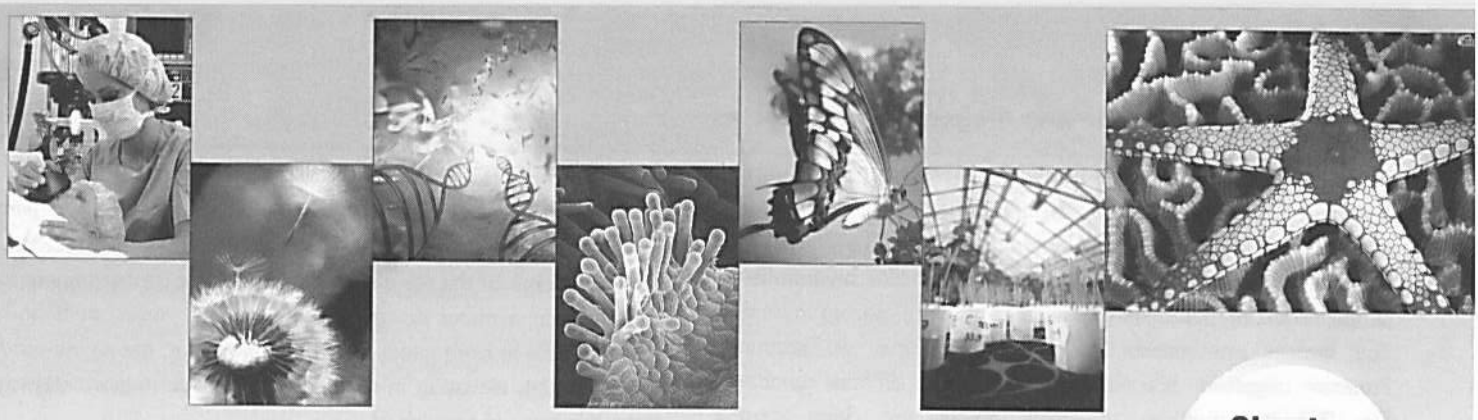


Chapter

10.3

Biome and Biogeochemical Cycles

Biome

Definition : Each of the major terrestrial ecosystems or distinctive terrestrial areas with their group of climax plants and associated animals constitutes biomes. A biome is the largest terrestrial community. Rainfall, temperature range, nature of soil, barriers, latitude and altitude determine the nature and extent of biomes.

Major biomes of world : Biomes are often classified in seven categories :

(1) **Tropical Evergreen/Rain forests :** The tropical rain forest, a biome occurs in regions of high temperature (average 25°C) and high rainfall (200-450 *cm* per year). These tropical rain forests occur in Central America, around Amazon basin in South America, in Africa and in South-East Asia. In India they occur in Western Ghats, Assam and Andamans.

(i) This biome is characterized by multistoried vegetation (upto five distinct layers or storeys of vegetation). Further maximum biodiversity on land is shown by this biome and it is estimated that one half to two-thirds of all species of terrestrial plants and insects live in tropical forests.

(ii) Lianas (vascular plants rooted in soil and they only get support of trees for climbing to top) and epiphytes (air plants) are common in this biome due to excess of moisture. Further giant trees of the tropical forest support a rich and diverse community of animals on their branches.

(iii) No one species dominates in this biome.

(iv) The productivity of this biome is maximum.

(v) The trees of this biome possess buttressed trunks and phenomenon of cauliflory (presence of flowers and fruits on main trunk and main branches) is common in this biome.

(vi) Maximum absorption of rainfall water is done by tropical evergreen forest.

(2) **Savannahs :** Like tropical forests, savannahs are found near the equator but in areas having less annual rainfall (90-150 *cm/year*). Some areas near the equator experience prolonged dry seasons. Savanna occurs in North Australia, India, Central and Southern Africa including east-central Southern Africa. The heat, periodic dryness and poor soils cannot support a forest but have led to evolution of tropical open grasslands with scattered shrubs and trees.

(i) The vegetation of this biome supports large grazing herbivores like buffalo, zebra, etc., which are food for carnivores like lions, tigers, etc. The savannah also supports a large number of plant eating invertebrates like mites, grasshoppers, ants, beetles and termites.

(ii) The termites are one of the most important soil organisms in savannahs.

(iii) Indian tropical grasslands are not true savannahs but these are the result of destruction and modification of tropical deciduous forests by cutting, grazing and fire.

Common tree species are *Phoenix*, Eucalyptus, *Grevillea*. *Acacia* and *Prosopis*. Shrub include Capparis, Balaritis, Carissa and Tamarix.

(3) **Deserts :** These are the biomes that have 25 *cm* (10 inches) or less of precipitation annually.

