worship and a place of burial. Later, small settlements developed into villages. Several villages together formed a town. Bigger towns developed into cities. Settlements were formed in different shapes, sizes and locations.

6.3.1 Classification of Settlements

On the basis of occupation, settlements may be classified as **rural** and **urban settlements.**

6.3.1 (A) Rural Settlements

Any settlement where most of the people are engaged in primary activities like agriculture, forestry, mining and fishery is known as a rural settlement. Most of the world's settlements are rural, that are mostly stable and permanent. The most important and unique feature of rural settlements is the vast, open spaces with green, pollution-free environment.

Patterns of Rural Settlements:

Rectangular pattern:

Rectangular pattern of settlements are found in plain areas or valleys. The roads are rectangular and cut each other at right angles.

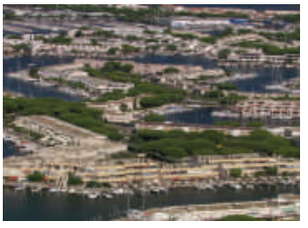
Linear pattern:

In a linear pattern, the houses are located along a road, railway line and along the edge of the river valley or along a levee.

Circular or semicircular pattern:

The pattern of settlement that is found around the lakes, ponds and sea coasts are called circular or semi circular pattern.

Star like pattern:



Where several metalled or unmetalled roads converge, star shaped settlements develop. In the star shaped settlements, houses are spread out along the sides of roads in all directions.

Triangular pattern:

Triangular patterns of rural settlement generally develop at the confluence of rivers.

T-Shaped, Y-Shaped, Cross-Shaped or Cruciform settlements:

T-shaped settlements develop at tri-junctions of the roads **(T),** while **Y**-shaped settlements emerge as the places where two roads converge with the third one. Cruciform settlements develop on the cross-roads which extend in all four directions.

Nebular pattern:

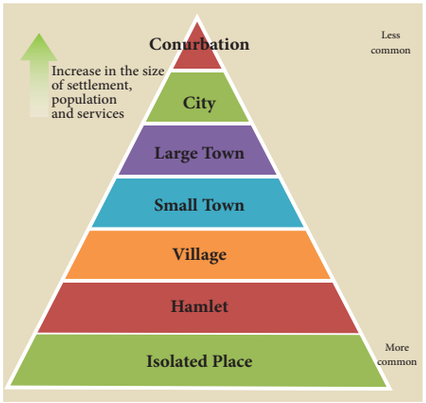
The arrangement of roads is almost circular which ends at the central location or nucleus of the settlement around the house of the main landlord of the village or around a mosque, temple or church.

6.3.1 (B) Urban Settlements

Urban is the term related to cities and towns where people are primarily engaged in non-agricultural activities, such as secondary, tertiary and quaternary activities. The common characteristic feature of an urban unit is that they are compact, congested and liable to a large number of population. They comprise of mostly man-made structures that fulfill the requirements of a society's administrative, cultural, residential and religious functions. The factors responsible for urbanization are better employment opportunities, suitable conditions for business, education, transport, etc.

Classification of Urban Settlements

Urban centres are classified as towns, cites, metropolitan cities, mega cities, conurbation, etc., depending on the size and services available and functions rendered to it.



Town: A town is generally larger than a village, but smaller than a city. It has a population of less than 1 lakh. E.g.: Arakkonam near Chennai

City: Cities are much larger than towns and have a greater number of economic functions. The population in cities are estimated to be more than 1 lakh. E.g.: Coimbatore

Metropolitan cities: Cities accommodating population between 10 lakhs and 50 lakhs are metropolitan cities. E.g.: Madurai

Megacities: Cities with more than 50 lakh population are called Megacities. E.g.: Greater Chennai

Conurbation: A conurbation is a region comprising of a number of cities, large towns and other urban areas. E.g.: Delhi conurbation

- Damascus is widely believed to be the oldest, continuously inhabited city in the world, dating back to at least 11, 000 years.
- Tokyo is the world's largest city with the greater Tokyo area, housing about 38 million inhabitants.
- According to the Quality of Living Rankings by Consultancy Mercer, in 2016, the city offering the best quality of life was Vienna, with Zurich falling second. (Sources: United Nations, UNESCO, Mercer).

6.4 Economic Activities

Economic activities are those efforts or actions that involve production, distribution and consumption of commodities and services at all levels within a region.

Types of Economic Activities

Primary Activities:

Primary Activities pertain to the extraction of raw materials from the earth's surface. For example: food gathering, hunting, lumbering, fishing, cattle rearing, mining and agriculture.

Secondary Activities:

Secondary Activities transform raw materials into finished goods. For example: Iron and Steel industries, automobile manufacturing etc.

Tertiary Activities:

Activities which by themselves do not produce goods, but support the process of production are called tertiary activities. For example: Transport, communication, banking, storage and trade.

Quaternary Activities:

The activities related to Research and Development, as well as knowledge are called Quaternary activities. For e.g. Services like consultation, education and banking

Quinary Activities:

The activities that focus on the creation, rearrangement and interpretation of new and existing ideas are called quinary activities. It includes the highest levels of decision making in a society or economy. E.g.: Senior business executives, scientists and policy makers in the Government.

6.5 Environmental Issues

Environment is the basic life support system that provides air, water, food and land to all living organisms. But human beings degrade the environment through rapid industrialization.

Some of the environmental issues that we are going to learn are:

- Deforestation
- Pollution such as air, water ,noise, etc
- Urbanisation
- Fracking
- Waste disposal

Deforestation

Deforestation is the cutting down of trees permanently by the people to clear forests in order to make the land available for other uses.

Effects of Deforestation:

Deforestation results in many effects like floods and droughts, loss of soil fertility, air pollution, extinction of species, global warming, spread of deserts, depletion of water resource, melting of ice caps and glaciers, rise in sea level and depletion of ozone layer.

The United Nations Conference on Environment and Development (UNCED) by name Earth Summit Conference held at Rio de Janeiro, Brazil, on June 1992 concluded that all member countries should reduce their emission of carbon dioxide, methane and other green house gases thought to be responsible for global warming.

Conservation of forests

(i) Conservation of forests can be done through the **regulation of cutting of trees**.

(ii) Control over forest fire: Through regular monitoring and controlling the movement of the people forest fire can be prevented.

