SEMESTER – I

DSC-101 PHYSICAL GEOGRAPHY

UNIT – I:

Definition, Nature, scope of Physical Geography. theories of Origin of the Earth – Big Bang Laplace Jean's & Jeffrey's, Earth movements and plate tectonics; volcanism; Earthquake, weathering, erosion, mass movement.

UNIT – II:

Climatology - The atmosphere; its structure and composition; temperature; humidity, precipitation, pressure, and wind; jet streams; air masses and fronts; cyclones and related phenomena.

UNIT – III:

Soil and Vegetation - Soil genesis, classification and distribution, biotic successions, and major biotic regions of the world with special references to ecological aspects of Savanna and monsoon forest biomes.

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UNIT – IV:

Oceanography - Ocean bottom relief; salinity, temperature, currents, and tides; ocean deposits and coral reefs; Marine resources – biotic mineral, and energy resources and their utilization.

UNIT - V:

Ecosystem - Ecosystem concept, interrelations of energy flows, water circulation, biotic communities, and land capability; Man’s impact on the ecosystem, global ecological imbalances.

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UNIT – 1

ONE MARK:

Section A: Definition, Nature and Scope of Physical Geography

Q1. What is Physical Geography?

Answer: Physical Geography is the branch of geography that studies the natural features of the Earth, such as landforms, climate, soil, water bodies and vegetation.

Q2. What is the main objective of Physical Geography?

Answer: The main objective of Physical Geography is to understand the natural environment of the Earth and the processes that shape it.

Q3. Mention any two branches of Physical Geography.

Answer: Two important branches of Physical Geography are Geomorphology and Climatology.

Q4. What is the scope of Physical Geography?

Answer: The scope of Physical Geography includes the study of landforms, climate, oceans, soil, natural vegetation and other physical features of the Earth.

Section B: Theories of the Origin of the Earth

Q5. What is the Big Bang Theory?

Answer: The Big Bang Theory explains that the universe originated from an extremely hot and dense state about 13.8 billion years ago and has been expanding ever since.

Q6. Who proposed the Nebular Hypothesis?

Answer: The Nebular Hypothesis was proposed by Immanuel Kant and later developed by Pierre-Simon Laplace.

Q7. What is the main idea of Laplace's Nebular Hypothesis?

Answer: According to Laplace, the Sun and planets were formed from a large rotating cloud of hot gases called a nebula.

Q8. Who proposed the Planetesimal Hypothesis?

Answer: The Planetesimal Hypothesis was proposed by Thomas C. Chamberlin and Forest R. Moulton.

Q9. What is the main idea of the Jeans and Jeffreys theory?

Answer: According to the tidal hypothesis of Jeans and Jeffreys, a massive star passed close to the Sun and pulled out gaseous material, which later formed the planets.

Section C: Earth Movements and Plate Tectonics

Q10. What are Earth movements?

Answer: Earth movements are the movements of the Earth's crust caused by internal forces, which may result in folding, faulting and changes in landforms.

Q11. What is plate tectonics?

Answer: Plate tectonics is the theory that the Earth's lithosphere is divided into several large and small plates that move slowly over the semi-fluid asthenosphere.

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Section D: Volcanism and Earthquake

Q12. What is volcanism?

Answer: Volcanism is the process through which magma and gases from the Earth's interior move towards or reach the Earth's surface.

Q13. What is an earthquake?

Answer: An earthquake is the sudden shaking of the Earth's surface caused by the release of energy within the Earth's crust.

Section E: Weathering, Erosion and Mass Movement

Q14. What is weathering?

Answer: Weathering is the process of breaking down rocks into smaller pieces at or near the Earth's surface without their transportation.

Q15. What is mass movement?

Answer: Mass movement is the downward movement of rock, soil and other materials along a slope under the influence of gravity.

TWO MARK:

1. Define Physical Geography and explain its nature.

Answer: Physical Geography is the branch of geography that deals with the study of natural features and processes of the Earth, such as landforms, climate, soil, water bodies and vegetation. Its nature is scientific because it studies the natural environment and the processes responsible for changes on the Earth's surface.

2. Explain the scope of Physical Geography.

Answer: The scope of Physical Geography is very wide. It includes the study of landforms, climate, oceans, soil, natural vegetation and environmental processes. It also helps us understand natural hazards and the relationship between human beings and the physical environment.

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3. Mention any four important branches of Physical Geography.

Answer: Four important branches of Physical Geography are Geomorphology, Climatology, Oceanography and Biogeography. Geomorphology studies landforms, Climatology deals with climate, Oceanography studies oceans, and Biogeography deals with the distribution of plants and animals.

4. What is the Big Bang Theory?

Answer: The Big Bang Theory explains the origin and expansion of the universe. According to this theory, the universe began from an extremely hot and dense state about 13.8 billion years ago and has been expanding ever since. It is the most widely accepted scientific explanation of the early development of the universe.

5. Explain Laplace's Nebular Hypothesis.

Answer: Laplace's Nebular Hypothesis states that the Sun and planets were formed from a large, hot and rotating cloud of gases called a nebula. As the nebula cooled and contracted, rings of matter separated from it and gradually formed the planets, while the central mass developed into the Sun.

6. What is the Planetesimal Hypothesis?

Answer: The Planetesimal Hypothesis was proposed by Thomas Chamberlin and Forest Moulton. According to this hypothesis, a passing star came close to the Sun and pulled out some of its material through gravitational attraction. This material gradually cooled and formed small solid bodies called planetesimals, which later combined to form planets.

7. Explain the Jeans and Jeffreys Tidal Hypothesis.

Answer: The Jeans and Jeffreys Tidal Hypothesis suggests that a massive star passed close to the Sun and produced strong tidal forces. These forces pulled gaseous material out of the Sun. The material gradually cooled and condensed to form the planets. This is a historical theory of planetary origin and is not the currently accepted explanation.

8. What are Earth movements? Mention their types.

Answer: Earth movements are the movements of the Earth's crust caused by forces operating inside the Earth. They bring changes to the Earth's surface and help in the formation of different landforms. The two main types are slow movements, such as uplift and subsidence, and sudden movements, such as earthquakes and volcanic eruptions.

9. What is plate tectonics?

Answer: Plate tectonics is the theory that the Earth's lithosphere is divided into several large and small plates. These plates move slowly over the underlying, slowly deforming asthenosphere. Their movements cause earthquakes, volcanic activities, mountain building and the formation of ocean trenches.

10. What is volcanism? Explain its main types.

Answer: Volcanism refers to the movement of magma and gases from the Earth's interior towards or onto the Earth's surface. It is mainly of two types: intrusive volcanism, in which magma cools and solidifies below the surface, and extrusive volcanism, in which lava and other materials reach the Earth's surface through volcanic eruptions.

11. What is an earthquake? Mention its main causes.

Answer: An earthquake is the sudden shaking of the Earth's surface due to the release of energy inside the Earth. Its main cause is the sudden movement of rocks along faults, usually due to tectonic forces. Volcanic activities and some human activities, such as mining and reservoir-induced changes, can also cause earthquakes.

12. Differentiate between weathering and erosion.

Answer: Weathering is the process of breaking down rocks into smaller pieces at or near the Earth's surface without moving them from their original position. Erosion is the process of wearing away and removing rock and soil materials by agents such as rivers, wind, glaciers and sea waves. Thus, weathering breaks down rocks, while erosion removes and transports them.

13. What are the main types of weathering?

Answer: Weathering is mainly divided into three types: physical, chemical and biological weathering. Physical weathering breaks rocks into smaller pieces without changing their chemical composition. Chemical weathering changes the minerals of rocks through chemical reactions, while biological weathering occurs due to the activities of plants, animals and microorganisms.

14. What is erosion? Name its major agents.

Answer: Erosion is the process of wearing away and removing soil and rock materials from the Earth's surface. Its major agents are running water, wind, glaciers, sea waves and groundwater. These

agents transport materials from one place to another and help in shaping different landforms.

15. What is mass movement? Give two examples.

Answer: Mass movement refers to the downward movement of rock, soil and other materials along a slope under the influence of gravity. It commonly occurs on steep slopes and may be triggered by heavy rainfall, earthquakes or slope instability. Landslides and rockfalls are two common examples of mass movement.

BROAD ANSWER:

Q1. Define Physical Geography. Discuss its nature and scope.

Answer:

Introduction

Physical Geography is an important branch of Geography that deals with the study of the natural environment of the Earth. It focuses on different natural features and processes such as mountains, plateaus, plains, rivers, oceans, climate, soil and natural vegetation. It helps us understand how the Earth's surface is formed and how different natural processes bring changes to the environment. Physical Geography also explains the relationship between different elements of nature and their influence on the Earth's environment.

Nature of Physical Geography

The nature of Physical Geography is scientific because it studies the natural environment through observation, investigation and scientific methods. It examines different physical processes and explains how they operate on the Earth's surface. For example, it studies how rivers form valleys, how wind changes desert landscapes and how volcanic activities create new landforms.

Physical Geography is dynamic in nature because the natural environment is continuously changing. Mountains are affected by

weathering and erosion, rivers change their courses, and climatic conditions also change over time. These changes may take place within a short period or over millions of years.

It is also an integrated subject because it studies the relationship between different components of the natural environment. For example, climate influences soil formation and vegetation, while landforms affect river systems and the distribution of natural resources. All these elements are connected with one another.

Scope of Physical Geography

The scope of Physical Geography is very wide. It includes the following major branches:

1. Geomorphology: Geomorphology is the study of the Earth's landforms and the processes responsible for their formation. It deals with mountains, plateaus, plains, valleys and other physical features. It also studies weathering, erosion, earthquakes and volcanic activities.

2. Climatology: Climatology is the study of climate and atmospheric conditions over a long period. It deals with temperature, rainfall, humidity, atmospheric pressure, winds and climatic changes. It helps us understand different climatic regions of the world.

3. Oceanography: Oceanography deals with the scientific study of oceans and seas. It includes ocean currents, waves, tides, ocean-floor features and marine resources. It also helps us understand the importance of oceans in regulating global climate.

4. Biogeography: Biogeography studies the distribution of plants and animals over the Earth's surface. It explains how climate, soil, relief and other environmental conditions influence the distribution of living organisms.

5. Soil Geography: Soil Geography deals with the study of different types of soil, their formation, characteristics and distribution. It also explains the importance of soil for agriculture and natural vegetation.

6. Hydrology: Hydrology is the study of water on, above and below the Earth's surface. It includes rivers, lakes, groundwater and the water cycle.

Importance of Physical Geography

Physical Geography is useful in understanding natural resources and environmental problems. It provides knowledge about floods, earthquakes, landslides, droughts and other natural hazards. It is also helpful in agriculture, environmental planning, disaster management and sustainable development.

Q2. Explain the major theories regarding the origin of the Earth, with special reference to the Big Bang Theory, Laplace's Nebular Hypothesis and the Jeans and Jeffreys Tidal Hypothesis.

Answer:

Introduction

The origin of the Earth has been an important subject of scientific study. Scientists have proposed different theories and hypotheses to explain the origin of the universe and the formation of the Solar System and planets. The Big Bang Theory, Laplace's Nebular Hypothesis and the Jeans and Jeffreys Tidal Hypothesis are important explanations discussed in the history of ideas about the origin of the universe and the Earth.

1. Big Bang Theory

The Big Bang Theory is the most widely accepted scientific explanation of the origin and early development of the universe. According to this theory, the universe began approximately 13.8 billion years ago from an extremely hot and dense state. It then started expanding, and this expansion continues even today.

As the universe expanded, it gradually cooled. Matter began to form, and over a long period stars and galaxies developed. Later, the Solar System formed approximately 4.6 billion years ago from a large cloud

of gas and dust. The Earth was also formed during this period from material present in the early Solar System.

It is important to understand that the Big Bang Theory explains the origin and expansion of the universe, not the direct formation of the Earth.

2. Laplace's Nebular Hypothesis

The Nebular Hypothesis was first suggested by Immanuel Kant in 1755 and later developed by the French mathematician and astronomer Pierre-Simon Laplace in 1796.

According to Laplace, the Solar System originated from a large, hot and rotating cloud of gases known as a nebula. Due to cooling and contraction, the nebula gradually became smaller and rotated faster.

As the nebula contracted, rings of gaseous material were believed to separate from its outer region. These rings gradually cooled and condensed to form planets. The central mass of the nebula eventually developed into the Sun.

This hypothesis was an important early attempt to explain the formation of the Solar System. However, its original mechanism is not accepted as a complete modern scientific explanation.

3. Jeans and Jeffreys Tidal Hypothesis

The Tidal Hypothesis was proposed by Sir James Jeans in 1917 and later modified by Harold Jeffreys.

According to this hypothesis, a massive star passed very close to the Sun. Due to its strong gravitational attraction, the passing star produced powerful tidal forces on the Sun and pulled out a long stream of gaseous material.

This material gradually cooled and was believed to break into smaller portions. These portions eventually condensed and formed the planets. The hypothesis attempted to explain the formation of planets through the gravitational influence of a passing star.

However, this hypothesis is not accepted as the modern scientific explanation of the origin of the Solar System.

Modern Scientific Explanation

According to the modern Solar Nebular Model, the Solar System formed from a rotating cloud of gas and dust about 4.6 billion years ago. Gravity caused the cloud to collapse and form a rotating disc. The Sun developed at the centre, while the remaining material gradually combined to form planets, including the Earth.

Q3. What are Earth movements? Explain the theory of plate tectonics and its major types of plate boundaries.

Answer:

Introduction

The Earth's surface is not fixed or completely stable. It continuously changes due to forces operating inside the Earth. These forces cause movements of the Earth's crust and produce different landforms such as mountains, plateaus, valleys and ocean trenches. Earth movements play an important role in shaping the physical features of the Earth. The theory of plate tectonics provides a scientific explanation of these movements and changes.