(i) Sahara of North Africa, Thar of West Asia and Gobi of Asia are most important deserts. Desert can be cold (*e.g.*, Tibet, Gobi) and hot (*e.g.*, Thar, Sahara).

(ii) Annual plants are abundant in deserts and tide over unfavourable dry season in the form of seeds. Succulent plants are characteristics of deserts. Trees and shrubs present in deserts have deep roots. *e.g., Alhagi camelorum, Cirsium. Boerhavia repens* etc.

(iii) Desert animals (Kangaroo, Lizards, Spiders, Scorpions etc.) have also fascinating adaptations that enable them to adjust with limited water supply.

(iv) Desert plants show phenomenon of Allelopathy, *i.e.*, they secrete some chemical substances which inhibit the growth of plants growing in their near vicinity.

(v) Deserts show poor biodiversity and their productivity is minimum.

(4) **Temperate grasslands :** Temperate grasslands experience a greater amount of rainfall than deserts but a lesser amount than savannahs. Mean annual rainfall is 25 – 75 cm. They occur at higher latitudes than savannahs but like savannahs are characterized by perennial grasses and herbs of grazing mammals. Tall grasses are mainly *Andropogon, furcatus, A. scoparius, Panicum virgatum, Sorghastrum nutaris* and *Elymus canadensis* etc, Principal medium to small grasses are *Stipa spartea, Sporobolus asper* and *Dicantheum annulatum.*

Temperate grasslands have different names in different parts of the world, *e.g.*, Prairies of North America, Steppes of Russia, Veldts of South Africa, Pampas of South America, Pusztas of Hungary and Tussocks of New Zealand.

(5) **Temperate broadleaf (deciduous) forests :** Temperate deciduous forests occur in areas having warm summers, cold winters and moderate amount of precipitation (75 – 150 *cm* annually). The trees of this forest loose their leaves during autumn and remain dormant throughout winter (term 'deciduous' derived from Latin word meaning 'to fall'). These forests are present in Eastern United States, Canada and extensive region in Eurasia.

(i) In temperate forest biome, there is an upper canopy of dominant trees like beech, oak, birch, maple, etc. followed by lower tree canopy and then a layer of shrubs beneath.

(ii) Animal life in this biome is abundant on the ground as well as on the trees.

(6) **Taiga :** Mean annual rainfall ranges from 10 to 35 cm, and the average temperature is 6°C in the Winter while upto 20°C in Summer. The taiga or northern coniferous forests or boreal forests consist of evergreen, cone bearing trees like spruce, hemlock and fir and extend across vast areas of Eurasia, and North America.

In India coniferous forests are found in Himalayan region.

(i) The taiga is characterized by long, cold winters with little precipitation.

(ii) The harsh climate limits productivity of the taiga community. The cold temperatures, very wet soil during the growing season and acids produced by fallen conifers needles and *Sphagnum* inhibit full decay of organic matter, due to which thick layers of semidecayed organic material called peat is formed, which acts as energy source.

(7) **Tundra :** Tundra is located 60°*N* latitude just below the polar ice cap it is a circumpolar community occupying approx 8 million Km^2 area. The tundra encircles the top of the world. This biome is characterised by desert like levels of precipitation (less than 25 *cm* annually), extremely long and cold winters and short warmer summers.

(i) Tundra is uniform in appearance and is dominated by scattered patches of grasses, sedges and lichens. Some small trees do grow but are confined to margins of streams and lakes (In general treeless).

(ii) Tundra is a biome of low diversity and low productivity.

(iii) The precipitation that falls remains unavailable to plants for most of the year because it freezes. During the brief arctic summer, some of the ice melts and permafrost (or permanent ice) found about a meter down from the surface, never melts and is impenetrable to both water and roots. However, the alpine tundra found at high elevation in temperate or tropical regions does not have this layer of permafrost.

(8) **Chapparal (Mediterranean Scrub Forest).**

Location : Pacific coast of north America, Chile, South Africa and South Australia.

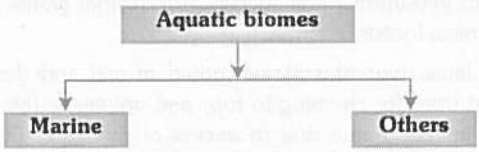
Physical Characteristic : It is a broad-leaved evergreen **shrub forest** of hard and thick leaved small trees and shrubs which usually contain resin but are resistant to fires. The area has frequent bush fires during 'dry' summer. It receives humid air from nearby oceans which also keeps the temperature moderate. Rainfall is during winter only.

Life : Both plants and animals are adapted to long droughts.