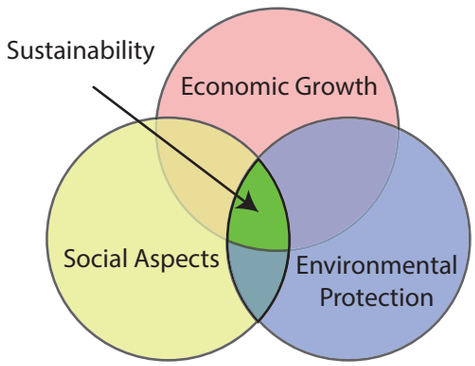
(iii) Proper use of forest products: We depend on forests for our survival from the air we breathe, to the wood we use. Besides providing habitats for animals and livelihoods for humans, forest products are one of the most essential things in our day to day life. Therefore we must use forest products properly

6.6 Sustainable Development

In 1987, the **Brundtland Commission** cited the definition of sustainability.

"Sustainable development is development that meets the needs of the present without compromising the ability of future generation to meet their own needs".

For sustainable development to be achieved, it is crucial to harmonize three core elements: **economic growth, social aspects and environmental protection**. These elements are interconnected and are crucial for the well-being of individuals and societies. To achieve true sustainability, we need to balance the economic ,social and environmental factors of sustainability in equal harmony.



Social Sustainability

The ability of a social system such as a country, family or organization to function at a defined level of social well being and harmony is called social sustainability. Problems like war, endemic poverty, widespread injustice and low education rates are symptoms of a system in socially unsustainable. The balancing capacity of a government in maintaining peaceful existence towards other countries and at the same time providing the requirements of its citizens without affecting the environment creates social sustainability.

Economic Sustainability

The people on earth consume far more than what is their fair share.

- The economic sustainability is successfully implemented through strong Public Distrubution System.
- Economic sustainability ensures that our economic growth maintains a healthy balance with our ecosystem.

Environmental Sustainability

Environmental sustainability is the ability of the environment to support a defined level of environmental quality and natural resource extraction rates forever to mankind. Unnecessary disturbances to the environment should be avoided whenever possible.

Students' Activity

(Teacher should get a record of the students)

* **Play outside!**

  This simple activity goes a long way in teaching sustainability. Sharing in and appreciating a love of the outdoors will inspire children to care for earth.

* **Read books about the earth.**

  Books are great for young children to begin to learn about the earth.

* **Make your own paper.**

  Kids can use recycled paper scraps to make new paper!

Why is sustainability important?

The excessive usage of natural and manmade resources deplete its availability for the future generation. We need to look after our planet, our resources and our people to ensure that we can hand over our planet to our children to live in true sustainability. Hence conservation and awareness are the two important terms that can bring sustainability to our living. When we use the word sustainability to mean maintain, it means to maintain it forever. This is because our actions have a lasting effect on the environment and we should protect it for our future generations.

How to help the value of sustainability grow among students?

- **Lifestyle**

Your lifestyle is your choice and you can change it. For example, when you go to the grocery store, make sure you always carry a cloth bag. This way the shopkeeper does not have to give you many plastic bags.

- **Fixing**

If your watch or a toy or a camera is broken or not working, try getting it fixed before you buy yourself a new one.

- **Recycle**

Try and be conscious about the things around you. When you consume something, see if you can re-use it later.

- **Needs vs Wants**

Before you buy something, ask yourself the question- do I NEED this or do I WANT it? Remember sustainability begins with you. So act locally and think globally.

Recap

- The place, things and nature that surround any living organism is called environment.
- The interaction between man as an individual with his family, occupation and society is called human environment.
- Population is a dynamic phenomenon where the number, distribution and composition are constantly changing.
- Population change refers to an increase or a decrease in the population of an area influenced by births, deaths and migration.
- The density of population is measured by dividing the total population by its total area.
- On the basis of occupation, settlements are classified as rural and urban.
- Primary, secondary, tertiary, quaternary and quinary are the different types of economic activities.
- Problems such as climatic changes, poverty, war and uneven distribution of resources leads to an unbalanced ecosystem. Therefore, to sustain mankind, it is a must to learn about sustainable development.

EXERCISE

GK7T4Q

I Choose the correct answer

1. All external influences and factors that affect the growth and development of living organisms is _____.

   a) Environment b) Ecosystem
   c) Biotic factors d) Abiotic factors

2. The 'World Population Day' is observed on _____ every year.

   a) August 11th b) September 11th
   c) July 11th d) January 11th

3. The statistical study of human population is _____.

   a) Demography b) Morphology
   c) Etymology d) Seismography

4. The extraction of valuable minerals and other geological minerals from the mines, is _____.

   a) Fishing b) Lumbering
   c) Mining d) Agriculture

5. The Secondary sector of the economy produces _____from raw materials.

   a) Semi finished goods
   b) Finished goods
   c) Economic goods
   d) raw materials

6. Gradual increase of the earth's temperature by the Green house gases in the atmosphere is called _____.

a) Acid rain b) thermal pollution
c) Global warming d) Deforestation

II. Match the following:

1.	Loudspeaker	-	Push factor
2.	Rio de Janeiro, Brazil	-	Pull factor
3.	Cruciform settlement	-	noice pollution
4.	Natural disaster	-	T- shaped settlement
5.	Better living conditions	-	Earth Summit, 1992

III. Consider the given statements and choose the right option given below

1. **Assertion(A):** Ozone layer in the stratosphere is considered as a protective shield.

   Reason(R): It prevents the UV radiation from reaching the earth's surface.

   a) A and R are correct and A explains R
   b) A and R are correct, but A does not explain R
   c) A is incorrect but R is correct
   d) Both A and R are incorrect

2. **Assertion(A):** In tertiary activities, instead of producing goods by themselves, they are in the process of production.

   Reason(R): People in Tertiary activities are purely eco friendly.

   a) Both A and R are incorrect
   b) A and R are correct but A does not explain R
   c) A is correct and R is incorrect
   d) A and R are correct and A explains R

IV. Answer the following in brief:

1. What do you mean by the term 'density of population'?
2. What is 'black death'?
3. Where do we have high and low densities of population?
4. Write any two ways of how the locals and the government restored Palk Bay.
5. Define.
   i) Population growth
   ii) Census
   iii) Sustainable Development.

V. Give reasons for the following:

1. Deforestation is encouraged throughout the world.
2. Acid rain destroys the ecosystem..
3. The economy of the quaternary sector is called knowledge economy.
4. Population growth has to be brought under control.
5. Sustainable development growth has been set to protect the planet.