Meaning of Earth Movements

Earth movements refer to the movements of the Earth's crust caused by internal forces. These movements may take place slowly over millions of years or suddenly within a short period. They are responsible for folding, faulting, mountain building, earthquakes and volcanic activities.

Types of Earth Movements

Earth movements are broadly divided into two main types.

1. Slow or Diastrophic Movements

These movements take place gradually over a long period due to forces operating inside the Earth. They are mainly responsible for large-scale changes in the Earth's crust. They include two important forms.

Epeirogenic movements are large-scale vertical movements of the Earth's crust that cause the uplift or sinking of extensive land areas. These movements may result in the formation of plateaus, coastal plains and raised or submerged land regions.

Orogenic movements are mainly associated with horizontal or compressional forces that cause folding and faulting of rocks. They are responsible for the formation of major mountain ranges. The formation of the Himalayas is an important example of mountain building caused by the collision of tectonic plates.

2. Sudden Movements

Sudden movements take place within a short period and may cause major changes to the Earth's surface. Earthquakes and volcanic eruptions are common examples. These movements may cause loss of life and damage to buildings, roads and other structures.

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Theory of Plate Tectonics

The theory of plate tectonics explains that the Earth's outer solid layer, known as the lithosphere, is divided into several large and small plates. These plates consist of continental and oceanic portions.

The lithospheric plates move slowly over the underlying asthenosphere, which is a relatively weak and slowly deforming layer of the upper mantle. Their movement is driven by forces such as slab pull, ridge push and mantle flow. The movement of these plates is responsible for many important physical features of the Earth.

Major Types of Plate Boundaries

There are three major types of plate boundaries.

1. Convergent Boundary

A convergent boundary is formed when two tectonic plates move towards each other. When two continental plates collide, they may form high mountain ranges. For example, the collision of the Indian Plate with the Eurasian Plate helped in the formation of the Himalayas. When an oceanic plate meets a continental plate, the denser oceanic plate usually sinks beneath the continental plate. This process is known as subduction.

2. Divergent Boundary

A divergent boundary occurs when two tectonic plates move away from each other. Magma rises from the Earth's interior and cools to form new crust. This process is common along mid-ocean ridges. The Mid-Atlantic Ridge is an important example.

3. Transform Boundary

A transform boundary is formed when two tectonic plates slide horizontally past each other. This movement may cause earthquakes. The San Andreas Fault in California is a well-known example.

Importance of Plate Tectonics

The theory of plate tectonics helps explain the distribution of earthquakes, volcanoes, mountain ranges and ocean trenches. It also explains continental movement and the development of major physical features of the Earth.

Q4. What is volcanism? Explain the causes, types and effects of volcanic activities.

Answer:

Introduction

Volcanism is an important geological process that takes place due to the movement of molten rock material from the Earth's interior towards or onto its surface. It is one of the major processes responsible for the formation and modification of landforms. Volcanic

activities may create mountains, islands, plateaus and other physical features. They also bring significant changes to the natural environment.

Meaning of Volcanism

Volcanism refers to the processes through which magma and associated gases move from the Earth's interior towards or onto the surface. Magma is molten or partially molten rock material found beneath the Earth's surface. When magma reaches the Earth's surface, it is known as lava. The opening through which lava, gases and other volcanic materials come out is called a volcanic vent.

Causes of Volcanism

Volcanism mainly occurs due to the high temperature and pressure inside the Earth. The melting of rocks in the mantle or crust produces magma, which may rise because it is less dense than the surrounding solid rocks.

The movement of tectonic plates also plays an important role in volcanic activities. Volcanoes are commonly found at convergent and divergent plate boundaries. At convergent boundaries, one plate may sink beneath another, causing conditions that help generate magma. At divergent boundaries, plates move apart and magma rises through the gaps. Volcanoes also occur at certain hotspots, where unusually hot material rises from deep within the mantle.

Types of Volcanism

Volcanism is mainly divided into two types.

1. Intrusive Volcanism

Intrusive volcanism takes place when magma enters cracks and spaces within the Earth's crust but does not reach the surface. It gradually cools and solidifies below the surface. This process produces different intrusive landforms.

Some common examples include batholiths, laccoliths, dykes and sills. A batholith is a large mass of intrusive igneous rock. A dyke is a

sheet of igneous rock that cuts across existing rock layers, while a sill is formed when magma spreads between rock layers. These features may become visible when the overlying rocks are removed through erosion.

2. Extrusive Volcanism

Extrusive volcanism occurs when magma reaches the Earth's surface through volcanic openings. The erupted material is known as lava. It may also contain volcanic ash, gases, dust and rock fragments.

When lava cools and solidifies, it forms different volcanic landforms such as volcanic cones, lava plateaus and volcanic islands. The Deccan Traps of India are an important example of a large volcanic plateau formed by repeated lava flows in the geological past.

Types of Volcanoes According to Activity

Volcanoes are commonly classified into three groups according to their activity.

Active volcanoes are those that are erupting or have erupted in recent times and may erupt again. Dormant volcanoes have remained inactive for a long period but may become active again. Extinct volcanoes are those that are not expected to erupt again under present geological conditions.

Effects of Volcanic Activities

Volcanic activities have both positive and negative effects on the environment. On the positive side, volcanic materials help in the formation of fertile soils that are useful for agriculture. Volcanic eruptions also create new landforms, islands and mineral resources. Geothermal energy can also be developed in volcanic regions.

On the negative side, volcanic eruptions may cause loss of human life, destruction of houses, damage to agricultural land and environmental pollution. Volcanic ash and gases may create respiratory problems and disturb air transportation. Lava flows can destroy roads, forests and settlements.

Q5. Explain earthquakes, weathering, erosion and mass movement. Discuss their causes and effects on the Earth's surface.

Answer:

Introduction

The Earth's surface is continuously changing due to different natural processes. Some processes originate inside the Earth, while others operate on or near its surface. Earthquakes, weathering, erosion and mass movement are important geographical processes that help shape the Earth's landforms. These processes may occur naturally and can bring significant changes to the physical environment.

1. Earthquake

An earthquake is the sudden shaking of the Earth's surface caused by the release of energy within the Earth. This energy produces seismic waves that travel through the Earth's interior and along its surface.

The main cause of earthquakes is the sudden movement of rocks along faults due to tectonic forces. Earthquakes commonly occur near the boundaries of tectonic plates. Volcanic activities and certain human activities, such as mining and reservoir-induced changes, can also cause earthquakes.

The point inside the Earth where an earthquake originates is called the focus or hypocentre. The point directly above it on the Earth's surface is known as the epicentre. Earthquakes may cause serious damage to buildings, roads, bridges and other structures. They may also trigger landslides, tsunamis and ground cracks.

2. Weathering

Weathering is the process of breaking down rocks into smaller pieces at or near the Earth's surface without transporting them from their original position. It is an important process in soil formation and landform development.

Weathering is mainly divided into three types.

Physical weathering breaks rocks into smaller pieces without changing their chemical composition. It may occur due to temperature changes, frost action and pressure release.

Chemical weathering takes place when minerals in rocks undergo chemical changes due to water, oxygen, carbon dioxide and other substances. Processes such as oxidation, carbonation and solution are examples of chemical weathering.

Biological weathering occurs due to the activities of living organisms. For example, plant roots may grow into cracks in rocks and gradually break them apart. Burrowing animals and microorganisms may also contribute to the process.

3. Erosion

Erosion is the process of wearing away, removing and transporting soil and rock materials from one place to another. It is mainly carried out by natural agents such as running water, wind, glaciers and sea waves.

Running water erodes rocks and soil and forms valleys, gorges and river channels. Wind erosion is common in dry and desert regions, where strong winds remove loose sand and dust. Glaciers erode the land through the movement of ice and form features such as U-shaped valleys. Sea waves continuously erode coastal areas and may form cliffs and caves.

Erosion is a natural process, but excessive soil erosion can reduce soil fertility, damage agricultural land and increase sedimentation in rivers and reservoirs.

4. Mass Movement

Mass movement refers to the downward movement of rock, soil and other materials along a slope under the influence of gravity. Unlike erosion by rivers or wind, gravity is the main driving force behind mass movement.

It commonly occurs on steep slopes and may be triggered by heavy rainfall, earthquakes, volcanic activity and the removal of vegetation. Landslides, rockfalls, mudflows and soil creep are common examples.

Mass movement can destroy houses, roads, bridges and agricultural land. It may also block rivers and create temporary lakes. In hilly regions, it is an important natural hazard.

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UNIT – 2

ONE MARK:

Section A: The Atmosphere – Structure and Composition

Q1. What is the atmosphere?

Answer: The atmosphere is the envelope of gases surrounding the Earth, held in place by gravitational force.

Q2. Name the major gases present in the atmosphere.

Answer: The major gases in the atmosphere are nitrogen (about 78%), oxygen (about 21%), argon (about 0.93%) and carbon dioxide (about 0.04%).

Q3. Name the five main layers of the atmosphere.

Answer: The five main layers are Troposphere, Stratosphere, Mesosphere, Thermosphere and Exosphere.

Q4. In which layer of the atmosphere does weather activity mainly occur?

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Answer: Most weather activities occur in the Troposphere, the lowest layer of the atmosphere.

Section B: Temperature, Humidity and Precipitation

Q5. What is atmospheric temperature?

Answer: Atmospheric temperature refers to the degree of hotness or coldness of the air at a particular place and time.

Q6. What is insolation?

Answer: Insolation is the incoming solar radiation received by the Earth from the Sun.

Q7. What is humidity?

Answer: Humidity is the amount of water vapour present in the atmosphere.

Q8. What is relative humidity?

Answer: Relative humidity is the percentage of actual water vapour present in the air compared with the maximum amount the air can hold at the same temperature.

Q9. What is precipitation?

Answer: Precipitation is the process by which water falls from the atmosphere to the Earth's surface in the form of rain, snow, sleet or hail.

Section C: Atmospheric Pressure and Wind

Q10. What is atmospheric pressure?

Answer: Atmospheric pressure is the force exerted by the weight of the air on a unit area of the Earth's surface.

Q11. What is wind?

Answer: Wind is the horizontal movement of air from an area of high atmospheric pressure towards an area of low atmospheric pressure.

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Q12. What are jet streams?

Answer: Jet streams are narrow bands of very strong winds that blow in the upper atmosphere, generally from west to east.

Section D: Air Masses, Fronts and Cyclones

Q13. What is an air mass?

Answer: An air mass is a large body of air having nearly uniform temperature and moisture characteristics over a wide area.

Q14. What is a weather front?

Answer: A weather front is the boundary separating two air masses having different temperature and moisture characteristics.

Q15. What is a cyclone?

Answer: A cyclone is a large-scale atmospheric system in which winds circulate around a low-pressure centre, usually in an

anticlockwise direction in the Northern Hemisphere and clockwise in the Southern Hemisphere.

TWO MARK:

Q1. What is the atmosphere? Explain its importance.

Answer: The atmosphere is the envelope of gases surrounding the Earth, held in place by gravity. It is important because it provides essential gases like oxygen and carbon dioxide, protects the Earth from harmful solar radiation, regulates temperature and supports weather and climate processes necessary for life.

Q2. Describe the composition of the atmosphere.

Answer: The atmosphere is mainly composed of nitrogen (about 78%) and oxygen (about 21%). It also contains argon, carbon dioxide, water vapour and other gases in small quantities. These gases play an important role in maintaining the Earth's temperature, supporting life and controlling weather conditions.

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Q3. Explain the different layers of the atmosphere.

Answer: The atmosphere is divided into five major layers: Troposphere, Stratosphere, Mesosphere, Thermosphere and Exosphere. The Troposphere is the lowest layer where most weather activities occur, while the Stratosphere contains the ozone layer. The other layers extend towards outer space and have different temperature and atmospheric characteristics.

Section B: Temperature and Humidity

Q4. What is atmospheric temperature? Mention its major controlling factors.

Answer: Atmospheric temperature refers to the degree of hotness or coldness of the air at a particular place and time. It is mainly controlled by latitude, altitude, distance from the sea, ocean currents,

prevailing winds and cloud cover. These factors create differences in temperature from one place to another.

Q5. What is insolation? Why is it important?

Answer: Insolation refers to the incoming solar radiation received by the Earth from the Sun. It is the main source of energy for the Earth's surface and atmosphere. It controls temperature, influences atmospheric circulation and helps in the formation of winds, clouds and rainfall.

Q6. What is humidity? Explain its main types.

Answer: Humidity refers to the amount of water vapour present in the atmosphere. It is mainly expressed in three forms: absolute humidity, specific humidity and relative humidity. These measurements help us understand the moisture content of the air and its role in weather conditions.

Q7. What is relative humidity? How is it measured?

Answer: Relative humidity is the percentage of actual water vapour present in the air compared with the maximum amount the air can hold at the same temperature. It is expressed as a percentage (%) and is commonly measured with an instrument called a hygrometer or psychrometer.

Section C: Precipitation

Q8. What is precipitation? Mention its major forms.

Answer: Precipitation is the process by which water falls from the atmosphere to the Earth's surface in liquid or solid form. Its major forms include rainfall, snowfall, sleet and hail. Precipitation is an important part of the water cycle and provides water for rivers, lakes, agriculture and other natural activities.

Q9. Explain the three major types of rainfall.

Answer: The three major types of rainfall are convectional, orographic and cyclonic rainfall. Convectional rainfall occurs when

heated air rises, cools and condenses. Orographic rainfall occurs when moist air is forced to rise over mountains. Cyclonic or frontal rainfall occurs when air rises due to the movement and meeting of different air masses.