Flora and Fauna : Both plants and animals are adopted to frequent and long periods of drought. The common plants of chapparal are *Arctostaphylos* (Manzita), Sage, *Carnithus, Adenostema,* (Cheemise), Oak and *Eucalyptus* (in Australia). Animals include rabbits, rat, chipmunks, deer, snakes, lizards, birds, tiger, etc.

(9) **Alpine/Alpine Tundra :** It is tree-less area on high mountains (above 3500 *m*) which has snow for long months. It is well drained and slopy. Plants include lichenes, mosses, grasses, herbs, small shrubs (*e.g., Artemesia, Primula, Arenaria, Anemone*) and dwarf trees (*e.g., Rhododendron, Abies, Juniperus*). Animals are Snow Leopard, Snow Bear, Mountain Goat, Yak, Wolf, Rabbit, Willow Grouce and migratory birds.

Indian biomes : Indian forests are classified into three major types. Based on temperature they are tropical, temperate, alpine.



(1) **The marine environment :** It is characterized by its high concentration of salt (about 3.5 percent in open sea) and mineral ions (mostly sodium and chloride followed by sulphur, magnesium and calcium).

(i) The vertical zones of the ocean are determined on the basis of availability of light for photosynthesis. The lighted upper 200 metres form the photic or euphotic zone. The next zone upto the depth 200–2000 metres gets less light which is insufficient for photosynthesis form the aphotic zone. Below 2000 metre is the area of perpetual darkness, the abyssal zone.

(ii) Three major environments may be recognized in the ocean basin

(a) **The littoral zone :** The sea floor from the shore to the edge or the continental shelf.

(b) **The benthonic zone :** The sea floor along the continental slope and the aphotic and abyssal zone.

(c) **The pelagic zone :** Constituting the water of the ocean basin.

❑ **Marine life : It can be grouped into three main categories :**

(i) **Plankton :** These are passively drifting or floating organisms. Most of these minute organisms, plankton includes photosynthesizing organisms like diatoms (phytoplankton) as well as heterotrophic organisms like small crustaceans (zooplanktons).

(ii) **Nektons :** These consist of actively moving organisms with well developed locomotory organs.

(iii) **Benthonic organisms :** These are found along the floor of the sea bed and include creeping, crawling or sessile organisms.

(2) **Other (Lakes and Ponds) :** Lakes and ponds are stagnant fresh water bodies and are found practically in every biome. Many lakes are direct or indirect result of glaciation. Others are natural or man made depression filled with water. The relatively shallow lakes, called eutrophic lakes, have a rich accumulation of organic products *e.g.*, Dal lake of Kashmir.

Generally deep lakes, often with the steep and rocky sides, are poor in circulating nutrients like phosphates. These are called oligotrophic lakes. Some of the lakes contain a saline or brackish water (Sambhar lake of Rajasthan).

Biogeochemical cycle

Organisms are built up on chemical substances. They require certain chemicals like N_2, O_2, H_2, P, C, etc. continuously for their survival. These chemicals enter the organisms from the environment and come out after undergoing changes or without changes. Thus these elements tend to circulate in a characteristic path from the environment to the organism and back to the environment. This cyclical path of the elements from the abiotic system to the biotic system and back is called biogeochemical cycles (Bio = living organism; Geo = water, air, earth). As these chemicals form the components of food, these cycles are also called nutrient cycles.

Phases of biogeochemical cycles : Each biogeochemical cycle has two phases, namely the biotic phase (organic phase) and the abiotic phase.

(1) **Biotic phase :** It refers to the flow of chemicals in the living organisms through food chain.

(2) **Abiotic phase :** It refers to the distribution and flow of chemicals in the non-living environment.

Types of biogeochemical cycles : The biogeochemical cycles are classified into two types, namely gaseous cycles and sedimentary cycles.

(1) **Gaseous cycles :** In gaseous cycles the main reservoirs of chemicals are the atmosphere and ocean. *e.g.*, Carbon cycle, N_2 cycle, O_2 cycle, etc.

(2) **Sedimentary cycle :** In sedimentary cycles the main reservoirs are soil and rocks. *e.g.*, Sulphur cycle, phosphorus cycle, etc.

Important biogeochemical cycles

(1) **Carbon Cycle :** The cycling of carbon between biotic and abiotic systems is called carbon cycle. It is a gaseous cycle. The main source of carbon is the carbon dioxide (CO_2). CO_2 is present in the air and water. Air is the main reservoir. CO_2 content of air is 0.03%. Its amount remains constant.