VI. Distinguish the following:

1. Birth rate and Death Rate
2. Rural settlement and urban settlement
3. Primary activities and Secondary activities

VII. Answer in a paragraph:

1. Explain the factors affecting the distribution of population.
2. Describe the patterns of rural settlement with neat diagrams.

VIII. Map skill:

A. On the outline map of the world mark the following.

1. An area of high density of population in Europe.

2. An area of low density of population in Australia.
3. Palk Bay.
4. A fracking banned country.
5. England - A country affected by 'black death'.
6. Denmark - First country where the modern census was conducted.
7. River Hwang Ho.

B. On the outline map of Tamil Nadu mark the following.

1. A metropolitan city
2. A district with 7857 people per sq. km.
3. Gulf of Mannar
4. Palk Strait

IX. HOTS:

Study your area and write down about its settlement pattern.

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1. Savindra Singh, (1991), *Environmental Geography,* Prayag Pustak Bhawan, Allahabad – 211002
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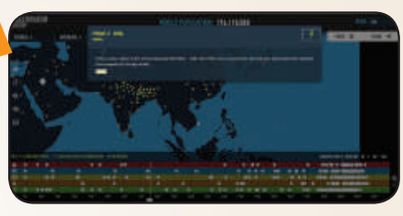
ICT CORNER

MAN AND ENVIRONMENT



Through this activity, you will know about the population growth from the ancient age to the present.

Procedure

Step 1: Use the URL or scan the QR code to open the activity page.

Step 2: Click the 'Change Projection' to explore the map and data from the globe

Step 3: Click the' Reset Map' button to reset the map to starting position.

Step 4: Click the ' Play' button in timeline to show the gradual growth of population.

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UNIT 7

Mapping Skills

Learning objectives

- To introduce maps
- To read maps using its components
- To learn the methods of surveying and other techniques of acquiring map data like aerial photography and satellite remote sensing
- To gain knowledge of the latest techniques of mapping, namely GIS and GNSS

GKGP6D

Introduction

With maps on hand, one can see the world in one sweep. A map is worth a thousand words. Mapping skills are the basics to understand a map and to interpret the area depicted. Maps are introduced with its components such as scale, signs and symbols. Surveying is the process of recording the measurement of a land area. Its outcomes are the data sources of maps. This lesson deals with the latest techniques of mapping - remote sensing, GPS, GIS, global navigation system and web maps of the 21st century.

7.1 Map as a Tool

A map is the basic tool of a geographer. It illustrates the earth's surface clearly and effectively through a combination of drawings, words and symbols. Thus, maps form an integral part of teaching geography. A map is a location guide.

DO YOU KNOW?

A cartographer is one who measures, analyzes and interprets geographical information to create maps and charts for political, cultural and educational purposes.

7.1.1 Maps and Cartography

Maps are drawings of an area as seen from above. A map is defined as the miniature image of the 3 dimensional earth's surface on a paper/cloth or any flat surface. Maps can show a whole or part of the world. Maps are drawn to a scale and direction. Maps have legends to explain the meaning of symbols and colours used on it. The art of map - making is called **Cartography**.

7.1.2 Components of a map

A map should include the following components namely, the title, scale, direction, grid system, projection, legend, conventional signs and symbols.

GKQK81

(A) Title

It indicates the purpose or theme of the map. Example: India – Physical, World – Political, Tamil Nadu – Transport.

(B) Scale

Scale makes it possible to reduce the size of the whole earth to show it on a piece of paper. A scale is a ratio between the actual

distance on the map to the actual distance on the ground. Scales can be represented in three methods. They are the **Statement, Representative Fraction (R.F) and Linear or Graphical scale methods.**

Statement scale

The statement scale describes the relationship of map distance to ground distance in words, such as one centimetre to ten kilometres. It is expressed as 1cm = 10 km.

The Representative Fraction (R.F)

It describes the proportion or ratio of the map distance to ground distance. It is usually abbreviated as R.F. It is stated as 1/100000 (or) 1:100000. This means that one unit on the map represents 100,000 of the same unit on the ground. This unit may be an inch or a centimetre or any other linear measurement unit. Thus,

$$\text{Representative Fraction (R.F.)} = \frac{\text{Distance on the map}}{\text{Distance on the ground}}$$

For example: To find the RF when the scale is 1 cm to 1km. Here, 1 cm =1 km

According to the formula, R.F= $\frac{1\,cm}{1\,km}$

Convert the km to cm. Therefore, 1km =100000 cm. So, RF. is 1:100000.

Find the R.F. when the scale is 1 centimetre to 2 kilometre.

Linear (or) Graphical scale

In a map, a linear scale is represented by a straight line divided into equal parts (Primary and secondary) to show what these markings represent on the actual ground. This scale helps in the direct measurement of distance on the map.

Linear scale model

(Graphic Scale)

1/50,000 (fractional scale)
1:50,000 (ratio)
1 unit on the map represents 50,000 units in the real world.

(C) Direction

Maps are drawn normally with north orientation. North direction in a map is always towards the North Pole of the earth. If you position yourself looking at the North Pole, on your right will be the east; your left will be the west; at your back will be south. These four main directions are called the cardinal directions. Direction is usually indicated on a map by a North-South line, with the North direction represented by an arrow head.

Activity

Imagine you are standing in India facing north, find in which direction are the following located using the map given below

Saudi Arabia _____

Myanmar_____

China _____

Indian ocean _____

Kazakhstan _____

Sumatra _____

Afghanistan _____

Mnemonic device or memory technique to recall cardinal directions is the sentence "Never Eat Soggy Wheaties." (North, East, South and West)

(D) Grid System

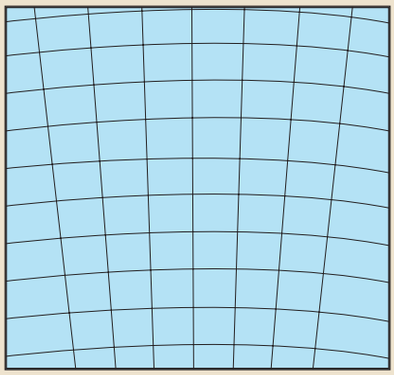
The location of a place can be simply defined by its latitude and longitude. In normal practice, latitude is stated first and then comes the longitude. The latitude and longitude of a place can be expressed in units of **degree, minutes and seconds**.

DO YOU KNOW?