Section D: Atmospheric Pressure, Wind and Jet Streams

Q10. What is atmospheric pressure? Mention its controlling factors.

Answer: Atmospheric pressure is the force exerted by the weight of the air on a unit area of the Earth's surface. It is mainly controlled by temperature, altitude, humidity and the movement of air. Atmospheric pressure generally decreases with an increase in altitude.

Q11. What is wind? Explain the factors responsible for wind movement.

Answer: Wind is the horizontal movement of air from an area of high atmospheric pressure towards an area of low atmospheric pressure. Its movement and direction are influenced by pressure differences, the Coriolis force caused by the Earth's rotation and friction near the Earth's surface.

Q12. What are jet streams? Explain their importance.

Answer: Jet streams are narrow bands of very strong winds that blow in the upper atmosphere, generally from west to east. They influence weather conditions, the movement of cyclones and the development of weather systems. They also play an important role in the distribution of temperature and rainfall in different regions.

Section E: Air Masses, Fronts and Cyclones

Q13. What is an air mass? Mention its major types.

Answer: An air mass is a large body of air having nearly uniform temperature and moisture characteristics over a wide area. It is commonly classified according to its source region as continental or maritime and tropical or polar. These air masses influence the temperature, humidity and weather conditions of different regions.

Q14. What is a weather front? Explain its major types.

Answer: A weather front is the boundary separating two air masses with different temperature and moisture characteristics. Its major types are cold front, warm front, stationary front and occluded front. Fronts are important because they often cause cloud formation, rainfall, thunderstorms and changes in temperature.

Q15. What is a cyclone? Explain its main characteristics.

Answer: A cyclone is a large-scale atmospheric system in which winds circulate around a low-pressure centre. It is generally associated with cloudy weather, strong winds and rainfall. In the Northern Hemisphere, cyclonic winds usually move anticlockwise, while in the Southern Hemisphere, they move clockwise due to the Coriolis effect.

BROAD ANSWER:

Q1. Describe the composition and vertical structure of the atmosphere. Explain the importance of the atmosphere.

Answer

Introduction

The atmosphere is the envelope of gases surrounding the Earth. It is held around the Earth by the force of gravity and extends thousands of kilometres above the surface. Although the atmosphere becomes thinner with increasing height, it is very important for the existence of life. It provides the air we breathe, protects the Earth from harmful solar radiation and helps maintain a suitable temperature for living organisms.

Composition of the Atmosphere

The atmosphere is made up of different gases, water vapour and tiny particles called aerosols. The main gases in dry air near the Earth's surface are nitrogen and oxygen. Nitrogen makes up about 78 per cent

of the atmosphere, while oxygen accounts for about 21 per cent. Argon forms approximately 0.93 per cent, and carbon dioxide is present in a much smaller and variable amount, around 0.04 per cent. Other gases, such as neon, helium, hydrogen and ozone, are found in very small quantities.

Water vapour is also an important component of the atmosphere. Its amount varies from place to place and from season to season. It plays an important role in cloud formation, rainfall and the transfer of heat. Dust, smoke, salt particles and other aerosols also remain suspended in the air and help in the formation of clouds.

Vertical Structure of the Atmosphere

On the basis of temperature changes with height, the atmosphere is divided into five main layers.

1. Troposphere: The troposphere is the lowest layer of the atmosphere. It extends from the Earth's surface to an average height of about 12 kilometres. Its height is generally greater near the equator and lower near the poles. Almost all important weather activities, such as clouds, rainfall, storms and winds, take place in this layer. Temperature generally decreases with increasing height.

2. Stratosphere: The stratosphere lies above the troposphere and extends approximately from 12 to 50 kilometres. It contains the ozone layer, which absorbs much of the harmful ultraviolet radiation coming from the Sun. Temperature increases with height in this layer because ozone absorbs solar energy.

3. Mesosphere: The mesosphere extends roughly from 50 to 80–85 kilometres. Temperature decreases with height and becomes extremely low near its upper boundary. Most meteors burn up in this layer due to friction and interaction with atmospheric gases.

4. Thermosphere: The thermosphere lies above the mesosphere. Temperature increases considerably with height because gases absorb high-energy solar radiation. The ionosphere, which contains

electrically charged particles, overlaps mainly with this region. Auroras are commonly observed in the upper atmosphere.

5. Exosphere: The exosphere is the outermost layer. It contains extremely thin gases and gradually merges into outer space.

Importance of the Atmosphere

The atmosphere provides oxygen for respiration and carbon dioxide for photosynthesis. It protects living organisms from harmful ultraviolet radiation through the ozone layer. It also helps regulate Earth's temperature through the natural greenhouse effect. Water vapour in the atmosphere produces clouds and rainfall, supporting agriculture and freshwater resources. In addition, the atmosphere burns up many small meteors before they reach the Earth's surface.

Q2. Explain atmospheric temperature and discuss the major factors affecting its distribution on the Earth's surface.

Answer

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Introduction

Atmospheric temperature refers to the degree of hotness or coldness of the air at a particular place and time. It is an important element of climate and weather. Temperature influences air pressure, wind, humidity, rainfall and many other atmospheric conditions. The Sun is the main source of energy for the Earth's atmosphere, but temperature is not the same everywhere. It varies from place to place because of several geographical factors.

Heating of the Atmosphere

The atmosphere receives most of its heat indirectly from the Earth's surface. Solar radiation reaches the Earth in the form of short waves. The Earth's surface absorbs some of this energy and becomes warm. It then releases energy as long-wave terrestrial radiation, which heats the air above it.

The atmosphere is heated through different processes. Radiation transfers energy through electromagnetic waves. Conduction occurs when heat passes from the Earth's warm surface to the air in direct contact with it. Convection transfers heat through the vertical movement of air. Advection refers to the horizontal movement of warm or cold air from one region to another.

Factors Affecting the Distribution of Temperature

1. Latitude: Latitude is one of the most important factors affecting temperature. The equatorial regions receive more direct solar rays throughout the year, so they generally remain warmer. In higher latitudes, the Sun's rays fall at a slant and spread over a larger area. Therefore, polar regions receive less heat and remain colder.

2. Altitude: Temperature generally decreases with increasing height in the troposphere. On average, it decreases at a rate of about 6.5°C per kilometre. This is known as the normal environmental lapse rate. As a result, mountain areas are usually cooler than nearby lowland areas.

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3. Distance from the Sea: Water heats and cools more slowly than land. Therefore, coastal areas usually experience a moderate climate, with less extreme temperatures. Inland areas, especially those far from the sea, often experience hotter summers and colder winters.

4. Ocean Currents: Ocean currents influence the temperature of nearby coastal regions. Warm ocean currents raise the temperature of adjoining coastal areas, while cold currents lower it. For example, the warm North Atlantic Drift helps keep parts of Western Europe relatively mild.

5. Prevailing Winds: Winds carry the temperature conditions of their source regions. Winds coming from warm areas may raise local temperatures, while winds from cold regions may lower them. Thus, prevailing winds influence the climate of different places.

6. Cloud Cover: Clouds affect the amount of solar radiation reaching the Earth's surface. During the day, thick clouds reflect some

incoming sunlight and reduce heating. At night, clouds absorb and re-radiate outgoing heat, reducing rapid cooling. Therefore, cloudy areas often have a smaller daily temperature range.

7. Slope and Aspect: The direction in which a slope faces also affects temperature. In the Northern Hemisphere, south-facing slopes generally receive more direct sunlight than north-facing slopes. As a result, they are often warmer.

8. Nature of the Earth's Surface: Different surfaces absorb and reflect solar energy differently. Dark surfaces generally absorb more heat, while light-coloured surfaces reflect more sunlight. Forests, deserts, snow-covered regions and urban areas therefore show different temperature conditions.

Horizontal and Vertical Distribution

Horizontally, temperature is generally higher near the equator and lower towards the poles, although ocean currents, winds and landforms create local differences. Vertically, temperature usually decreases with height in the troposphere. However, in the stratosphere, temperature increases with height because ozone absorbs ultraviolet radiation.

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Q3. What is humidity? Explain its different types and discuss the major forms and types of precipitation.

Answer

Introduction

Humidity refers to the amount of water vapour present in the atmosphere. Water vapour is an important component of the atmosphere because it influences weather, cloud formation and rainfall. It also helps regulate temperature by absorbing and releasing heat. Humidity and precipitation are closely related because rainfall and other forms of precipitation develop when moist air cools and water vapour condenses or deposits into liquid water or ice.

Types of Humidity

Humidity is commonly expressed in three main ways.

1. Absolute Humidity: Absolute humidity refers to the actual mass of water vapour present in a unit volume of air. It is generally expressed in grams per cubic metre. It tells us how much water vapour is present in a given volume of air.

2. Specific Humidity: Specific humidity is the mass of water vapour present per unit mass of moist air. It is usually expressed in grams per kilogram. It is useful because it measures the actual amount of water vapour in the air.

3. Relative Humidity: Relative humidity is the ratio of the actual amount of water vapour present in the air to the maximum amount the air can hold at the same temperature, expressed as a percentage. For example, if relative humidity is 70 per cent, the air contains about 70 per cent of the water vapour needed for saturation at that temperature. Relative humidity is measured with instruments such as a hygrometer or psychrometer.

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Condensation and Formation of Precipitation

When moist air rises, it expands because atmospheric pressure decreases with height. As a result, the air cools. When it reaches its dew point, it becomes saturated. Water vapour then changes into tiny water droplets or ice crystals around small particles called condensation nuclei. These droplets or crystals grow in clouds. When they become sufficiently heavy, they may fall to the Earth's surface as precipitation.

Major Forms of Precipitation

Precipitation means water falling from the atmosphere to the Earth's surface in liquid or solid form. Its major forms include:

1. Rain: Rain occurs when water droplets in clouds become large and heavy enough to fall to the ground. It is the most common form of precipitation in many regions.

2. Snow: Snow forms when water vapour changes into ice crystals in very cold atmospheric conditions. These crystals join together and fall as snowflakes.

3. Sleet: Sleet generally refers to small ice pellets formed when raindrops or partially melted snow freeze before reaching the ground. The exact usage of the term may vary between regions.

4. Hail: Hail consists of balls or lumps of ice formed inside strong thunderstorm clouds. Strong upward-moving air currents carry water droplets into very cold regions, where layers of ice build up around them.

Major Types of Rainfall

1. Convectional Rainfall: This type of rainfall occurs when the Earth's surface becomes strongly heated. The warm air above it rises, expands and cools. Condensation takes place, producing clouds and often heavy showers with thunderstorms. It is common in equatorial regions.

2. Orographic Rainfall: Orographic rainfall occurs when moist air is forced to rise over a mountain or highland. As it rises, it cools and produces rainfall on the windward side. The leeward side receives less rainfall and is often called the rain-shadow region.

3. Cyclonic or Frontal Rainfall: This rainfall occurs when warm and cold air masses meet. The lighter warm air rises over the denser cold air, cools and condenses. This process produces clouds and rainfall. It is commonly associated with frontal systems and temperate cyclones.

Q4. Explain atmospheric pressure and winds. Discuss the major factors affecting wind direction and speed. Add a note on jet streams.

Answer

Introduction

Atmospheric pressure and wind are two important elements of climatology. Atmospheric pressure refers to the force exerted by the weight of air on the Earth's surface. Wind refers to the horizontal movement of air from one place to another. Differences in atmospheric pressure create winds, while the Earth's rotation and surface conditions influence their direction and speed. These processes play an important role in the distribution of heat and moisture around the world.

Atmospheric Pressure

Atmospheric pressure is the pressure exerted by the weight of the air above a particular place. It is commonly measured in hectopascals (hPa) or millibars (mb). The standard average pressure at sea level is approximately 1013.25 hPa.

Atmospheric pressure is not equal everywhere. It generally decreases with increasing altitude because the amount of air above a place becomes smaller. Temperature also affects pressure. Warm air expands, becomes less dense and tends to rise, which can create low-pressure conditions near the surface. Cold air is denser and tends to sink, often producing high-pressure conditions.

Pressure is shown on weather maps by lines called **isobars**. Isobars join places having equal atmospheric pressure. Closely spaced isobars indicate a strong pressure gradient, while widely spaced isobars indicate a weak pressure gradient.

Major Factors Affecting Atmospheric Pressure

The main factors affecting atmospheric pressure are altitude, temperature and the amount of water vapour in the air. Pressure decreases with height. Heating causes air to expand and become less dense, while cooling makes air denser. Moist air is generally less dense than dry air at the same temperature and pressure because water vapour has a lower molecular mass than the main gases in dry air.

Winds and Their Causes

Wind is the horizontal movement of air caused mainly by differences in atmospheric pressure. Air generally moves from high-pressure areas towards low-pressure areas. However, its actual direction and speed are affected by several forces.

1. Pressure Gradient Force: This force develops because of differences in atmospheric pressure. It moves air from high-pressure regions towards low-pressure regions. A steep pressure gradient produces stronger winds, while a weak pressure gradient produces lighter winds.

2. Coriolis Force: The Coriolis force is the apparent deflection of moving air caused by the Earth's rotation. It deflects winds towards the right in the Northern Hemisphere and towards the left in the Southern Hemisphere. It influences wind direction but does not create wind.

3. Frictional Force: Friction occurs when moving air comes into contact with the Earth's surface, buildings, trees and other obstacles. It reduces wind speed and changes wind direction near the surface. Friction is generally stronger over rough land than over the open sea.

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Types of Winds

Winds can be classified into different groups. Planetary winds, such as trade winds, westerlies and polar easterlies, blow over large areas of the Earth. Seasonal winds, such as monsoon winds, change direction according to seasons. Local winds, such as land and sea breezes, affect smaller areas. Land breezes generally blow from land towards the sea at night, while sea breezes blow from sea towards land during the day.