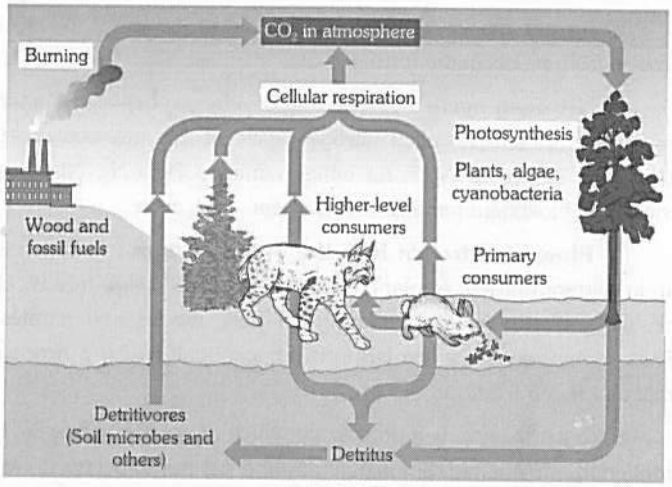


Fig : 10.3-1 Carbon cycle

(i) **Flow of Carbon into the biotic system :** Carbon flows into the biotic system in two ways :

(a) **Photosynthesis :** Carbon enters the biotic system through photosynthesis. In photosynthesis green plants utilize CO_2 and incorporate the carbon of CO_2 in glucose. Glucose is used for the synthesis of other types of carbohydrates, proteins and lipids. These compounds, containing carbon, are stored up in the plant tissues. When plants are eaten up by herbivores, the carbon flows into the body of herbivorous animals through food chain. When herbivores are eaten by carnivores, the carbon enters the body of carnivorus animals.

$$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2.$$

(b) **Formation of shell :** The CO_2 dissolved in sea water is utilized by the marine animals like protozoans, corals, molluscs, algae, etc., for the construction of shell. In these animals CO_2 is converted into calcium carbonate ($CaCO_3$) which is used for the construction of shells.

$CO_2 + H_2O \rightarrow H_2CO_3$ (Carbonic acid)

$H_2CO_3 \rightarrow H^+ + HCO_3$ (Bicarbonate)

$HCO_3 + Ca^+ \rightarrow H^+ + CaCO_3$ (Calcium carbonate)

(ii) **Flow of Carbon into the abiotic system :** The carbon of the biotic system flows into the abiotic system in five ways :

(a) **Respiration :** Plants and animals release CO_2 by respiration (biological oxidation).

$$C_6H_{12}O_6 + 6O_2 \xrightarrow{\text{Enzymes}} 6CO_2 + 6H_2O + \text{Energy}$$

(b) **Decomposition :** When plants and animals die, the dead bodies are decomposed into CO_2 by decomposers like bacteria, algae, etc.

(c) **Shells :** After the death of marine animals, $CaCO_3$ stored in the shells is either deposited as sedimentary rocks or dissolved in water to release CO_2 by the reversion of the above said reactions.

(d) **Coal :** A certain proportion of carbon from plants is deposited as coal. Carbon from coal returns to air in the form of CO_2 through combustion and weathering.

(e) **Forest fire :** Combustion of wood in the forest, releases carbon from plants in the form of CO_2.

(2) **Nitrogen cycle :** The cycling of nitrogen between abiotic and biotic systems is called nitrogen cycle. It is a gaseous cycle. The main source of N_2 is air which contains 79% N_2. Nitrogen content of biosphere remains constant due to N_2 cycle.

(1) **Flow of Nitrogen into the biotic system :** Nitrogen is an important nutrient of plants. But plants cannot utilize free N_2 of air. They obtain N_2 from ammonium salts, nitrites and nitrates. These compounds are formed from atmospheric N_2 by a process called nitrogen fixation.

Nitrogen fixation is a process by which atmospheric free N_2 is converted into soluble salts like nitrites and nitrates. It occurs in two ways namely electrochemical fixation and biological fixation.

(a) **Electrochemical fixation :** A certain amount of free N_2 is fixed by the action of lightning. The amount of nitrate formed by this method is about 35 $mg/m^2/year$.

(b) **Biological fixation :** It refers to the conversion of free N_2 into soluble salts by the activity of certain organisms. These organisms are called N_2 fixing organisms. The amount of nitrate formed by this method is about 140 to 700 $mg/m^2/year$, and in a fertile area it exceeds 20000 mg/m. The N_2 fixing organisms are bacteria, blue green algae, fungi and other micro-organisms. *e.g., Rhizobium, Azotobacter, Closteridium, Bacillus, Nitrosomonas, Nitrococcus, Nitrobacter, Anabaena, Nostoc,* etc.

The fixed N_2 is absorbed by plants through the root system and is incorporated into the proteins. When herbivores feed on these plants, the N_2 flows on the carnivores through food chain.

(2) **Flow of Nitrogen into the abiotic system :** The nitrogen of the biotic system flows into the abiotic system by four methods, namely decomposition, excretion, denitrification and sedimentation.