The mainland of India extends from 8°4'N to 37°6'N latitude and from 68°7' E to 97°25' E longitude. Here, (°) is degree and (') is minutes.

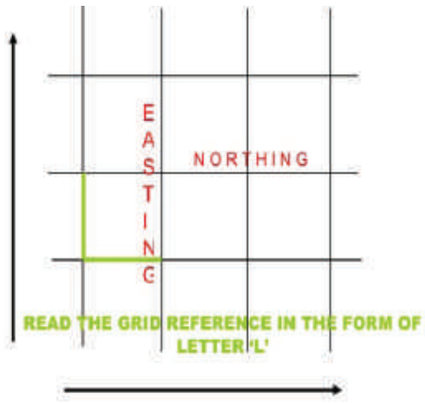
Activity

Use grids to enlarge Australia.



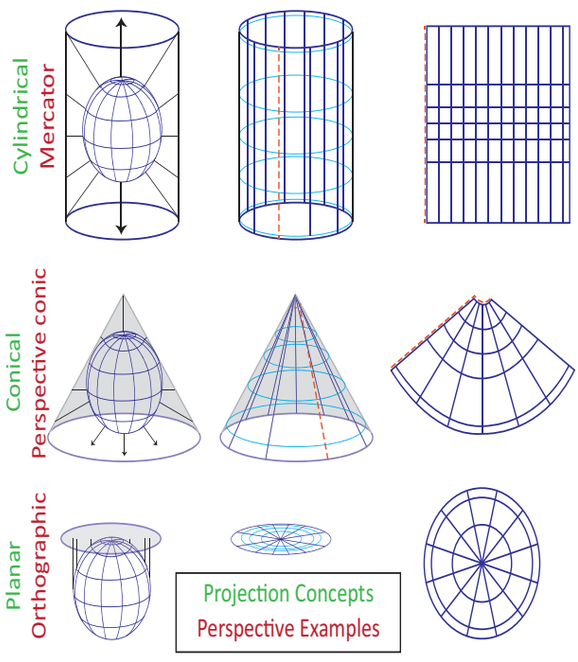
(E) Projection

A map projection is a way of showing the spherical shaped earth on a flat piece of paper. Where does the word 'projection' come from? Imagine a clear globe with latitude and longitude lines and the outlines of the landmasses on it. Suppose there was a light bulb inside the globe. If you wrapped a piece of paper around the globe and turned on the light bulb, the outlines of the grid and landmasses would be projected onto the paper. Map projection is defined as the transformation of spherical network of latitudes and longitudes on a plane surface. Projections are drawn to maintain the **shape, area and directions**.



The three methods in widest use are as follows:

- Projection on the surface of a cylinder
- Projection on to the surface of a cone
- Projection directly onto a flat plane, called planar or zenithal or azimuthal projection



(F) Legend

The legend of a map helps to understand the map details which are placed at the left or right corner at the bottom of the map.

(G) Conventional signs and symbols

Conventional signs and symbols are standard symbols used on a map and explained in the legend to convey a definite meaning. The topographic map contains a variety of information about physical and cultural features.

These are shown by using signs and symbols in various colours so that the clarity of the map is maintained.

There are three types of map symbols

1. **Point Symbols** - buildings, dipping tanks, trigonometrical beacons
2. **Line Symbols** - railways, roads, power lines, telephone lines
3. **Area Symbols** - Cultivated lands, ponds, orchards and vineyards

The actual shape of the Earth is termed Geoid, which is an oblate spheroid.

The "azimuthal" polar projection is depicted on the United Nations flag.

North America was prominent on the initial 1945 UN flag (which had the longitude line 90 degrees west pointing upwards). The following year, the map on the flag was reoriented to be more neutral by having the International Date Line (180 degrees east, lying in the middle of the Pacific Ocean) pointing upwards. The map ends at 60 degrees South latitude, meaning Antarctica does not appear.

The following colour codes are used with map symbols

1. **Brown:** land or earth features - contour lines, eroded areas, prominent rock outcrops, sand areas and dunes, secondary or gravel roads
2. **Light Blue:** water features - canals, coastlines, dams, lakes, marshes, swamps and levees, ponds, rivers and water towers.
3. **Dark Blue:** national waterways
4. **Green:** vegetation features - cultivated fields, golf courses, nature and game reserve boundaries, orchards and vineyards, recreation grounds, woodland
5. **Black:** construction features - roads, tracks, railways, buildings, bridges, cemeteries, communication towers, dam walls, excavations and mine dumps, telelphone lines, power lines, windpumps, boundaries
6. **Red:** construction features - national, arterial and main roads, lighthouses and marine lights
7. **Pink:** international boundaries

Conventional Signs and Symbols

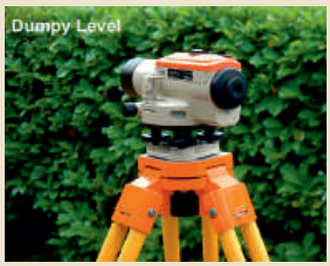
	Fort		Metalled Road
	Church		Cart track
	Pagoda		Pack-track
	Graveyard		Foot-path with bridge
	Chhatri		Aerodrome
	Mosque		Light-house
	Temple		Electric power Line
PO	Post Office		Perennial Stream
PS	Police Station		Dry Stream
RH	Rest House		Canal
CH	Circuit House		Dry River
IB	Inspection Bunglow		Dam with masonry work
RS	Railway station		Dam with earth work
	Broad Gauge Railway		Permenant Hut
	Level Crossing		Temporary Hut
	Metalled Road		Tower Antiquities

7.1.3. Survey

Surveying is done to measure the angle, direction, area, height and distance of an object or place on the surface of the earth using instruments. Surveying techniques are used to obtain the field data and to prepare maps. A knowledge of surveying helps one in map-making, particularly in the preparation of physical maps.

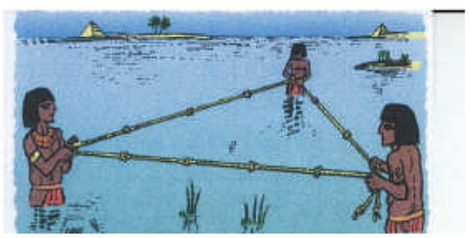
Geographers mainly use **Chain, Prismatic compass, Plane table, Dumpy level, Abney level, Clinometre, Theodolite, Total Station** and **GNSS** to measure the distance, angle, altitude and position of the area of survey.