Jet Streams

Jet streams are narrow bands of very fast-moving winds found in the upper troposphere, generally near the tropopause. They usually flow from west to east. Two important types are the polar-front jet stream and the subtropical jet stream. Their position and strength change with seasons.

Jet streams influence the movement of weather systems, the development of storms and the distribution of temperature. They are also important for aviation because aircraft may use favourable jet-stream winds to reduce travel time and fuel consumption.

Q5. What are air masses and fronts? Explain the formation and characteristics of cyclones and anticyclones.

Answer

Introduction

Air masses, fronts, cyclones and anticyclones are important features of the atmosphere. They influence weather conditions such as temperature, cloud formation, rainfall, wind and storms. Their study helps us understand why some regions experience heavy rainfall and strong winds, while others have clear skies and stable weather.

Air Masses

An air mass is a large body of air that has relatively uniform temperature and moisture conditions over a wide area. Air masses usually develop over large land or ocean surfaces where the air remains for a sufficient period to acquire the characteristics of that region. These areas are known as source regions.

Air masses are classified mainly according to their temperature and moisture conditions. Continental air masses develop over land and are generally dry, while maritime air masses develop over oceans and are generally moist. Tropical air masses are warm, whereas polar air masses are cold.

Some common types are continental tropical (cT), maritime tropical (mT), continental polar (cP) and maritime polar (mP). For example, a maritime tropical air mass is generally warm and moist because it develops over warm tropical oceans. A continental polar air mass is generally cold and dry because it develops over cold land areas.

Atmospheric Fronts

A front is the boundary or transition zone between two air masses having different temperatures and moisture conditions. When two contrasting air masses meet, they do not mix immediately. Instead, one air mass may rise over the other, leading to cloud formation and changes in weather.

There are four major types of fronts:

1. Cold Front: A cold front develops when a cold air mass advances and pushes a warm air mass upwards. It may produce heavy showers, thunderstorms and a sudden fall in temperature.

2. Warm Front: A warm front forms when a warm air mass advances over a colder air mass. It usually produces widespread clouds and gentle, continuous rainfall.

3. Stationary Front: A stationary front develops when neither air mass moves forward significantly. It may remain in an area for several days and produce cloudy weather and prolonged rainfall.

4. Occluded Front: An occluded front forms when a faster-moving cold front catches up with a warm front and lifts the warm air away from the ground. It is commonly associated with mature temperate cyclones.

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Cyclones

A cyclone is a large atmospheric system in which winds move towards a central low-pressure area. Air rises near the centre, often leading to cloud formation, rainfall and stormy weather. Due to the Coriolis effect, cyclones generally rotate anticlockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.

Cyclones are mainly divided into tropical and temperate cyclones. Tropical cyclones develop over warm tropical oceans. They require warm ocean water, sufficient moisture, atmospheric instability and relatively low vertical wind shear. They have a central region called the eye, surrounded by the eyewall, where the strongest winds and

heaviest rainfall generally occur. Their major effects include strong winds, heavy rainfall, flooding and storm surges.

Temperate cyclones, also known as extra-tropical cyclones, generally develop in middle latitudes along boundaries between warm and cold air masses. They are commonly associated with warm and cold fronts and can bring widespread rainfall, strong winds and changes in temperature.

Anticyclones

An anticyclone is a high-pressure system in which air generally sinks and spreads outward near the Earth's surface. It usually produces clear skies, dry conditions and stable weather. Winds generally rotate clockwise in the Northern Hemisphere and anticlockwise in the Southern Hemisphere.

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UNIT – III

ONE MARK:

Q1. What is soil?

Answer: Soil is the uppermost layer of the Earth's surface, formed through the weathering of rocks and the decomposition of organic matter. It supports plant growth and provides essential nutrients.

Q2. What is soil genesis?

Answer: Soil genesis refers to the process of soil formation through the combined effects of climate, organisms, parent material, relief and time.

Q3. Name the five major factors of soil formation.

Answer: The five major factors of soil formation are climate, organisms, parent material, relief (topography) and time.

Q4. What is parent material?

Answer: Parent material is the original rock or unconsolidated material from which soil develops through weathering and other soil-forming processes.

Q5. What is soil profile?

Answer: A soil profile is a vertical section of soil that shows its different layers or horizons, from the surface down to the parent material.

Q6. What is humus?

Answer: Humus is the dark-coloured organic material formed by the decomposition of dead plants and animals. It improves soil fertility and structure.

Q7. What is soil erosion?

Answer: Soil erosion is the removal of the fertile top layer of soil by natural agents such as running water, wind and glaciers, or through human activities.

Q8. What is soil classification?

Answer: Soil classification is the systematic grouping of soils based on their physical, chemical and biological properties, formation processes and characteristics.

Q9. What is biotic succession?

Answer: Biotic succession is the gradual and natural process through which one biological community is replaced by another in an area over time.

Q10. What is a climax community?

Answer: A climax community is a relatively stable and mature biological community that develops at the final stage of ecological succession under particular environmental conditions.

Q11. What is a biome?

Answer: A biome is a large natural ecological region characterised by a particular climate, vegetation and animal life.

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Q12. What is a Savanna biome?

Answer: The Savanna biome is a tropical grassland ecosystem characterised by tall grasses, scattered trees and distinct wet and dry seasons.

Q13. What is a monsoon forest?

Answer: A monsoon forest is a tropical forest found in regions with seasonal rainfall, where many trees shed their leaves during the dry season to conserve water.

Q14. What is ecological balance?

Answer: Ecological balance refers to the natural stability maintained among living organisms and their physical environment through their interactions.

Q15. Name any two major biotic regions of the world.

Answer: Two major biotic regions of the world are the tropical rainforest region and the Savanna grassland region.

TWO MARK:

Q1. What is soil genesis? Explain briefly.

Answer: Soil genesis refers to the process of soil formation from rocks and organic materials over a long period. It takes place through physical, chemical and biological weathering. Climate, organisms, parent material, relief and time are the five major factors responsible for soil formation.

Q2. Mention the five major factors responsible for soil formation.

Answer: The five major factors of soil formation are climate, organisms, parent material, relief and time. Climate influences weathering, organisms add organic matter, parent material provides minerals, relief affects drainage and erosion, and time allows soil to develop gradually.

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Q3. What are the main layers of a soil profile?

Answer: A soil profile consists of different layers known as soil horizons. The main horizons are O (organic layer), A (topsoil), E (eluviated layer, where present), B (subsoil), C (weathered parent material) and R (solid bedrock). Each layer has different physical and chemical characteristics.

Q4. What is the importance of humus in soil?

Answer: Humus is the dark organic material formed by the decomposition of dead plants and animals. It increases soil fertility by supplying nutrients and improves the soil's ability to retain water. It also improves soil structure and supports the growth of microorganisms.

Q5. What are the major types of soil classification?

Answer: Soils are classified into different groups based on their properties, formation and geographical distribution. Broad categories include sandy soil, clayey soil, silty soil and loamy soil. In geographical studies, soils are also classified according to their formation, such as zonal, intrazonal and azonal soils.

Q6. Differentiate between zonal and azonal soils.

Answer: Zonal soils are well-developed soils whose characteristics are mainly influenced by climate and natural vegetation over a long period. Azonal soils are young or weakly developed soils that have not formed distinct horizons. Examples of azonal soils include many alluvial and recent river-deposited soils.

Q7. What is soil erosion? Mention its major causes.

Answer: Soil erosion is the removal of the upper fertile layer of soil by natural agents such as running water and wind. Major causes include deforestation, overgrazing, improper agricultural practices, heavy rainfall and construction activities. It reduces soil fertility and affects agricultural production.

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Q8. What is biotic succession?

Answer: Biotic succession is the gradual process through which one biological community is replaced by another in a particular area over time. It occurs due to changes in environmental conditions and interactions among plants, animals and microorganisms. It generally leads towards the development of a relatively stable community.

Q9. Differentiate between primary and secondary succession.

Answer: Primary succession begins in an area where no soil or established biological community exists, such as newly exposed bare rock. Secondary succession occurs in an area where a previous community has been disturbed but soil remains, such as an abandoned agricultural field or a forest affected by fire.

Q10. What is a climax community?

Answer: A climax community is a relatively stable and mature biological community that develops during the later stage of ecological succession. It remains in balance with the local environmental conditions unless disturbed by natural events or human activities. A mature forest can be an example of a climax community.

Q11. What is a biome? Mention its major characteristics.

Answer: A biome is a large ecological region characterised by a particular climate, natural vegetation and animal life. Its major characteristics include temperature, rainfall, soil type, dominant plant species and wildlife. Examples include tropical rainforests, deserts, grasslands, temperate forests and tundra.

Q12. What are the major biotic regions of the world?

Answer: The major biotic regions or biomes of the world include tropical rainforests, tropical deciduous or monsoon forests, Savanna grasslands, deserts, temperate grasslands, temperate forests, Mediterranean vegetation, coniferous forests and tundra. Each region has distinct climatic conditions, vegetation and animal life.

Q13. Explain the main characteristics of the Savanna biome.

Answer: The Savanna biome is a tropical grassland region characterised by tall grasses and scattered trees. It generally experiences distinct wet and dry seasons, with warm temperatures throughout the year. Common animals include elephants, giraffes, zebras and lions. It is mainly found in Africa, South America and northern Australia.

Q14. What are the main characteristics of monsoon forests?

Answer: Monsoon forests are found in tropical regions that experience seasonal rainfall. These forests have distinct wet and dry seasons. Many trees shed their leaves during the dry season to reduce water loss. Teak, sal, bamboo and sandalwood are some common examples of vegetation found in these forests.

Q15. Explain the ecological importance of Savanna and monsoon forest biomes.

Answer: Savanna and monsoon forest biomes play an important role in maintaining ecological balance. Savannas provide grassland habitats for large herbivores and carnivores, while monsoon forests support diverse plant and animal species. Both ecosystems help conserve biodiversity, protect soil, store carbon and maintain the natural water cycle.

BROAD ANSWER:

Q1. Define soil. Explain the process of soil genesis and the major factors responsible for soil formation.

Answer:

Introduction

Soil is the uppermost layer of the Earth's surface, consisting of mineral particles, organic matter, water, air and living organisms. It is one of the most important natural resources because it supports plant growth, agriculture and different ecosystems. The process of soil formation is known as soil genesis. It takes place slowly through the combined effects of physical, chemical and biological processes.

Process of Soil Genesis

Soil formation begins with the weathering of rocks. Physical weathering breaks rocks into smaller particles due to temperature changes, frost action and other natural forces. Chemical weathering changes the minerals present in rocks through processes such as oxidation, hydration and carbonation. Biological weathering occurs through the activities of plant roots, animals and microorganisms.

As rocks break down, their particles mix with decomposed plant and animal remains. This organic material forms humus, which improves soil fertility. Gradually, water moves through the soil and carries some minerals from the upper layers to the lower layers. This process helps

in the development of different soil horizons. Over a long period, these processes create a mature soil profile.

Major Factors Responsible for Soil Formation

1. Climate: Climate is one of the most important factors of soil formation. Temperature and rainfall influence the rate of weathering and decomposition of organic matter. High temperature and heavy rainfall generally increase chemical weathering, while dry climates often experience slower soil development.

2. Organisms: Plants, animals, bacteria, fungi and other microorganisms play an important role in soil formation. Plant roots break rocks into smaller particles, while microorganisms decompose dead plants and animals. This process adds humus and nutrients to the soil.

3. Parent Material: Parent material refers to the original rock or loose material from which soil develops. It determines many of the soil's initial characteristics, such as mineral composition, texture and colour. For example, soils formed from limestone may have different properties from soils formed from granite.

4. Relief or Topography: Relief refers to the shape and slope of the land. On steep slopes, soil erosion is generally greater and soil tends to be thinner. In low-lying areas, materials may accumulate and form deeper soils. Drainage conditions are also influenced by topography.

5. Time: Soil formation is a slow process that requires a long period. Young soils are generally less developed and may have fewer distinct horizons. Older soils often show more developed layers, although erosion and other disturbances can affect their development.

Soil Profile

A mature soil generally develops different layers known as horizons. The O horizon contains organic material, the A horizon is the topsoil, the E horizon is a zone of leaching where present, the B horizon is the

subsoil, and the C horizon contains partly weathered parent material. The R horizon represents solid bedrock.

Q2. Explain the classification and geographical distribution of soils in the world.

Answer:

Introduction

Soil is an essential component of the natural environment. Different regions of the world have different types of soil because of variations in climate, parent material, vegetation, relief and soil-forming processes. Soil classification is the systematic grouping of soils according to their characteristics, properties and formation. It helps us understand soil distribution, agricultural suitability and geographical variations.

Major Soil Classification Systems

In traditional geographical studies, soils are broadly classified into three major groups: zonal, intrazonal and azonal soils.

1. Zonal Soils: Zonal soils are well-developed soils whose characteristics are mainly influenced by climate and natural vegetation over a long period. They generally have distinct soil horizons. Examples include podzol soils in cold and humid regions, laterite soils in hot and humid tropical regions, and chernozem soils in temperate grasslands. Their properties reflect the environmental conditions under which they develop.

2. Intrazonal Soils: Intrazonal soils develop mainly due to local factors such as drainage, parent material and chemical conditions. Their characteristics are not controlled entirely by regional climate. Examples include saline soils, alkaline soils and peat soils. Saline soils are common in areas where salts accumulate due to high evaporation and poor drainage, while peat soils develop in

waterlogged areas with the accumulation of partly decomposed organic matter.