(a) **Decomposition :** Plants and animals contain nitrogen in their body protein. After death, the proteins of dead bodies are decomposed by decomposers into amino acids and ammonia. The convertion of protein from dead bodies into ammonia by decomposition is called ammonification. This ammonia may be converted into nitrates or free nitrogen.

$$\text{Protein in dead bodies} \xrightarrow[-\,fication]{Ammoni-} NH_3 \begin{matrix} \nearrow N \\ \searrow NO_3 \end{matrix}$$

(b) **Excretion :** Animals excrete nitrogenous waste products in the form of ammonia, urea and uric acid. These compounds are decomposed to release N_2.

(c) **Denitrification :** The conversion of nitrate into ammonia or free nitrogen is called denitrification. This is done by denitrifying bacteria. *e.g., Pseudomonas.*These bacteria utilize the O_2 present in the nitrate for the oxidation of carbohydrate.

(d) **Sedimentation :** Some amount of nitrate is lost from the ecosystem by sedimentation.

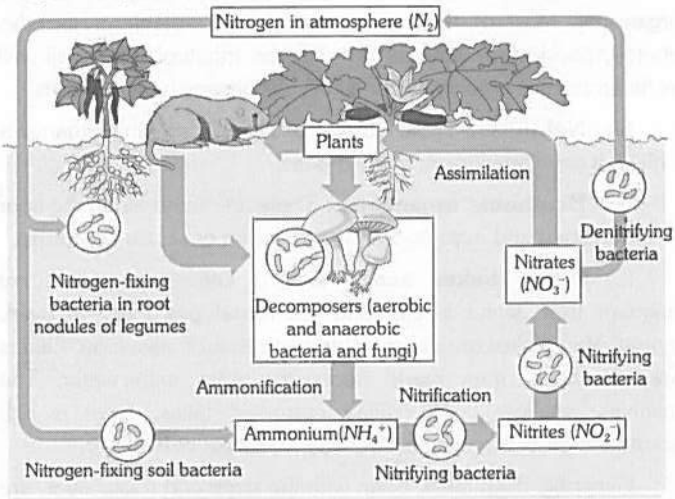


Fig : 10.3-2 Nitrogen cycle

(3) **Oxygen cycle :** The cycling of O_2 between biotic and abiotic systems is called O_2 cycle. It is a gaseous cycle. Air is the reservoir for O_2. O_2 enters the biosphere through respiration. The O_2 taken into the body is used for oxidation of carbohydrates, proteins and fats. Certain amount of O_2 in atmospheric air is converted into ozone (O_3). The ozone forms an umbrella-like layer in the outer atmosphere. This layer prevents the ultraviolet radiations from reaching the earth's surface.

$$C_6H_{12}O_6 \rightarrow 6CO_2 + 6H_2O + \text{Energy},\ O_2 + O \rightarrow O_3$$

Carbon monoxide is released from volcanoes. This CO is unstable. It combines with O_2 to form CO_2.

O_2 combines with a variety of elements to form compounds. For example, it forms CO_2 with carbon, water with hydrogen, nitrates with N_2, ferric oxide with iron etc. O_2 returns to air by two main methods, namely photosynthesis and photodissociation.

$$O_2 + C \rightarrow CO_2,\ O_2 + 2H_2 \rightarrow 2H_2O$$

$$3O_2 + N_2 \rightarrow 2NO_3$$

(i) **Photosynthesis :** Green plants synthesize carbohydrates by photosynthesis. During photosynthesis water molecules break up into hydrogen and oxygen. O_2 is released into the atmosphere and H_2 is trapped and turned into carbohydrates.

$$12H_2O + 6CO_2 \rightarrow C_6H_{12}O_6 + 6H_2O + 6O_2$$

(ii) **Photodissociation :** Water vapour is dissociated to release H_2 and O_2, in presence of light.