Modern survey tools used by geographers for map making.



Early History of Surveying: In Egypt, surveyors were called 'rope stretchers' because they used ropes to measure distances.

The Egyptian 'Rope Stretchers'



7.2 Remote Sensing as a Source of Map Data

Remote Sensing refers to the observation and measurement of earthly objects without touching them.

'**Remote**' means far away and '**Sensing**' means observing or collecting information. Remote sensing means acquiring information of things/places from a distance, using a variety of tools and methods.

We operate three remote sensing organs in our body.

a) Eyes -sense of sight

b) Nose - sense of smell

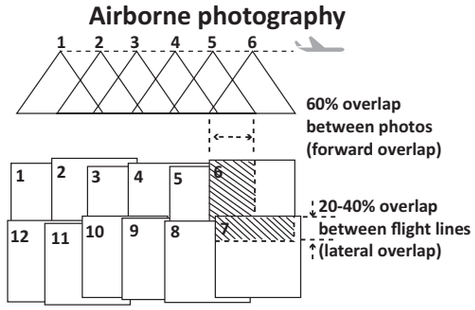
c) Ear – Sense of hearing

Remote sensing has a long history, dating back from the use of cameras carried by balloons and pigeons in the 18th and 19th centuries. During the 20th century, airborne photographs and satellite remote sensing developed swiftly.

7.2.1. Aerial photography

Aerial photography refers to the technique of obtaining information about places or objects or phenomena with the help of photographs taken using cameras mounted on **low flying birds, balloons, helicopters, aeroplanes and drones.** The aerial photographs are captured continuously with a time gap of 10-30 seconds at a fixed height. Each photo will have a slight overlap of the area in the preceding photo. By making a mosaic of all the photos excluding the overlapping areas, a stereoscopic (3D) image of the study area can be produced.

Felix Nadar was a French photographer, journalist, novelist and balloonist. In 1858, he became the first person to take aerial photographs. He took his first photograph in 1853 and pioneered the use of artificial lighting in photography, working in the catacombs of Paris. Around 1863, Nadar built a huge (6000 m^3) balloon named Le Géant ('The Giant').



Aerial photography using drone in the techno world

7.2.2 Satellite Remote Sensing

Satellite remote sensing is the science of collecting data about an object or area from artificial satellites orbiting the Earth. The term 'satellite imagery' refers to digitally transmitted images of the satellites.

The preliminary data is retrieved from satellites like LANDSAT, CARTOSAT, OCEANSAT, etc. Fire and flood details can be extracted and delivered to relevant authorities within two hours of satellite image capture. E.g. major earthquakes in China and New Zealand, bushfire in Victoria and floods in Kerala. Dynamic phenomena such as flood, movement of wild animals, shoreline changes, finding lost ships and planes. Researchers use satellite imageries for these.

Components of Remote Sensing

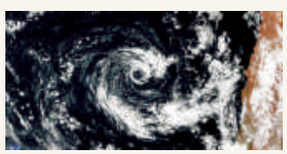
- Energy source
- Transmission path
- Target
- Sensor

People cannot be tracked generally by satellite or aerial photographs but they can be tracked by their mobile phone signals.

7.2.3 Global Navigation Satellite System (GNSS)

Have you ever booked a cab using a smart phone app? Did you see the map showing the route of your travel and movement of your vehicle on mobile phones? How is it possible to calculate the time duration of your travel?

GKZG9N

Satellite remote sensing	Aerial Photography
	
■ High cost of satellite systems. Takes at least 10 years to plan, construct, test and launch. ■ Satellites collect large amount of data of the entire area in a short span. ■ It allows global coverage and does not require permission. ■ Satellites circle the Earth; they can repeat and revisit easily. ■ Weather does not affect the functioning of satellites. ■ All information is digital; it can be easily integrated with software for image improvement.	■ Surveying can be planned and executed in a shorter time economically. ■ Takes more time to capture an area. Aircraft needs to fly back and forth. ■ It covers a small area and needs permission from authorities. ■ Revisits or repeatability involves extra cost. ■ Adversely affected by bad weather ■ It is an analogue record, so no further improvement is possible after obtaining photographs.

In the 21st century, GNSS has become a part of our lives to promote the safety and convenience of transport. **Global Navigation Satellite System (GNSS)** is a satellite system connected with a small electronic receiver or tracker to locate, monitor and track a user's vehicle wherever in the world. It can also set up instant alerts when a driver of a vehicle speeds or deviates from a particular area. GNSS applications are used in tracking or mapping vehicles, ships and aircraft. A group of satellites (Space Segment) working with a network of ground stations (Control Segment) provide location data. The receiver (User Segment) converts satellite signals into location, speed and time data.

Examples of GNSS

- Europe-Galileo
- USA-NAVSTAR Global Positioning System (GPS)
- Russia-Global'naya Navigatsionnaya Sputnikovaya Sistema (GLONASS)
- China- BeiDou Navigation Satellite System
- India's-IRNSS (NAVIC) system

a. Global Positioning System (GPS)

Without the Global Positioning System (**GPS**) on our vehicles and mobile phones, we would feel lost. GPS is the U.S. implementation of the world's first and currently the most used Global Navigation Satellite System (GNSS) created by the U. S. Department Of Defense (**DOD**). It became fully operational in 1995. **NAVSTAR** (Navigation Satellite Timing and Ranging) is a network of 24 U.S. satellites in six different orbits in space flying 20,350 km above the surface of the Earth; each one circles the planet twice a day to provide continuous, worldwide coverage. GPS receivers now come in all shapes and sizes, Most are the size of a cellular phone. Some are handheld, others are installed in ships, planes, trucks and cars.

Advantages of GPS

- GPS technology has tremendous applications in everything from mobile phones, watches, bulldozers, shipping containers and ATMs.
- The main purpose of GPS is to help in providing accurate transport data (distance, route and direction). It helps in military searches and rescue in wars. It can work as a reliable tourist guide.
- GPS helps during accident and rescue efforts, speeding the delivery of emergency services and disaster relief.
- Weather forecasting, earthquake monitoring and environmental protection can be done effectively by using GPS.

b. Geographic Information System (GIS)

Geographic Information System is a computer-based tool for managing a large amount of data collected for a given geographic region through remote sensing, GPS and other sources. The Geographic Information System is a combination of computer hardware, software, geographic data and the personnel.