3. Azonal Soils: Azonal soils are young or weakly developed soils that have not developed distinct horizons. They are often found in areas where soil materials are frequently deposited or disturbed. Alluvial soils deposited by rivers and many sandy coastal soils are examples. These soils may be fertile, depending on their mineral and organic content.

Geographical Distribution of Major Soils

1. Tundra and Podzol Soils: Tundra soils occur in very cold polar and subpolar regions, such as northern Canada and Siberia. They are generally shallow and poorly developed due to low temperatures and permafrost. Podzol soils are commonly found in cool, humid regions under coniferous forests, particularly in northern Europe, Canada and Russia.

2. Chernozem Soils: Chernozem soils are dark, fertile soils found mainly in temperate grassland regions. They are widely distributed in the Ukrainian and Russian steppes, the North American prairies and parts of Argentina. They contain considerable humus and are suitable for growing wheat and other crops.

3. Desert Soils: Desert soils are found in dry regions such as the Sahara, Arabian Desert and Australian deserts. They generally contain low organic matter and may have accumulated salts because of limited rainfall and high evaporation.

4. Laterite Soils: Laterite soils develop mainly in tropical and subtropical regions with high temperature and heavy seasonal rainfall. They are found in parts of India, Brazil, Africa and Southeast Asia. Heavy rainfall causes the leaching of many soluble minerals, often leaving iron and aluminium-rich materials.

5. Alluvial Soils: Alluvial soils are formed by the deposition of sediments carried by rivers. They are common in river valleys and floodplains, including the Ganga-Brahmaputra plains of India, the

Nile Valley and the plains of China. Many alluvial soils are highly suitable for agriculture.

6. Mediterranean and Brown Forest Soils: Mediterranean soils occur in regions with hot, dry summers and mild, wet winters. Brown forest soils are generally found in temperate deciduous forest regions.

Q3. What is biotic succession? Explain its different stages and types with suitable examples.

Answer:

Introduction

Biotic succession, also known as ecological succession, is the gradual and natural process through which one biological community is replaced by another in a particular area over time. It involves changes in plant, animal and microorganism communities. These changes take place because organisms modify their surroundings and respond to changing environmental conditions. Ecological succession is an important process in the development and maintenance of ecosystems.

Types of Ecological Succession

Ecological succession is mainly divided into two types: primary succession and secondary succession.

1. Primary Succession: Primary succession begins in an area where no developed soil or established biological community exists. It may occur on newly exposed bare rocks, volcanic lava or land exposed by the retreat of glaciers. The process is usually very slow because soil must first develop.

For example, when a new volcanic island is formed, the surface initially consists of bare rock. Lichens and mosses gradually colonise the area. Their growth and decomposition help produce organic matter and contribute to soil formation. Later, grasses, shrubs and trees may develop.

2. Secondary Succession: Secondary succession takes place in an area where an existing biological community has been destroyed or disturbed, but the soil remains. It may occur after forest fires, floods, storms or the abandonment of agricultural land. Since soil and some seeds or roots are already present, secondary succession is generally faster than primary succession.

For example, after a forest fire, grasses and small plants may grow first. These are gradually replaced by shrubs and young trees. Over time, a mature forest may develop again if environmental conditions remain suitable.

Major Stages of Ecological Succession

1. Nudation: Nudation refers to the formation of a bare area where no established biological community exists. It may occur due to volcanic activity, erosion, landslides, fire or other natural disturbances.

2. Invasion: Invasion is the arrival and establishment of new organisms in the bare area. Seeds, spores and other reproductive materials may reach the area through wind, water or animals.

3. Competition and Co-action: As the number of organisms increases, competition develops for resources such as sunlight, water, nutrients and space. Different species interact with one another, and better-adapted organisms gradually become dominant.

4. Reaction: During this stage, organisms modify their physical environment. For example, plants add organic matter to the soil, provide shade and change soil moisture conditions. These changes may make the environment suitable for new species.

5. Stabilisation or Climax: In the later stage, a relatively stable and mature community develops. This is traditionally known as the climax community. It remains comparatively stable under existing environmental conditions, although it can change due to natural disturbances or climate change.

Examples and Importance of Ecological Succession

Ecological succession can be observed in abandoned agricultural fields, newly formed volcanic islands, grasslands and forests recovering after fires. It helps in soil formation, nutrient cycling, biodiversity development and the restoration of damaged ecosystems. It also demonstrates how living organisms and the physical environment influence each other.

Q4. Describe the major biotic regions or biomes of the world and their important characteristics.

Answer:

Introduction

The Earth has different climatic regions with distinct types of natural vegetation and animal life. A biome is a large ecological region characterised by a particular climate, vegetation and wildlife. Temperature, rainfall, soil conditions and geographical location are the major factors that influence the distribution of biomes. The major biotic regions of the world include forests, grasslands, deserts and tundra regions.

Major Biotic Regions of the World

1. Tropical Rainforest Biome: Tropical rainforests are found near the equator, particularly in the Amazon Basin of South America, the Congo Basin of Africa and Southeast Asia. These regions experience high temperatures and heavy rainfall throughout the year. They contain dense evergreen forests with several layers of vegetation. Trees, climbers, shrubs and epiphytes are common. Animals include monkeys, birds, snakes, insects and many other species. Tropical rainforests are among the richest ecosystems in terms of biodiversity.

2. Savanna Biome: The Savanna is a tropical grassland region characterised by tall grasses and scattered trees. It experiences distinct wet and dry seasons. It is widely distributed in Africa, South America and northern Australia. Common vegetation includes grasses, acacia

and baobab trees. Animals such as elephants, giraffes, zebras, antelopes and lions are found in this biome.

3. Desert Biome: Deserts are found in regions receiving very little rainfall. The Sahara, Arabian, Kalahari and Australian deserts are important examples. Desert vegetation is limited and includes cactus, thorny shrubs and drought-resistant plants. Animals such as camels, lizards, snakes and desert foxes have special adaptations to survive under dry conditions.

4. Temperate Grassland Biome: Temperate grasslands are found in regions with moderate rainfall and seasonal temperature variations. Important examples include the Prairies of North America, the Steppes of Eurasia, the Pampas of South America and the Velds of South Africa. These regions are dominated by grasses, with relatively few trees. They are important agricultural areas, particularly for wheat cultivation and livestock rearing.

5. Temperate Deciduous Forest Biome: This biome is mainly found in eastern North America, Europe and parts of East Asia. It experiences four distinct seasons. Trees such as oak, maple and beech shed their leaves during autumn or winter. The soil is often relatively fertile because of the accumulation and decomposition of fallen leaves. Deer, foxes, bears and several bird species are common animals.

6. Mediterranean Biome: Mediterranean vegetation is found around the Mediterranean Sea and in regions such as California, central Chile, southwestern Australia and parts of South Africa. It experiences hot, dry summers and mild, wet winters. Vegetation includes evergreen shrubs and small trees adapted to drought and frequent fires.

7. Coniferous Forest or Taiga Biome: The taiga is found in high-latitude regions of Canada, Russia and Scandinavia. It has long, cold winters and short summers. Pine, spruce and fir are the dominant trees. Animals include bears, wolves, moose and reindeer.

8. Tundra Biome: The tundra is found in Arctic regions and on high mountain areas. It experiences extremely low temperatures, short growing seasons and often permanently frozen subsoil known as permafrost. Mosses, lichens and small shrubs are common vegetation.

Importance of Biomes

Biomes maintain ecological balance and support biodiversity. They regulate climate, store carbon, protect soil, maintain water cycles and provide habitats for wildlife. They also provide important natural resources for human beings.

Q5. Explain the ecological characteristics and importance of the Savanna and monsoon forest biomes.

Answer:

Introduction

Savanna and monsoon forests are important tropical biomes found in different parts of the world. Both are influenced by seasonal variations in rainfall and temperature. However, they differ in their vegetation structure, animal life and ecological characteristics. Savanna is mainly a tropical grassland with scattered trees, whereas monsoon forests are tropical forests in which many trees shed their leaves during the dry season.

1. Savanna Biome

The Savanna biome is a tropical grassland ecosystem characterised by extensive grass cover and scattered trees or shrubs. It is mainly found in Africa, South America, northern Australia and parts of India. The climate remains warm throughout the year, but rainfall is seasonal. Most rainfall occurs during the wet season, while the dry season may last for several months.

Vegetation: The vegetation of Savanna consists mainly of tall grasses, small shrubs and scattered trees. Common trees include acacia and baobab. These plants have special adaptations to survive

long dry periods. Some trees have deep roots to absorb water from deeper soil layers, while others have thick bark or small leaves to reduce water loss.

Animal Life: Savanna supports a wide variety of wildlife. Large herbivores such as elephants, zebras, giraffes, antelopes and buffaloes depend on grasses and trees for food. Carnivores such as lions, cheetahs, leopards and hyenas depend on these herbivores. This creates an important food chain and maintains ecological balance.

Ecological Importance: Savanna grasslands provide habitats for wildlife, support grazing animals, store carbon in vegetation and soil, and contribute to nutrient cycling. However, overgrazing, frequent uncontrolled fires, agricultural expansion and habitat destruction create serious environmental problems.

2. Monsoon Forest Biome

Monsoon forests are tropical forests found in regions that experience seasonal rainfall. They are mainly distributed in South and Southeast Asia, including India, Bangladesh, Myanmar, Thailand and parts of China. These regions generally experience high temperatures, a rainy season and a dry season.

Vegetation: Monsoon forests are often called tropical deciduous forests because many trees shed their leaves during the dry season to reduce water loss. They may be divided into moist deciduous and dry deciduous forests according to rainfall conditions. Common trees include teak, sal, bamboo and sandalwood. In areas receiving higher rainfall, forests are generally denser and taller, while drier areas have more open vegetation.

Animal Life: Monsoon forests support diverse wildlife, including elephants, tigers, deer, monkeys, wild boars, reptiles and many species of birds. These animals depend on forests for food, shelter and breeding habitats.

Ecological Importance: Monsoon forests help maintain biodiversity, protect soil from erosion, regulate local climate and support the water

cycle. They also absorb carbon dioxide and provide timber, fuelwood, fruits, medicinal plants and other forest products. Many local communities depend on these forests for their livelihoods.

Major Ecological Threats

Both Savanna and monsoon forest ecosystems face threats from deforestation, habitat fragmentation, climate change, uncontrolled fires and human activities. In Savanna regions, excessive grazing can reduce grass cover and increase soil erosion. In monsoon forests, clearing land for agriculture, settlements and commercial activities can destroy natural habitats.

Conservation Measures

Conservation requires the protection of natural habitats, prevention of illegal tree cutting, controlled grazing, sustainable forest management and the establishment of protected areas. Local communities should also be involved in conservation programmes to ensure the long-term protection of these ecosystems.

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UNIT – IV

ONE MARK:

Q1. What is Oceanography?

Answer: Oceanography is the scientific study of oceans, including their physical, chemical, biological and geological characteristics.

Q2. What is ocean bottom relief?

Answer: Ocean bottom relief refers to the different physical features found on the ocean floor, such as continental shelves, continental slopes, abyssal plains, oceanic ridges and trenches.

Q3. What is a continental shelf?

Answer: A continental shelf is the gently sloping submerged edge of a continent that extends from the coastline to the continental slope.

Q4. What is an ocean trench?

Answer: An ocean trench is a long, narrow and extremely deep depression found on the ocean floor, usually formed at convergent plate boundaries.

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Q5. What is ocean salinity?

Answer: Ocean salinity refers to the total amount of dissolved salts present in seawater. The average salinity of ocean water is approximately 35 parts per thousand (35‰).

Q6. What is the average temperature of ocean surface water?

Answer: The average temperature of ocean surface water is approximately 17°C, although it varies according to latitude, season and ocean currents.

Q7. What are ocean currents?

Answer: Ocean currents are the continuous and directed movements of seawater from one place to another due to winds, temperature differences, salinity differences and other forces.

Q8. What is a warm ocean current?

Answer: A warm ocean current is a current that carries relatively warm water from low-latitude regions towards higher-latitude regions.

Q9. What is a cold ocean current?

Answer: A cold ocean current is a current that carries relatively cold water from higher-latitude regions towards lower-latitude regions.

Q10. What are tides?

Answer: Tides are the periodic rise and fall of ocean water mainly caused by the gravitational attraction of the Moon and the Sun.

Q11. What are spring tides?

Answer: Spring tides are tides with a greater tidal range that occur when the Sun, Moon and Earth are approximately in a straight line during new moon and full moon.

Q12. What are ocean deposits?

Answer: Ocean deposits are materials such as sand, mud, clay, shells and the remains of marine organisms that accumulate on the ocean floor.

Q13. What are coral reefs?

Answer: Coral reefs are underwater structures formed mainly by the accumulation of calcium carbonate skeletons of tiny marine animals called coral polyps.

Q14. What are marine resources?

Answer: Marine resources are the natural resources obtained from oceans and seas, including fish, minerals, petroleum, natural gas and ocean energy.

Q15. What is tidal energy?

Answer: Tidal energy is a form of renewable energy generated by using the rise and fall or movement of ocean tides to produce electricity.

TWO MARK:

Q1. What is ocean bottom relief? Mention its major features.

Answer: Ocean bottom relief refers to the different physical features found on the ocean floor. The major features include continental shelves, continental slopes, continental rises, abyssal plains, mid-oceanic ridges and ocean trenches. These features differ in depth, shape and geographical distribution.

Q2. What is a continental shelf? Explain its importance.

Answer: A continental shelf is the gently sloping submerged portion of a continent that extends from the coastline to the continental slope. It is generally shallow and receives sufficient sunlight. Continental shelves are economically important because they support fishing activities and contain valuable petroleum, natural gas and mineral resources.