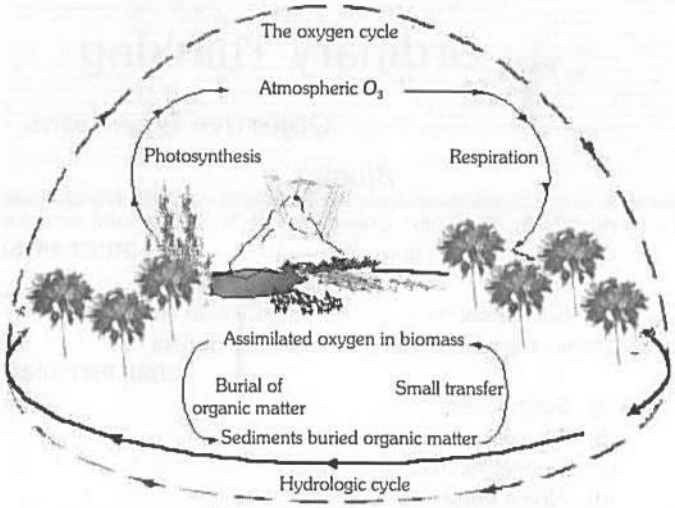


Fig : 10.3-3 Oxygen cycle

(4) **Phosphorus cycle :** The cycling of phosphorus between biotic and abiotic system is called phosphorus cycle. It is a sedimentary cycle. Phosphorus is an important mineral nutrient. The main source of phosphorus is rocks. Through erosion and weathering phosphorus is made available in the soil. Plants absorb ionic phosphate through roots. In plants it is incorporated into the protoplasmic components like DNA, RNA, AMP, ADP, ATP, GDP, GTP, NADP, phospholipids etc. From plants, it passes into herbivores and animals, the organic molecules containing phosphate are decomposed and phosphate is liberated as inorganic ion phosphate. It is again used by plants.

The excess of phosphate in the bodies of animals is excreted out through faeces. The bird guano (excreta) contains a large amount of phosphate. Phosphate is also released to the soil through the combustion of forest trees and grasses. A large amount of phosphate is lost in the sea by sedimentation. A certain amount of phosphorus gets locked in bones and teeth.

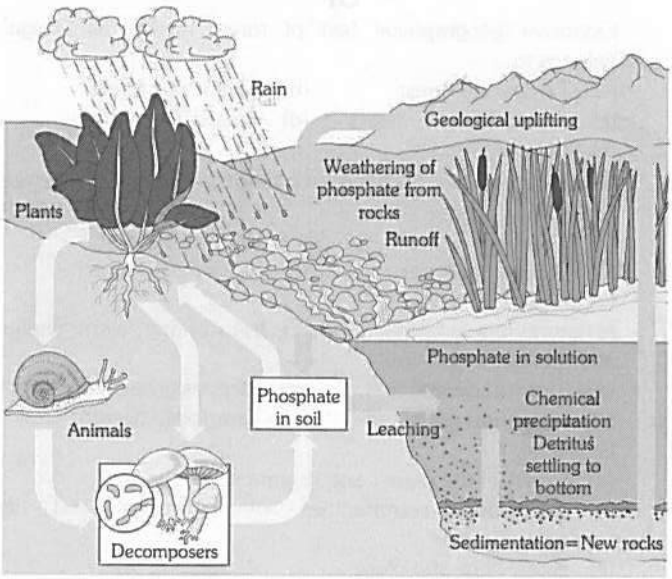


Fig : 10.3-4 Phosphorus cycle

(5) **Sulphur cycle :** The cycling of sulphur between biotic and abiotic systems is called sulphur cycle. It is a sedimentary cycle. Sulphur is an important component of proteins and amino acids.

Sulphur exists in a number of states. Of these, three are important. They are elemental sulphur, sulphides and sulphates. Sulphur is present in rocks. It is made available for plants in the form of inorganic sulphate by weathering and erosion. Sulphur passes into the animals through food chain. By the death of plants and animals, the decomposers again bring the sulphur to the soil for the use of plants.

Some sulphur in dead bodies is released into the air as hydrogen sulphide (H_2S) by the bacteria called *Escherichia coli* under anaerobic combustion. Similarly incomplete combustion of fossil fuel releases sulphur dioxide (SO_2) into the air.

Certain bacteria (green and purple photosynthetic bacteria) oxidise H_2S of air to sulphate which can be used by plants.

$$H_2S + 2O_2 \rightarrow SO^{-}_4 + 2H^{+}$$

Certain amount of sulphur is lost in the sediments. If iron is present in the sediments, sulphur combines with it to form iron sulphide. $Fe + S \rightarrow FeS$

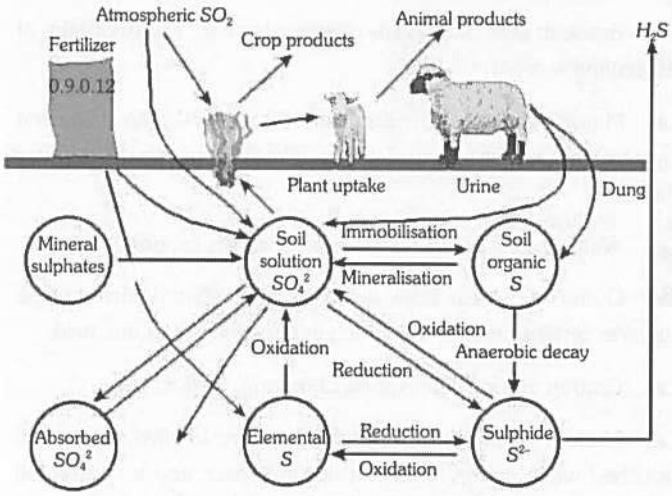


Fig : 10.3-5 Sulphur cycle

Tips & Tricks

- Number of biomes on a mountain range decreases with the increase in the latitude of the mountain.
- Muskegs : Water filled depressions in tundra biome.
- Latossols : Red coloured nutrient-rich highly fertile soil of tropical rain forests.
- Temperate forests occur in India in Himalayas.