G - Geographic - A particular area
I - Information - facts in order
S - System - arrangement

GIS was first recognised in the late 1950s by Waldo Tobler and Roger Tomlinson (Canada). Prime examples of importing GIS for public welfare are Google Maps, Yahoo Maps and Google Earth.

The key ingredient is location. We must have a coordinate, an address or a distance from a known point that helps us to link the information to a location on a map. Each type of data of an area is stored as a separate 'layer' of the map. In GIS, layers may be used some times and removed according to need. Examples are hospitals, schools, water bodies, parks and ATMs. The computers can create maps showing any combination of data.

7.3 Bhuvan

Bhuvan (Sanskrit for Earth) is a **free internet based computer application** launched by the **Indian Space Research Organization** (ISRO)

on August 12th 2009. It enables visualization of Indian Remote Sensing (IRS) images taken over a year ago, by ISRO's seven satellites, including CartoSat-1 and CartoSat-2. Using Bhuvan connected to Internet, one can explore places of interest, scenes of events in the news or parts around the world they may never visit in person, by either entering the names of places or co-ordinates (latitudes and longitudes). Bhuvan has tremendous uses for scientists, academicians, policy makers and the general public.

Recap

- Surveying is the process of recording the measurements of a land area.
- Anaximander was the first ancient Greek to draw a map of the known world.
- Maps can show the whole or a part of the world.
- The art and science of map making is called Cartography.
- A map should include certain components namely, the title, scale, direction, grid reference, projection, legend, conventional signs and symbols.
- Grids are sets of lines for defining a location on a map.
- Remote sensing means acquiring information of things / places from a distance.
- Global Navigation Satellite System (GNSS) helps to locate, monitor and track a user's vehicle anywhere in the world.
- GIS is a combination of computer hardware, software, geographic data and the personnel.

EXERCISE

GL9CBB

I. Choose the best answer

1. The new phase in topographical surveying in the 20th century is _____.
   a) toposheets b) aerial photography
   c) maps d) satellite imagery
2. _____ indicates the purpose or theme of the map.
   a) Title b) Scale
   c) Direction d) Legend
3. Standard symbols that are used in maps to convey a definite meaning are called _____.
   a) conventional signs and symbols
   b) coordinates
   c) grid references
   d) directions
4. Which one of the following maps show us a very large area with less details? _____.
   a) Large scale b) Thematic
   c) Physical d) Small scale
5. GPS consists of a constellation of _____ satellites.
   a) 7 b) 24
   c) 32 d) 64

II. Match the following

1.	The art and science of mapping	–	a) USA
2.	Thematic mapping	–	b) Geoid
3.	Actual shape of the earth	–	c) Inmarsat
4.	A satellite	–	d) Political map
5.	NAVSTAR	–	e) Cartography

III. Consider the given statements and choose the right option given below

1. **Assertion (A):** The points at which the vertical and horizontal lines of the grid intersect are called coordinates.

   Reason (R): The lines that run horizontally and vertically are called Northings and Eastings respectively.

   (a) Both (A) and (R) are true ; (R) explains (A)

   (b) Both (A) and (R) are true ; (R) does not explain (A)

   (c) (A) is correct ; (R) is false

   (d) (A) is false ; (R) is true

2. **Assertion (A)** The legend of a map does not help us to understand the information in a map.

   Reason (R) It is usually placed at the left or right corner at the bottom of the map.

   (a) (A) is false ; (R) is true

   (b) Both (A) and (R) are true ; (R) does not explain (A)

   (c) (A) is correct ; (R) is false

   (d) Both (A) and (R) are true ; (R) explains (A)

IV. Answer in brief

1. Name the different methods to represent the Earth.
2. What is a map?
3. What are the components of a map?
4. The distance between two cities A and B is 5 km. It is represented by a line of 5 cm on the map. Calculate the distance and give the answer in RF.
5. Mention a few surveying instruments.
6. Define remote sensing.
7. What are the components of remote sensing?

V. Give Reasons

1. Satellite imageries stimulate map making.
2. Map is the basic tool of a geographer.
3. Grid references are essential to find the exact location of places on a map.

VI. Distinguish Between The Following

1. Globe and Map
2. Large scale map and small scale map
3. Aerial photographs and satellite imageries
4. GIS and GPS

VII. Answer in Paragraph

1. What do you mean by the term 'scale of the map'? Explain its classification.
2. Write a note on directions with relevant diagram.
3. Explain the major uses of GPS? Explain about any one.
4. Bhuvan has tremendous uses for scientists, policy makers and the general public. Justify.

VIII. Map Excercise:

1. With the help of an atlas, mark the following on the outline map of Tamil Nadu.

   a) The latitude and longitude of Chennai.

   b) Mark the city located at 10^{0} N, 78^{0} E.

   c) Locate the city approximately on 11^{0}N and 76^{0}E.

   d) Find the latitude and longitude of Kanyakumari and mark it.

IX. HOTS

1. Can you imagine a world without satellites?
2. Imagine you are a cartographer. Draw the map of your area.

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INTERNET RESOURCES

ICT CORNER

MAPPING SKILL

Through this activity, you will know about the distance between any two landmarks in the maps.

Procedure

Step 1: Use the URL or scan the QR code to open the activity page.

Step 2: Click 'Polyline' button. Draw a poly line between any two favourable places.

Step 3: After finishing, the Poly line shows the measurement of distance as miles and kilometres.

Step 4: Click '+' and '-'button to zoom in and zoom out.

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UNIT

8

Disaster Management: Responding to Disasters

Learning objectives

- To know the phases of disaster management
- To understand how to respond to disaster such as Tsunami, earthquake, riot and fire
- To describe the measures to manage riots disaster

GLI8CY

Case Study - Tsunami

Shortly before 8 am on 26 December 2004, the cicadas fell silent and the ground shook in dismay. The Moken, an isolated tribe on the Andaman Islands in the Indian Ocean, knew that the Laboon, the 'wave that eats people', had stirred from his ocean lair. The Moken also knew what was next: a towering wall of water washing over their island, cleansing it of all that was evil and impure. To heed the Laboon's warning signs, elders told their children, run to high ground. 'If the water recedes after an earthquake, run immediately to high ground'

The tiny Andaman and Nicobar Islands were directly in the path of the tsunami generated by the magnitude 9.1 of earthquake off the coast of Sumatra. Final total put the islands' death toll at 1,879 alone with another 5,600 people missing. The islanders who had heard the stories about the Laboon or similar mythological figures survived the tsunami essentially unscathed. Most of the casualties that occurred in the southern Nicobar Islands were outsiders, leaving them with no indigenous tsunami warning system to guide them to higher ground.