Q3. Differentiate between continental slope and abyssal plain.

Answer: A continental slope is the steeply sloping part of the ocean floor that connects the continental shelf with the deeper ocean basin. An abyssal plain is a very deep, broad and relatively flat area of the ocean floor, generally covered with fine sediments. Both are important features of ocean bottom relief.

Q4. What is ocean salinity? Mention the factors affecting it.

Answer: Ocean salinity refers to the total amount of dissolved salts present in seawater. The average salinity of ocean water is approximately 35 parts per thousand (35‰). It is influenced by evaporation, precipitation, river water supply, freezing and melting of ice, and the mixing of ocean currents.

Q5. Explain the distribution of ocean temperature.

Answer: Ocean temperature varies according to latitude, depth, season and ocean currents. Surface water is generally warmer near the equator and colder towards the polar regions. Temperature usually

decreases with increasing depth. Warm currents increase the temperature of nearby coastal regions, while cold currents reduce it.

Q6. What are ocean currents? Mention their major causes.

Answer: Ocean currents are continuous and directed movements of seawater from one place to another. Their major causes include prevailing winds, differences in temperature and salinity, Earth's rotation, and differences in water density. The shape of coastlines and ocean basins also influences their direction.

Q7. Differentiate between warm and cold ocean currents.

Answer: Warm ocean currents carry relatively warm water from tropical or equatorial regions towards higher latitudes. Cold ocean currents carry relatively cold water from higher latitudes towards lower latitudes. The Gulf Stream is an example of a warm current, while the Labrador Current is an example of a cold current.

Q8. What are tides? Mention their main causes.

Answer: Tides are the periodic rise and fall of ocean water. They are mainly caused by the gravitational attraction of the Moon and the Sun, along with the effects of Earth's rotation. Tides are important for navigation, fishing, coastal activities and the generation of tidal energy.

Q9. Differentiate between spring tides and neap tides.

Answer: Spring tides occur during new moon and full moon when the Sun, Moon and Earth are approximately in a straight line. They produce a greater tidal range. Neap tides occur during the first and third quarter phases of the Moon, when the Sun and Moon act at right angles, producing a smaller tidal range.

Q10. What are ocean deposits? Mention their major types.

Answer: Ocean deposits are materials that accumulate on the ocean floor through natural processes. They include sediments from land, remains of marine organisms and chemical substances deposited from

seawater. The major types are terrigenous deposits, pelagic deposits and hydrogenous deposits.

Q11. What are coral reefs? Mention their major types.

Answer: Coral reefs are underwater structures formed by the accumulation of calcium carbonate skeletons produced by coral polyps. The three major types are fringing reefs, barrier reefs and atolls. They generally develop in warm, shallow and clear tropical marine waters and support rich marine biodiversity.

Q12. What are the major conditions required for coral reef formation?

Answer: Coral reefs generally develop in warm, shallow, clear and sunlit tropical waters. The ideal water temperature is usually around 23°C–29°C. They require sufficient sunlight, normal marine salinity, clean water and a suitable hard surface for coral growth. Excessive pollution and sedimentation can damage coral reefs.

Q13. What are biotic marine resources? Give examples.

Answer: Biotic marine resources are living resources obtained from oceans and seas. They include fish, prawns, crabs, lobsters, oysters, seaweeds and other marine organisms. These resources are important sources of food, employment, medicines and industrial raw materials for human beings.

Q14. What are mineral resources obtained from oceans?

Answer: Oceans provide several valuable mineral resources, including petroleum, natural gas, salt, magnesium, manganese nodules, sand and gravel. Petroleum and natural gas are mainly extracted from offshore sedimentary basins. These resources are important for industries, energy production and economic development.

Q15. Explain the major energy resources obtained from oceans.

Answer: Oceans provide several renewable energy resources, including tidal energy, wave energy and ocean thermal energy

conversion (OTEC). Tidal energy uses the movement of tides, wave energy uses ocean waves, and OTEC uses the temperature difference between warm surface water and cold deep water to generate electricity.

BROAD ANSWER:

Q1. Describe the major features of ocean bottom relief with suitable examples.

Answer:

Introduction

Ocean bottom relief refers to the different physical features and landforms found beneath the surface of oceans. The ocean floor is not completely flat; it contains several elevated and depressed features, just like the land surface. These features have been formed through tectonic movements, volcanic activities, sedimentation and other geological processes. The major features of ocean bottom relief include continental shelves, continental slopes, continental rises, abyssal plains, mid-oceanic ridges and ocean trenches.

1. Continental Shelf

The continental shelf is the gently sloping submerged portion of a continent that extends from the coastline towards the deeper ocean. It generally extends to a depth of about 200 metres, although its width varies from place to place. Continental shelves are important for fishing because sunlight reaches their shallow waters and supports marine life. They also contain valuable resources such as petroleum, natural gas and minerals. The continental shelf of the North Sea is an important example.

2. Continental Slope

The continental slope is the steeply inclined region that begins at the outer edge of the continental shelf and descends towards the deep ocean floor. It marks the transition between the continental margin

and the deeper ocean basin. Submarine canyons are sometimes found on continental slopes. These are deep, narrow valleys formed by underwater erosion and sediment movement.

3. Continental Rise

The continental rise is a gently sloping region found at the base of the continental slope. It is formed mainly by the accumulation of sediments transported from the continental shelf and slope. It is particularly well developed along many passive continental margins.

4. Abyssal Plains

Abyssal plains are extensive, deep and relatively flat areas of the ocean floor. They generally occur at depths of about 3,000 to 6,000 metres. These plains are covered with fine sediments such as clay and the remains of marine organisms. They are among the flattest and largest landforms on Earth.

5. Mid-Oceanic Ridges

Mid-oceanic ridges are long underwater mountain chains formed mainly by volcanic activity at divergent plate boundaries. At these boundaries, tectonic plates move away from each other, allowing magma to rise and create new oceanic crust. The Mid-Atlantic Ridge is a major example. It extends through the Atlantic Ocean.

6. Ocean Trenches

Ocean trenches are long, narrow and extremely deep depressions found on the ocean floor. They are generally formed at convergent plate boundaries where one tectonic plate moves beneath another through a process called subduction. The Mariana Trench in the Pacific Ocean is the deepest known ocean trench.

7. Seamounts and Guyots

Seamounts are underwater volcanic mountains that rise from the ocean floor but do not reach the sea surface. Guyots are flat-topped underwater volcanic mountains that were once eroded near sea level and later submerged.

Q2. Explain the distribution of ocean salinity and temperature and discuss the factors affecting them.

Answer:

Introduction

Ocean water contains dissolved salts and has different temperature conditions at different depths and geographical locations. Salinity refers to the amount of dissolved salts in seawater, while ocean temperature refers to the degree of heat present in ocean water. Both are important physical characteristics of oceans. They influence water density, ocean circulation, marine organisms and global climate.

A. Ocean Salinity

Ocean salinity refers to the total amount of dissolved salts present in seawater. The average salinity of ocean water is approximately 35 parts per thousand (35‰), meaning that one kilogram of seawater contains about 35 grams of dissolved salts. Sodium chloride is the most common dissolved salt, along with magnesium, calcium and potassium salts.

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Factors Affecting Ocean Salinity

1. Evaporation: High evaporation increases salinity because water is removed from the ocean while dissolved salts remain. Therefore, salinity is generally high in some warm and dry regions.

2. Rainfall: Heavy rainfall reduces surface salinity by adding freshwater to the ocean. Equatorial regions often experience lower salinity because of frequent rainfall.

3. River Water: Rivers carry freshwater into oceans and seas. This reduces salinity near river mouths and coastal areas. For example, the Bay of Bengal receives freshwater from several major rivers.

4. Freezing and Melting of Ice: When seawater freezes, most of the salt is excluded from the ice, increasing the salinity of the surrounding water. Melting ice adds freshwater and reduces surface salinity.

5. Ocean Currents: Ocean currents transport water with different salinity levels from one region to another, influencing the distribution of salinity.

Distribution of Salinity

Salinity generally increases in subtropical regions where evaporation is high and rainfall is relatively low. It is often lower near the equator because of heavy rainfall and in polar regions due to melting ice and low evaporation. Salinity also varies with depth and local conditions.

B. Ocean Temperature

Ocean temperature refers to the heat condition of seawater. The average temperature of ocean surface water is approximately 17°C, although it varies greatly according to latitude and season.

Factors Affecting Ocean Temperature

1. Latitude: Ocean surface temperature is generally highest near the equator because these regions receive more direct solar radiation. Temperature decreases towards the polar regions.

2. Depth: Temperature usually decreases with increasing depth. The upper layer is relatively warm, while deep ocean water remains very cold.

3. Ocean Currents: Warm currents increase the temperature of nearby coastal regions, whereas cold currents reduce it. For example, the Gulf Stream carries warm water towards the North Atlantic, while the Labrador Current carries cold water southward.

4. Winds and Seasons: Winds influence the mixing of ocean water, while seasonal changes affect surface temperature, particularly in middle and higher latitudes.

5. Cloud Cover: Clouds influence the amount of solar radiation reaching the ocean surface and affect surface heating.

Conclusion

Ocean salinity and temperature vary according to geographical and environmental conditions. Both play important roles in controlling water density, ocean circulation, marine ecosystems and the Earth's climate system.

Q3. What are ocean currents and tides? Explain their causes, types and geographical importance.

Answer:

Introduction

Ocean currents and tides are two important movements of ocean water. Ocean currents refer to the continuous movement of seawater in a particular direction, while tides refer to the periodic rise and fall of ocean water. Both play an important role in ocean circulation, climate regulation, marine ecosystems, fishing and navigation.

A. Ocean Currents

Ocean currents are continuous and directed movements of seawater from one region to another. They are mainly caused by prevailing winds, differences in temperature and salinity, Earth's rotation and variations in water density. The shape of continents and ocean basins also influences their direction.

Causes of Ocean Currents

1. Prevailing Winds: Winds such as trade winds and westerlies push surface water and produce large ocean currents. They are among the major causes of surface circulation.

2. Earth's Rotation: The rotation of the Earth produces the Coriolis effect. It deflects moving water towards the right in the Northern Hemisphere and towards the left in the Southern Hemisphere.

3. Temperature Differences: Warm water is generally less dense than cold water. Differences in temperature contribute to the movement of ocean water and deep-ocean circulation.

4. Salinity Differences: Water with higher salinity is generally denser than water with lower salinity at the same temperature. These density differences help drive deep-water circulation.

5. Shape of Continents: Continents and coastlines influence the direction and movement of ocean currents by guiding and restricting their flow.

Types of Ocean Currents

Ocean currents are mainly classified into two types:

1. Warm Currents: Warm currents carry relatively warm water from tropical or equatorial regions towards higher latitudes. They generally increase the temperature of nearby coastal areas. Examples include the Gulf Stream in the North Atlantic Ocean and the Kuroshio Current in the Pacific Ocean.

2. Cold Currents: Cold currents carry relatively cold water from higher latitudes towards lower latitudes. They generally reduce the temperature of nearby coastal regions. Examples include the Labrador Current in the North Atlantic and the Peru (Humboldt) Current along the western coast of South America.

Importance of Ocean Currents

Ocean currents influence the climate of coastal regions, distribute heat across the oceans and affect rainfall patterns. They also influence marine ecosystems and fishing activities. The meeting of warm and cold currents can create favourable conditions for plankton growth and rich fishing grounds. Ocean currents are also important for navigation and maritime transport.

B. Tides

Tides are the periodic rise and fall of ocean water. They are mainly caused by the gravitational attraction of the Moon and the Sun, along with the effects of Earth's rotation. The Moon has a greater influence on tides because it is much closer to the Earth.

Types of Tides

1. High Tide and Low Tide: High tide occurs when the sea level rises to its highest point, while low tide occurs when the sea level falls to its lowest point.

2. Spring Tides: Spring tides occur during the new moon and full moon when the Sun, Moon and Earth are approximately in a straight line. During this period, the tidal range is relatively high.

3. Neap Tides: Neap tides occur during the first and third quarter phases of the Moon, when the gravitational forces of the Sun and Moon act at approximately right angles. These tides have a smaller tidal range.

Importance of Tides

Tides help in navigation, fishing, coastal activities and the movement of ships through some harbours. They also support the exchange of water in estuaries and coastal ecosystems. The movement of tides can be used to generate renewable electricity through tidal power plants.

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Q4. Explain the major types of ocean deposits and discuss the formation, types and importance of coral reefs.

Answer:

Introduction

The ocean floor is covered with different types of materials known as ocean deposits. These deposits are formed from land materials, the remains of marine organisms and chemical substances present in seawater. Coral reefs are another important feature of the marine environment. They are underwater structures formed mainly by the accumulation of calcium carbonate skeletons produced by coral organisms. Both ocean deposits and coral reefs play important roles in marine geography and ecology.

A. Ocean Deposits

Ocean deposits refer to the materials that accumulate on the ocean floor through natural processes. These materials may come from continents, marine organisms, volcanic activities and chemical processes.

Major Types of Ocean Deposits

1. Terrigenous Deposits: Terrigenous deposits are materials derived from land and transported into the oceans by rivers, wind, glaciers and coastal erosion. They include sand, silt, clay and other rock particles. These deposits are commonly found near continental margins, particularly around river mouths and coastal regions.

2. Biogenous Deposits: Biogenous deposits are formed from the remains of marine organisms such as shells, skeletons and microscopic organisms. They contain materials such as calcium carbonate and silica. For example, calcareous ooze is formed from the remains of organisms containing calcium carbonate, while siliceous ooze contains the remains of silica-rich organisms.