- Tropical deciduous forests are also called monsoon forests.
- Chapparal of winter rain areas is called machhie.
- Black soils of tall grass prairies are richest in nutrients and so are most fertile in the world.
- Some latitudinal lines :
  (a) Tropic of cancer at 23.5°*N* of equator.
  (b) Arctic circle at 66.72°*N*
  (c) Tropic of capricorn at 23.5° S of equator.
  (d) Antarctic circle at 66.72°*S*.
- Biotic Zones :
  (a) Tropical Zone : Between 23°*N* and 23°*S*.
  (b) Subtropical Zone: Between 23° and 40°*N*.
  (c) Temperate Zone : Between 40° to 60°*N*.
  (d) Arctic Zone : Between 60° and 70°*N*.
- Dystrophic lakes. Lakes rich in undecomposed organic matter. *e.g.*, marshy lakes.
- Brackish salts are always oligotrophic *e.g.*, sambhar lake of Rajasthan.
- Major estuaries of India are : (Hooghly-Malta estuarine system, Adyar estuary and chilka lake (largest brackish water lake).
- Winogradsky (1891) discovered nitrogen fixation.
- Guano : Excreta from sea birds and others which can be used as fertilizer due to being rich in phosphate and uric acid.
- Carbon : It constitutes 49% of organic matter.
- Matter occupies a space. It can be seen, smelled, tasted and touched while energy does not occupy space and it can be felt through specific receptors *e.g.*, heat, sound, light.
- Reservoirs Pool : It is the reservoir of biogenetic nutrients from which the latter are slowly transferred to cycling pool *e.g.*, phosphates in rocks.
- Cycling pool : Pool of biogenetic nutrients which is being emptied and filled repeatedly by exchange between biotic and abiotic components of biosphere.
- In mature ecosystems, the amount of nutrient uptake is equal to amount of recycled nutrient.
- In young and growing ecosystems, nutrients uptake is more so that a lot of nutrients are retained by the growing biomass of biota.
- Inverted pyramid of biomass is seen in desert.

Ordinary Thinking

Objective Questions

Biomes

1. According to Rebert Constanza, 50% of the total cost for ecosystem services goes to **[KCET 2015]**
(a) Nutrient (b) Recreation
(c) Soil formation (d) Climate regulation

2. Quercus species are the dominant component in **[CBSE PMT 2008]**
(a) Scrub forests
(b) Tropical rain forests
(c) Temperate deciduous forests
(d) Alpine forests

3. Match Column I (Indian forest types) with Column II (dominant tree genera) and choose the correct option

Column I		Column II	
A.	Tropical rain forest	1.	Hopea
B.	Tropical deciduous forest	2.	Shorea
C.	Temperate broad leaf forest	3.	Quercus
D.	Temperate coniferous forest	4.	Picea

[Kerala PMT 2008]
(a) A – 1, B – 2, C – 3, D – 4 (b) A – 2, B – 1, C – 4, D – 3
(c) A – 3, B – 2, C – 1, D – 4 (d) A – 1, B – 2, C – 4, D – 3
(e) A – 4, B – 3, C – 2, D – 1

4. Most of the tree dwellers are found in which type of forest **[Odisha JEE 2009; AIPMT (Cancelled) 2015]**
(a) Deciduous forest (b) Tropical rain forest
(c) Tundra (d) Grassland

5. −1°C to 13°C annual variations in the intensity and duration of temperature and 50 to 250 *cm*. annual variation in precipitation, account for the formation of a major biome as **[Kerala PMT 2011]**

Or

Extensive geographical belt of forest known as 'Taiga' belongs to
(a) Temperate forest (b) Coniferous forest
(c) Tropical forest (d) Grassland
(e) Desert

6. Which one of the following is commonly found in temperate coniferous forest **[Kerala PMT 2009]**
(a) *Quercus* (b) *Dipterocarpus*
(c) *Shorea roubusta* (d) *Pinus wallichiana*
(e) *Prosopis*

7. A natural region characterised by hot summer, warm winter and treeless vegetation
(a) Tropical desert (b) Steppes grassland
(c) Savannah grassland (d) Temperate desert