Introduction

Humans have passed down stories through the ages that helped cultures to cope when disaster inevitably struck. These stories were fodder for anthropologists and social scientists, but in the past decade, geologists have begun to pay more attention to how indigenous people understood and prepared for disaster. These stories, which couched myth in metaphor, could ultimately help scientists prepare for cataclysms to come. In this lesson, you will learn about how to respond to certain disasters to become resilient.

A disaster is "a catastrophe that causes great damage or loss of life and property".

8.1 Disaster Response

Disaster response entails restoring physical facilities, rehabilitation of affected population, restoration of lost livelihoods and reconstruction efforts to restore the infrastructure lost or damaged. The Response Phase focuses primarily on emergency relief: saving lives, providing first aid, restoring damaged systems (communications and transportation), meeting the basic life requirements of those impacted by disaster (food, water and shelter) and providing mental health and spiritual support and care.

Who are the first responders?

No matter how large or small, local communities are expected to provide immediate disaster response. On a daily basis, **police officers, firefighters, and emergency medical technicians** are a community's first responders, whether during fire, flood or acts of terrorism. Mental health professionals and the community's hospitals may also be activated in those early minutes and hours after disaster.

Disaster management includes Prevention, Mitigation, Preparedness, Response and Recovery. Disaster management involves all levels of government. Non-governmental and community based organizations play a vital role in the process. Modern disaster management goes beyond post-disaster assistance. It now includes pre-disaster planning and preparedness activities, organizational planning, training, information management, public relations and many other fields. Crisis management is important, but is only a part of the responsibility of a disaster manager.

Disaster Management Cycle

The traditional approach to disaster management has a number of phased sequences of action or a continuum. These can be represented as a disaster management cycle. We mainly focus on the way how the community should respond to disasters.

8.1.1 Earthquake

An earthquake is a sudden vibration of the part of the earth caused by plate movements. It occurs along the plate boundaries. The place inside the earth where an earthquake originates is **focus**. The point on the earth's surface above the called a focus is called an **epicentre**. The damage caused by the earthquake is the highest near the **epicentre**. The earthquake is measured by an instrument called a **Seismograph**. It is recorded in **Richter scale**. Let us now see how the communities can better respond to earthquakes.

1. Japan is in a very active seismic area and it has the densest seismic network in the world.

2. Which country actually has the most number of earthquakes? Indonesia is in a very active seismic zone also, but because it is larger than Japan, it has more earthquakes.

3. Which country has the most earthquakes per unit area? This would probably be Tonga, Fiji or Indonesia, since they are all in extremely active seismic areas along subduction zones.

What to do during an earthquake?

Be aware that some earthquakes are actually foreshocks and a larger earthquake might occur later. Minimize your movements to a few steps that reach a safe place nearby and stay indoors until the shaking has stopped and you are sure exiting is safe.

If indoors

1. DROP to the ground; take COVER by getting under a sturdy table or other piece of furniture and HOLD ON until the shaking stops. If there is no table or desk near you, cover your face and head with your arms and crouch in an inside corner of the building.
2. Protect yourself by staying under the lintel of an inner door, in the corner of a room, under a table or even under a bed.
3. Stay away from glass windows, outside doors and walls and anything that could fall (such as lighting fixtures or furniture).
4. Stay inside until the shaking stops and go outside.

If outdoors

1. Move away from buildings, trees, streetlights and utility wires.
2. If you are in open space, stay there until the shaking stops. The greatest danger exists directly outside buildings at exits and alongside exterior walls. Most earthquake-related casualties result due to collapsing walls, flying glass and falling objects.

If in a moving vehicle

1. Stop as quickly as safety permits. Avoid stopping near or under buildings, trees, overpasses and utility wires.
2. Proceed cautiously once the earthquake has stopped. Avoid roads, bridges or ramps that might have been damaged by the earthquake.

Activity

Mock drill: Earthquake.

It is important that we know what to do if an earthquake occurs. In case we are inside the class when it occurs, instruct loudly "earth quake position – drop, cover, and hold on". Drop down on your knee. Cover your head, neck and face. Go under a table to protect your head and neck.

8.1.2 Tsunami

A tsunami can kill or injure people and damage or destroy buildings and infrastructure as waves come forth and recede. A tsunami is a series of enormous ocean waves caused by earthquakes, underwater landslides, volcanic eruptions or asteroids. Tsunamis can travel 700-800 km per hour, with waves 10-30 meter high. It causes flooding and disrupts transportation, power, communications, and water supply.

How to respond to Tsunami?

1. You should find out if your home, school, workplace or other frequently visited locations are in tsunami hazard areas along the sea-shore.
2. Plan evacuation routes from your home, school, workplace, or any other place you could be, where tsunamis poses a risk.
3. Use a weather radio or stay tuned to a local radio or television station to keep informed of local watches and warnings.
4. Discuss tsunamis with your family. Everyone should be aware of what to do when tsunami strikes. Discussing tsunamis ahead of time will help reduce fear and save precious time in an emergency. Review flood safety and precautionary measures with your family.

What to do after a Tsunami?

1. You should continue using a weather radio or staying tuned to a Coast Guard emergency frequency station or a local radio or television station for updated emergency information.
2. Check yourself for injuries and get first aid if necessary, before helping injured or trapped persons.
3. If someone needs to be rescued, call professionals with the right equipment to help.
4. Help people who require special assistance, like Infants, elderly people, those without transportation, large families who may need additional help in an emergency situation, people with disabilities, and the people who care for them.
5. Stay out of a building if water remains around it. Tsunami water, like floodwater, can undermine foundations, causing buildings to sink, floors to crack, or walls to collapse.
6. Check for gas leaks. If you smell gas or hear a blowing or hissing noise, open a window and get everyone outside quickly.

8.1.3 Riot

Though riot may seem dramatic, an angry mob can be just as dangerous and unpredictable as just about any natural disaster. Thousands of people are killed in riots all over the world each year, and

these riots erupt from a number of racial, religious, economic, political, or social causes that cannot be predetermined. As per Pew Research Center analysis of 198 countries on April 11, 2015. Syria tops in riot in the world followed by Nigeria, Iraq and India.