3. Hydrogenous Deposits: Hydrogenous deposits are formed through chemical precipitation directly from seawater. Examples include manganese nodules, phosphorite deposits and certain salt deposits. Manganese nodules are important because they contain manganese, nickel, copper and cobalt.

Ocean deposits are important because they provide information about ocean history, marine environmental conditions and geological processes. Some deposits also contain valuable mineral resources.

B. Coral Reefs

Coral reefs are underwater structures formed mainly by the accumulation of calcium carbonate skeletons produced by tiny marine animals called coral polyps. These organisms often live in colonies and gradually build reef structures over long periods.

Conditions Required for Coral Reef Formation

Coral reefs generally develop in warm, shallow, clear and sunlit tropical waters. The ideal temperature is usually around 23°C–29°C. They require sufficient sunlight, normal marine salinity and clean water. Most reef-building corals grow best where sunlight can reach the water because many of them live in association with photosynthetic algae. Excessive pollution, sedimentation and changes in water temperature can damage coral reefs.

Major Types of Coral Reefs

1. Fringing Reefs: Fringing reefs develop close to the coastline and are directly attached to or separated from the shore by a narrow shallow channel. They are among the most common types of coral reefs.

2. Barrier Reefs: Barrier reefs develop parallel to the coastline but are separated from the land by a wide and deep lagoon. The Great Barrier Reef of Australia is the largest and most famous example.

3. Atolls: Atolls are ring-shaped coral reefs that surround a central lagoon. They are commonly found in tropical oceanic regions, particularly in the Pacific and Indian Oceans.

Ecological and Economic Importance of Coral Reefs

Coral reefs provide habitats and breeding grounds for numerous marine organisms. They support biodiversity and protect coastlines by reducing the force of ocean waves. They are also important for fishing, tourism and scientific research. Many coastal communities depend on coral reef ecosystems for food and income.

Threats to Coral Reefs

Coral reefs face serious threats from rising sea temperatures, coral bleaching, ocean acidification, pollution, destructive fishing and coastal development. Conservation measures include reducing pollution, protecting reef areas and promoting sustainable fishing and tourism.

Q5. Discuss the major marine resources of the world, including biotic, mineral and energy resources and their utilisation.

Answer:

Introduction

Oceans cover about 71 per cent of the Earth's surface and contain a wide variety of natural resources. These resources are important for food production, industrial development, transportation, energy generation and economic growth. Marine resources are broadly classified into three major categories: biotic resources, mineral resources and energy resources. Their proper utilisation is essential for sustainable development.

1. Biotic Marine Resources

Biotic resources are living organisms obtained from oceans and seas. They include fish, prawns, crabs, lobsters, oysters, seaweeds and other marine organisms.

Major Sources and Utilisation: Fish is one of the most important marine resources and provides food and protein to millions of people. Fishing activities are carried out in coastal waters, continental shelves and deep-sea regions. Important fishing regions include the North Atlantic, the North Pacific and the coastal waters of Peru and Chile. Marine organisms are also used in the production of fish oil, fishmeal, medicines and other industrial products. Seaweeds are used in food, cosmetics, fertilisers and pharmaceutical industries.

Aquaculture, also known as fish farming, is another important method of producing marine and coastal resources. It helps increase seafood production and provides employment opportunities.

2. Mineral Resources

Oceans contain several valuable mineral resources that are important for industrial and economic development.

Petroleum and Natural Gas: Petroleum and natural gas are among the most important mineral resources obtained from offshore areas.

They are extracted from sedimentary basins beneath the seabed using offshore drilling platforms. Important offshore production regions include the Persian Gulf, the Gulf of Mexico and the North Sea. These resources are used for transportation, electricity generation, cooking and industrial production.

Salt and Magnesium: Seawater contains large quantities of dissolved salts. Common salt is obtained through the evaporation of seawater in coastal salt pans. Magnesium and other useful minerals can also be recovered from seawater.

Manganese Nodules: Manganese nodules are mineral deposits found on the deep ocean floor. They contain manganese, nickel, copper and cobalt. These metals have potential uses in manufacturing, electronics and industrial production.

Other Mineral Resources: Oceans also provide sand, gravel, phosphorites and other minerals. However, their extraction must be carefully managed to avoid damaging marine ecosystems.

3. Energy Resources

Oceans provide several renewable energy resources that can help reduce dependence on fossil fuels.

Tidal Energy: Tidal energy is generated by using the rise and fall of ocean tides. Tidal power plants use tidal movements to operate turbines and generate electricity. It is a predictable renewable energy source.

Wave Energy: Wave energy is produced by converting the movement of ocean waves into electricity. Special devices are installed in coastal or offshore areas to capture this energy.

Ocean Thermal Energy Conversion (OTEC): OTEC generates electricity by using the temperature difference between warm surface seawater and cold deep seawater. It is particularly suitable for tropical ocean regions where this temperature difference is sufficient.

Offshore Wind Energy: Offshore wind farms use strong and relatively steady winds over the sea to generate electricity. Although wind itself is not a marine resource, offshore locations provide an important opportunity for renewable energy development.

4. Importance and Sustainable Utilisation of Marine Resources

Marine resources provide food security, employment, foreign exchange earnings and industrial raw materials. Fishing, shipping, offshore petroleum production, tourism and marine energy projects contribute significantly to the economies of many countries.

However, overfishing, marine pollution, oil spills, habitat destruction and unsustainable mineral extraction threaten ocean ecosystems. Sustainable utilisation requires responsible fishing practices, marine protected areas, pollution control, environmental monitoring and the use of cleaner technologies.

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UNIT – V

ONE MARK

Q1. What is an ecosystem?

Answer: An ecosystem is a functional unit of nature in which living organisms interact with one another and with their non-living environment.

Q2. Who introduced the term ecosystem?

Answer: The term ecosystem was introduced by British ecologist Sir Arthur Tansley in 1935.

Q3. What are the two main components of an ecosystem?

Answer: The two main components of an ecosystem are biotic (living) components and abiotic (non-living) components.

Q4. What are biotic components?

Answer: Biotic components are the living parts of an ecosystem, including plants, animals, bacteria, fungi and other microorganisms.

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Q5. What are abiotic components?

Answer: Abiotic components are the non-living parts of an ecosystem, such as sunlight, air, water, soil, temperature and minerals.

Q6. What is energy flow in an ecosystem?

Answer: Energy flow refers to the transfer of energy from one organism to another through food chains and food webs within an ecosystem.

Q7. What is a food chain?

Answer: A food chain is a sequence of organisms through which energy and nutrients pass as one organism eats another.

Q8. What is a food web?

Answer: A food web is a network of interconnected food chains that shows the feeding relationships among different organisms in an ecosystem.

Q9. What is the main source of energy in an ecosystem?

Answer: The Sun is the main source of energy for most ecosystems because green plants capture solar energy through photosynthesis.

Q10. What is the water cycle?

Answer: The water cycle is the continuous circulation of water between the atmosphere, land and oceans through evaporation, condensation, precipitation and other processes.

Q11. What is a biotic community?

Answer: A biotic community is a group of different populations of plants, animals and microorganisms living and interacting in the same habitat.

Q12. What is land capability?

Answer: Land capability refers to the ability of land to support different uses, such as agriculture, forestry, grazing and wildlife conservation, without causing serious degradation.

Q13. What is ecological balance?

Answer: Ecological balance is the natural stability maintained between living organisms and their physical environment through their interactions.

Q14. What is deforestation?

Answer: Deforestation is the large-scale removal or destruction of forests, mainly due to agricultural expansion, urbanisation, industrial activities and logging.

Q15. What is global ecological imbalance?

Answer: Global ecological imbalance refers to the disturbance of the natural balance of the Earth's ecosystems due to human activities and

environmental changes such as climate change, pollution and biodiversity loss.

TWO MARK:

Q1. What is an ecosystem? Explain its main components.

Answer: An ecosystem is a functional unit of nature where living organisms interact with one another and with their physical environment. Its two main components are biotic components, such as plants and animals, and abiotic components, such as air, water, soil, sunlight and temperature.

Q2. Differentiate between biotic and abiotic components of an ecosystem.

Answer: Biotic components are the living parts of an ecosystem, including plants, animals and microorganisms. Abiotic components are the non-living elements, such as sunlight, air, water, soil and minerals. Both components interact with each other to maintain the functioning and balance of an ecosystem.

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Q3. What are producers, consumers and decomposers?

Answer: Producers are green plants that prepare their own food through photosynthesis. Consumers are organisms that depend on plants or other animals for food. Decomposers, such as bacteria and fungi, break down dead plants and animals and return nutrients to the environment.

Q4. What is energy flow in an ecosystem?

Answer: Energy flow refers to the transfer of energy from one organism to another through food chains and food webs. It generally begins with sunlight, which is captured by green plants through photosynthesis. Energy then passes to herbivores and carnivores. Energy flow is unidirectional, and some energy is lost as heat at each trophic level.

Q5. What is a food chain? Give an example.

Answer: A food chain is a sequence of organisms through which energy and nutrients pass as one organism eats another. It generally begins with producers and continues through different levels of consumers. For example, Grass → Grasshopper → Frog → Snake → Eagle represents a simple food chain.

Q6. What is a food web? Why is it important?

Answer: A food web is a network of interconnected food chains within an ecosystem. It shows the different feeding relationships among organisms. It is important because it provides alternative food sources for organisms and helps maintain ecological stability and balance.

Q7. What is the 10 per cent law of energy transfer?

Answer: The 10 per cent law was proposed by ecologist Raymond Lindeman. According to this law, approximately 10 per cent of the energy available at one trophic level is transferred to the next trophic level. The remaining energy is mainly used in life processes or lost as heat.

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Q8. What is the water cycle? Mention its major processes.

Answer: The water cycle is the continuous movement of water between the atmosphere, land and oceans. Its major processes include evaporation, transpiration, condensation, precipitation, infiltration and surface runoff. It maintains the availability and distribution of water on the Earth's surface.

Q9. What is a biotic community?

Answer: A biotic community is a group of different populations of plants, animals and microorganisms living and interacting in the same habitat. These organisms depend on one another through food relationships, competition and other ecological interactions. A forest community is an example of a biotic community.

Q10. What is ecological succession?

Answer: Ecological succession is the gradual process through which one biological community is replaced by another over time in a particular area. It may occur naturally in newly formed land or in areas disturbed by fire, floods and other environmental changes. It generally leads towards the development of a relatively stable community.

Q11. What is land capability? Explain its importance.

Answer: Land capability refers to the ability of land to support different uses, such as agriculture, forestry, grazing and wildlife conservation, without causing serious environmental damage. It helps in proper land-use planning, soil conservation and the sustainable utilisation of natural resources.

Q12. How does deforestation affect the ecosystem?

Answer: Deforestation destroys natural habitats and reduces biodiversity. It also increases soil erosion, disturbs the water cycle and contributes to climate change by reducing carbon absorption. Excessive deforestation can disturb ecological balance and negatively affect wildlife and human communities.

Q13. Mention two major human activities that disturb ecological balance.

Answer: Two major human activities that disturb ecological balance are deforestation and industrial pollution. Deforestation destroys natural habitats and increases soil erosion, while industrial pollution contaminates air, water and soil. Other activities include urbanisation, overpopulation, mining and excessive use of natural resources.

Q14. What is global warming and how does it affect the ecosystem?

Answer: Global warming refers to the long-term increase in the Earth's average temperature, mainly due to the increased concentration of greenhouse gases in the atmosphere. It causes changes in rainfall patterns, melting of glaciers, rising sea levels and

habitat loss, which negatively affect biodiversity and ecological balance.

Q15. What is global ecological imbalance? Mention its major causes.

Answer: Global ecological imbalance refers to the disturbance of natural relationships between living organisms and their environment on a worldwide scale. Its major causes include climate change, deforestation, pollution, biodiversity loss, overpopulation and excessive exploitation of natural resources. It threatens environmental stability and sustainable development.

BROAD ANSWER:

Q1. Define an ecosystem. Discuss its structure and major components.

Answer:

Introduction

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An ecosystem is a natural system in which living organisms interact with one another and with their physical environment. It includes plants, animals, microorganisms, soil, water, air and sunlight. These components are connected through the exchange of energy and the circulation of nutrients. The term *ecosystem* was introduced by British ecologist A. G. Tansley in 1935.

Structure of an Ecosystem

The structure of an ecosystem refers to the arrangement and relationship between its living and non-living components. Every ecosystem has two major components: abiotic components and biotic components.

1. Abiotic Components

Abiotic components are the non-living elements of an ecosystem. They provide the basic conditions necessary for the survival of living organisms. These include:

- **Climatic factors:** Temperature, sunlight, rainfall, humidity and wind.
- **Edaphic factors:** Soil, soil moisture, minerals and soil texture.
- **Inorganic substances:** Water, oxygen, carbon dioxide, nitrogen and other minerals.
- **Organic substances:** Proteins, carbohydrates and other organic materials found in the environment.

These factors influence the growth, distribution and survival of plants and animals.

2. Biotic Components

Biotic components include all living organisms present in an ecosystem. They are generally divided into three major groups.

a. Producers: Producers are green plants and other organisms that prepare their own food through photosynthesis. They use sunlight, water and carbon dioxide to produce food. Examples include grasses, trees, algae and aquatic plants. They form the first trophic level of an ecosystem.

b. Consumers: Consumers are organisms that depend directly or indirectly on other organisms for food. They are divided into different categories:

- Primary consumers: Plant-eating animals such as deer, rabbits and grasshoppers.
- Secondary consumers: Animals that feed on primary consumers, such as frogs and small fish.
- Tertiary consumers: Higher-level consumers such as snakes and large predatory birds.

c. Decomposers: Decomposers are organisms that break down dead plants, animals and organic waste into simpler substances. Bacteria and fungi are important examples. They return nutrients to the soil and help maintain the natural nutrient cycle.