If you've found yourself in the middle of a riot, you may not be able to run away immediately, but you can take some measures to protect yourself from harm. If you want to know how to survive a riot, just follow these steps.

Surviving a Riot

At Travel Destination: What to Do

1. Keep abreast of the current news if you are in a volatile area.
2. If you come across a demonstration, don't become inquisitive, just leave the area and find another route to your intended destination.
3. Avoid any place where police or security forces action is in progress.

If caught in a riot:

1. If you find yourself caught up in a demonstration, keep to the edge of the crowd where it is safer. At the first opportunity, break away and seek refuge in a nearby building or find a suitable doorway or alley and stay there until the crowd passes.
2. When leaving the fringe of the demonstration, just walk away – don't run as this will draw attention to you.
3. In the event that you are arrested by the police/military, do not resist. Go along peacefully and contact your law advisor to help you resolve your predicament.
4. If you are caught up in the crowd, stay clear of glass shop fronts, moreover, move with the flow.
5. If shooting breaks out, drop to the ground and cover your head and neck, and lie as flat as you can.

8.1.4 Fire

Wildfires occur when vegetated areas are set alight and are particularly common during hot and dry periods. They can occur in forests, grasslands, bush and deserts, and with blowing wind, can spread rapidly.

Fires can lead to the destruction of buildings, wooden bridges and poles, power, transmission and telecommunication lines, warehouses containing oil products and other fuel. It causes injury to people and animals.

The most common causes of fires are lightning strikes, sparks during arid conditions, eruption of volcanoes and man-made fires arising from deliberate arson or accidents.

A side-effect of wildfires which also threatens inhabited areas is smoke. Fires create large quantities of smoke, which can be spread far by wind and poses a respiratory hazard.

On an average, in India, every year, about **25,000 persons die** due to fires and related causes. Female accounts for about 66% of those killed in fire accidents. It is estimated that about **42 females and 21 males die every day in India due to fire.**

Think why

Smoke kills more than fire.

Fire Safety Do's and Don'ts

1. Know your building's evacuation plan.
2. Evacuate calmly and quickly, whenever a fire alarm or carbon monoxide alarm sounds.
3. Before opening a door, feel it with the back of your hand. If the door is hot, do not open it.
4. If you encounter smoke during your evacuation, stay low to the floor.
5. Know the outside rally point for your building.
6. Know the locations of fire extinguishers, fire alarm pull stations and exits.

Activity

Mock Drill :

To escape a **fire**, **stop**, **drop**, and **roll**. In case your clothes burn, stop running, drop on the floor and roll to stop the fire spreading.

What you should do during a fire:

1. Stay calm.
2. Pull the nearest fire alarm or call 112.
3. Give your name and location of the fire. Do not hang up until the police dispatcher tells you to do so.
4. Leave the building immediately.
5. Inform others as you pass them to leave the building immediately.
6. Walk—don't run—to the nearest exit.
7. Never use elevators—an elevator may become a trap.

HOTS

Why should you cut off all the branches of trees below 3 metres of height standing near your house?

Exercise

GM1ZG9

I. Choose the best answer

1. One among the following is not the first responder in case of a disaster.
   a. police officers
   b. firefighters
   c. insurance agents
   d. emergency medical technicians
2. 'Drop, Cover, Hold' is a mock drill a vowal for
   a. Fire b. Earthquake
   c. Tsunami d. Riot
3. When you happen to see a fire break out, you will make a call to
   a. 114 b. 112
   c. 115 d. 118
4. Which of the following statements is untrue?
   a. 'Stop, Drop, Roll' is for fire.
   b. 'Drop, Cover, Hold' is for an earthquake.
   c. 'If sea water recedes back, run to higher places' is for flood.
   d. 'If gunshots are heard, drop to the ground and cover the head with hand' is for riot.
5. Which of the following statements belongs to responding to earthquake?
   a. Avoid, any place where police or security forces action is in progress.
   b. Know the height of your street above sea level and the distance of your street from the coast.
   c. Stay away from glass, windows, outside doors and walls and anything that could fall.
   d. Before opening a door, feel it with the back of your hand.

II. Answer in brief

1. Who are the community's first responders to disaster?
2. What are the four phases of the Disaster Management Cycle?
3. Though Japan has the densest seismic network, Indonesia has the most number of earthquakes. Why?
4. How many males and females die per day due to fire in India?
5. What should you do after a Tsunami?

III. Answer in Paragraph

1. Write a short note on Tsunami.
2. What do you do if you are indoors during an earthquake?
3. How do you respond to Tsunami?
4. Write three sentences about what to do during fire.

Practice

1. Mock drill for fire
2. Mock drill for earthquake

REFERENCE BOOKS

1. Disaster management Module, TNSCERT.
2. NDMA.
3. Wikipedia

INTERNET RESOURCES

A-Z GLOSSARY

Asthenosphere	Upper layer of the earth's mantle below the lithosphere.
Air current	Movement of air when it rises upward or sinks down.
Cataclysms	Large scale violent events in the natural world
Condensation	Process of change of state of water from gaseous to liquid.
Continental drift	The gradual movement of the Earth's continents on the surface of the planet
Coriolis Force	Deflection of winds from their original path due to Earth's rotation.
Doldrums	The equatorial low pressure belt, extending between 5°N and 5°S.
Eruption	The ejection of molten rock, steam, etc. from a volcano or geyser.
Geology	The science that deals with the physical structure and substances of the earth, their history and the processes which act on them.
Hazard	Potential threat to life
Hostility	Unfriendliness
Inquisitive	Curious about learning things
Internal Radioactivity	Radiations emitted from radioactive metals inside the earth and act as a driving force for the earth's tectonics.

Lair	A place where a wild animal lives in
Mitigation	Action of reducing severity
Normal Lapse rate	Decrease of temperature at the rate of 6.5°C/km increase in altitude.
Orogeny	Mountain building process due to lateral compression of the crust.
Pacific ring of fire	The Pacific Ring of fire is an arc around the Pacific Ocean where many volcanoes are found.
Pangea	A super continent that existed during the late Palaeozoic and early Mesozoic eras.
Panthalasa	Super ocean that surrounded Pangaea.
Predicament	Unpleasant situation
Rehabilitation	Act of restoring someone to health or normal life through training and therapy
Riot	An occasion where a large number of people behave in a noisy, violent and uncontrolled way
Unscathed	Without suffering any injury or damage
Wind vane	Also known as windcock. It is a device to find out the direction of wind.