Major Functions of an Ecosystem

An ecosystem performs several important functions. First, it supports the flow of energy from the Sun to producers and then to consumers. Second, it helps in nutrient cycling, through which essential elements such as carbon, nitrogen and phosphorus circulate between living organisms and the physical environment.

Another important function is the maintenance of ecological balance. Different organisms depend on one another for food, shelter, reproduction and survival. Ecosystems also regulate natural processes such as soil formation, water purification and decomposition.

Example of an Ecosystem

A forest is a good example of an ecosystem. Trees and grasses act as producers, deer and insects act as primary consumers, and tigers and snakes act as higher-level consumers. Bacteria and fungi decompose dead organic matter. Sunlight, rainfall, air and soil provide the necessary physical conditions.

Q2. Explain the flow of energy in an ecosystem. Discuss food chains, food webs and the 10% law.

Answer:

Introduction

Energy flow is one of the most important functions of an ecosystem. All living organisms require energy to perform activities such as growth, movement, reproduction and survival. The Sun is the primary source of energy for most ecosystems. Green plants capture solar energy through photosynthesis and convert it into chemical energy in

the form of food. This energy then passes from one organism to another through different feeding relationships.

Flow of Energy in an Ecosystem

Energy enters an ecosystem mainly through sunlight. Green plants, known as producers, absorb sunlight and prepare food through photosynthesis. Herbivores obtain energy by eating plants, while carnivores obtain energy by eating other animals.

The movement of energy from producers to consumers is called energy flow. It generally follows a single direction and does not return to the original source. At every trophic level, some energy is used for respiration, movement and other life processes, while much of it is released as heat. Therefore, the amount of available energy decreases at successive trophic levels.

Trophic Levels

A trophic level represents the feeding position of an organism in a food chain.

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The major trophic levels are:

1. **First trophic level – Producers:** Green plants and algae that prepare their own food.
2. **Second trophic level – Primary consumers:** Herbivores such as rabbits, deer and grasshoppers.
3. **Third trophic level – Secondary consumers:** Animals that feed on herbivores, such as frogs and small fish.
4. **Fourth trophic level – Tertiary consumers:** Higher-level carnivores such as eagles and large predatory animals.

Decomposers act on dead organisms and organic waste from all trophic levels.

Food Chain

A food chain is a simple sequence that shows how energy and nutrients pass from one organism to another through feeding relationships.

For example:

Grass → Grasshopper → Frog → Snake → Eagle

In this example, grass is the producer. The grasshopper eats grass, the frog eats the grasshopper, the snake eats the frog, and the eagle feeds on the snake.

There are two commonly recognised types of food chains:

- **Grazing food chain:** Begins with green plants and passes to herbivores and carnivores.
- **Detritus food chain:** Begins with dead organic matter and passes to decomposers and other organisms that feed on it.

Food Web

A food web is a network of interconnected food chains within an ecosystem. In nature, most organisms depend on more than one food source. For example, a grassland rabbit may be eaten by a fox or an eagle, while grass may be consumed by rabbits, deer and grasshoppers.

Food webs provide alternative feeding relationships and help maintain ecological stability.

The 10% Law

The 10% law was proposed by ecologist Raymond Lindeman in 1942. According to this principle, approximately 10% of the energy available at one trophic level is transferred to the next trophic level. The remaining energy is used in life processes or lost as heat.

For example, if producers contain 10,000 units of energy, primary consumers may receive approximately 1,000 units, secondary consumers 100 units and tertiary consumers 10 units. This is an

approximate principle, as actual energy transfer varies between ecosystems.

Importance of Energy Flow

Energy flow supports the survival of organisms and maintains food relationships. It also explains why food chains usually have a limited number of trophic levels. The decreasing availability of energy at higher levels helps regulate the number of organisms that can be supported by an ecosystem.

Q3. Explain the water cycle and discuss its importance in maintaining the ecosystem.

Answer:

Introduction

Water is one of the most essential natural resources for all living organisms. Plants, animals and human beings depend on water for their survival. Water continuously moves between the atmosphere, land, oceans and living organisms through a natural process known as the water cycle or hydrological cycle. It is mainly driven by solar energy and the force of gravity.

Meaning of the Water Cycle

The water cycle refers to the continuous circulation of water between the Earth's surface and the atmosphere. During this process, water changes its physical state from liquid to vapour and sometimes to ice. It moves through different stages, including evaporation, transpiration, condensation, precipitation, infiltration and runoff.

Major Processes of the Water Cycle

1. Evaporation

Evaporation is the process through which water changes from a liquid state into water vapour due to heat energy from the Sun. Water

evaporates mainly from oceans, rivers, lakes, ponds and other water bodies. Oceans are the largest source of evaporation.

2. Transpiration

Transpiration is the process by which plants release water vapour into the atmosphere through small openings in their leaves called stomata. Along with evaporation, transpiration contributes to the movement of water from the Earth's surface into the atmosphere. Together, these processes are known as evapotranspiration.

3. Condensation

Condensation occurs when water vapour rises into the atmosphere, cools down and changes into tiny water droplets or ice crystals. These droplets form clouds, fog and mist. Condensation is an important stage in cloud formation.

4. Precipitation

Precipitation refers to the falling of water from clouds to the Earth's surface in different forms. It may occur as rainfall, snowfall, sleet or hail. Rainfall is the most common form of precipitation in many parts of the world.

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5. Infiltration and Percolation

Infiltration is the process through which water enters the soil from the surface. After entering the soil, some water moves downward through soil layers and rocks. This process is called percolation. It helps recharge groundwater resources.

6. Surface Runoff

When rainfall exceeds the amount that can enter the soil, excess water flows over the land surface. This is known as surface runoff. It eventually reaches streams, rivers, lakes and oceans.

7. Groundwater Flow

Some water moves underground through soil and rock layers. It may emerge through springs or flow into rivers, lakes and oceans.

Groundwater is an important source of freshwater for agriculture and human consumption.

Importance of the Water Cycle in an Ecosystem

The water cycle plays a significant role in maintaining ecological balance. It provides freshwater to plants, animals and human beings. Rainfall supports agricultural activities, forest growth and natural vegetation.

It also helps regulate the Earth's climate by transferring heat and moisture between the land, oceans and atmosphere. Water supports photosynthesis in plants and provides habitats for aquatic organisms. Infiltration and groundwater recharge help maintain water availability during dry periods.

The water cycle also supports soil formation and nutrient distribution. Moving water carries dissolved minerals and nutrients that are necessary for plant growth. Furthermore, rivers and rainfall help maintain wetlands, lakes and other aquatic ecosystems.

Human Impact on the Water Cycle

Human activities such as deforestation, urbanisation, groundwater overuse and pollution can disturb the natural water cycle. Deforestation reduces transpiration and may affect local rainfall patterns. Excessive groundwater extraction lowers the water table, while concrete surfaces in cities increase surface runoff and reduce infiltration.

Q4. What is a biotic community? Explain the relationship among organisms and discuss the concept of land capability.

Answer:

Introduction

A biotic community refers to a group of different populations of plants, animals and microorganisms living together in a particular

geographical area and interacting with one another. These organisms depend on each other for food, shelter, reproduction and survival. Their interactions help maintain the structure and functioning of an ecosystem.

Meaning and Characteristics of a Biotic Community

A biotic community consists of different species living in a common habitat. For example, a forest community includes trees, grasses, insects, birds, mammals, fungi and bacteria.

The main characteristics of a biotic community are:

1. It consists of different populations of living organisms.
2. Organisms share a common habitat.
3. Different species interact through feeding and other relationships.
4. It has a definite structure and composition.
5. It changes over time due to environmental conditions and ecological succession.

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Relationships Among Organisms

Different organisms establish various relationships within a community. The major types are discussed below.

1. Competition

Competition occurs when two or more organisms require the same limited resources, such as food, water, sunlight, space or shelter. For example, trees in a dense forest compete for sunlight and nutrients. Competition may occur between members of the same species or different species.

2. Predation

Predation is a relationship in which one organism captures and feeds on another organism. The organism that hunts is called the predator, while the organism being hunted is called the prey. For example, a

tiger hunts deer, and a frog eats insects. Predation helps regulate population sizes.

3. Mutualism

Mutualism is a relationship in which both participating organisms benefit from each other. A common example is the relationship between bees and flowering plants. Bees obtain nectar from flowers, while flowers receive help in pollination.

4. Commensalism

Commensalism is a relationship in which one organism benefits while the other is neither significantly benefited nor harmed. For example, some orchids grow on tree branches to receive better sunlight without taking nutrients from the host tree.

5. Parasitism

Parasitism occurs when one organism benefits at the expense of another organism. The organism that benefits is called the parasite, while the organism affected is called the host. For example, ticks live on animals and obtain nourishment from their bodies.

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Meaning of Land Capability

Land capability refers to the ability of a particular piece of land to support different types of human activities, especially agriculture, forestry, grazing and other land uses. It depends on several physical and environmental factors, including soil fertility, slope, soil depth, drainage, rainfall, erosion risk and vegetation cover.

Factors Affecting Land Capability

The major factors affecting land capability include:

- **Soil characteristics:** Soil texture, structure, depth and fertility determine its suitability for cultivation.
- **Slope:** Steep slopes are more vulnerable to soil erosion than flat or gently sloping land.

- **Climate:** Rainfall and temperature influence agricultural productivity.
- **Drainage:** Poor drainage may cause waterlogging and damage crops.
- **Erosion risk:** Areas exposed to severe soil erosion have limited agricultural suitability.

In the widely used USDA land capability classification, land is divided into eight classes, from Class I to Class VIII. Class I land has very few limitations for cultivation, while Class VIII is generally unsuitable for ordinary crop cultivation and is better suited to conservation or limited recreational uses.

Importance of Land Capability

Land capability assessment helps people select suitable land uses and avoid environmental damage. It supports proper agricultural planning, soil conservation, forest management and sustainable development. It also reduces the risk of soil erosion, land degradation and loss of productivity.

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Q5. Discuss the impact of human activities on the ecosystem and explain the causes of global ecological imbalances.

Answer:

Introduction

An ecosystem maintains a natural balance through interactions among plants, animals, microorganisms and the physical environment. However, increasing human activities have significantly changed the natural environment. Industrialisation, urbanisation, deforestation, pollution and excessive use of natural resources have disturbed ecological relationships. These disturbances have created serious environmental problems at both local and global levels.

Major Human Impacts on the Ecosystem

1. Deforestation

Deforestation refers to the large-scale removal of forests for agriculture, industries, roads, settlements and other developmental activities. Forests provide habitats for wildlife, absorb carbon dioxide, protect soil and regulate the water cycle. Their destruction causes biodiversity loss, soil erosion, habitat fragmentation and changes in local climatic conditions.

2. Industrialisation

Industries contribute to economic development, but unregulated industrial activities can damage ecosystems. Factories release harmful gases, smoke, chemicals and industrial waste into the environment. These pollutants contaminate air, water and soil and may negatively affect human health and wildlife.

3. Urbanisation

Urbanisation refers to the growth of towns and cities. The expansion of urban areas often leads to the conversion of forests, agricultural land and wetlands into buildings, roads and other infrastructure. It increases pressure on natural resources and contributes to waste generation, air pollution and water pollution.

4. Agricultural Activities

Modern agricultural practices sometimes involve excessive use of chemical fertilisers and pesticides. These substances may enter rivers, lakes and groundwater through surface runoff and leaching. Excessive irrigation can also cause waterlogging and soil salinity. Unsustainable farming practices may reduce soil fertility and biodiversity.

5. Pollution

Pollution is one of the major threats to ecosystems. Air pollution occurs due to vehicle emissions, industrial smoke and burning of fossil fuels. Water pollution results from sewage, industrial discharge and agricultural chemicals. Soil pollution is caused by plastics,

pesticides and harmful chemical waste. Noise pollution also affects wildlife and human well-being.

6. Overexploitation of Natural Resources

Excessive extraction of forests, minerals, freshwater and wildlife can reduce the availability of natural resources. Overfishing, illegal hunting and uncontrolled mining disturb ecological relationships and may threaten the survival of several species.

Global Ecological Imbalances

Global ecological imbalance refers to large-scale disturbances in the natural processes and relationships that maintain environmental stability. Several important problems are associated with it.

1. Global Warming and Climate Change: The increase in greenhouse gases, particularly carbon dioxide and methane, traps additional heat in the atmosphere. This contributes to rising global temperatures, changing rainfall patterns, melting glaciers and rising sea levels.

2. Loss of Biodiversity: Habitat destruction, pollution, climate change and overexploitation threaten many plant and animal species. The decline of biodiversity weakens ecosystem stability.

3. Desertification: Desertification is the degradation of land in dry areas due to climatic variations and human activities such as deforestation, overgrazing and unsustainable agriculture.

4. Ocean Pollution and Acidification: Plastic waste, chemical discharge and oil spills damage marine ecosystems. In addition, the absorption of excess atmospheric carbon dioxide by oceans causes ocean acidification, which affects organisms such as corals and shell-forming animals.

5. Ozone Layer Depletion: Certain chemicals, particularly chlorofluorocarbons (CFCs), have damaged the stratospheric ozone layer, increasing the amount of harmful ultraviolet radiation reaching the Earth's surface.

Measures to Maintain Ecological Balance

Human beings must adopt sustainable practices to reduce environmental damage. Afforestation, wildlife conservation, renewable energy, waste management, pollution control and sustainable agriculture are important measures. Governments and communities should also promote environmental education and enforce environmental protection laws.

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