8. Biome is
(a) A part of the planet and its atmosphere
(b) Interacting communities of organism and its environments
(c) Biotic flora of a place
(d) Biotic fauna of a place

9. Sal and teak is the dominant species in which of the following forests **[DPMT 2006; MP PMT 2013]**
(a) Tropical dry deciduous forests
(b) Temperate deciduous forest
(c) Temperate rain forest
(d) None of the above

10. Grasslands of Asia are **[Kerala PMT 2001]**
(a) Savannah (b) Pampas
(c) Steppes (d) Veldt
(e) Prairies

11. Estuaries are considered as nutrient trap due to the mixing of **[DPMT 2007]**
(a) River and sea water (b) Pond and lake
(c) Lake and river (d) Ocean and pond

12. Plains with snow, ice and frozen soil for most of the year are found in **[Kerala PMT 2000]**
(a) Chapparal (b) Taiga
(c) Tundra (d) Savannah
(e) Desert

13. Choose the wrong pair **[Kerala PMT 2007]**
(a) Salvodora – Desert
(b) Cenchrus – Savanna
(c) Abies – Coniferous forest
(d) Quercus – Broad leaf forest
(e) Tectona – Temperate forest

14. Which one of the following pairs is mismatched **[CBSE PMT 2005]**
(a) Tundra - permafrost
(b) Savanna - acacia trees
(c) Prairie - epiphytes
(d) Coniferous forest - evergreen trees

15. Taiga refers to **[MP PMT 2013]**
(a) Temperate deciduous forest
(b) Subtropical semi-deciduous forest
(c) Evergreen forest
(d) North temperate coniferous forest

16. The actively moving organism in aquatic ecosystem is **[Odisha JEE 2011]**
(a) Phytoplankton (b) Zooplankton
(c) Nekton (d) Benthos

17. Maximum absorption of rainfall water is done by **[BHU 2005]**
(a) Tropical deciduous forest (b) Tropical evergreen forest
(c) Tropical savannah (d) Scrub forest

18. The sphere of living matter together with water, air and soil on the surface of earth is **[AIIMS 1998; MP PMT 2004; PET (Pharmacy) 2013]**

Or

The part of earth and atmosphere supporting life is **[CPMT 1994, 98; Pb. PMT 1999; BHU 2000; MP PMT 2001]**

(a) Lithosphere (b) Biosphere
(c) Hydrosphere (d) Atmosphere

19. What is the main cause for the extinction of some species in tropical forest **[BHU 2006]**
(a) Deforestation (b) Afforestation
(c) Pollution (d) Soil erosion

20. Which one has evergreen vegetation and drought adapted animals **[Haryana PMT 2000]**

Or

Dense evergreen vegetation of broad sclerophyllous leaves and shrubs with fire resistant resisnous plants is known as **[AIIMS 1997]**

(a) Chapparal (b) Savannah
(c) Tundra (d) Deciduous forest

21. Plants such as *Prosopis, Acacia and Capparis* represent examples of tropical **[CBSE PMT 1998]**
(a) Grassland (b) Thorny deserts
(c) Deciduous forests (d) Evergreen forests

22. Large Woody Vines are more commonly found in **[CBSE PMT (Pre.) 2011]**
(a) Alpine forests (b) Temperate forests
(c) Mangroves (d) Tropical rainforests

23. Tropical rain forests are found in **[MP PMT 1996, 2010; BHU 1998]**

Or

Where do tropical wet evergreen forests occur in India **[APMEE 1998]**

(a) Andamans (b) Bihar
(c) Himachal Pradesh (d) Jammu and Kashmir

24. Succulent xerophytes are likely to be found in
(a) Tropical rain forest (b) Deciduous forest
(c) Desert (d) Tundra

25. Savannah's are **[MP PMT 2002; Haryana PMT 1993; BHU 1996]**
(a) Tropical rain forest
(b) Desert
(c) Grassland with scattered trees
(d) Dense forest with close canopy

26. In India coniferous forests are found in
(a) Madhya Pradesh (b) Himalayan region
(c) Satpura hills (d) Rajasthan

27. In India, tropical evergreen forests occur in
(a) Himachal Pradesh (b) Madhya Pradesh
(c) Assam (d) Tamil Nadu

28. Rhododendron is the characteristic vegetation of **[BHU 2000]**
(a) Tropical zone (b) Alpine zone
(c) Gangetic plains (d) Mangrove belt

29. MAB stands for **[CBSE PMT 1997]**
(a) Man and biosphere
(b) Man antibiotics and bacteria
(c) Man and biotic community
(d) Mayer, Anderson and Bishby

30. The upper part of sea water mainly contains
(a) Nektons only
(b) Planktons only
(c) Nektons and planktons both
(d) None of the above

31. Alpine plants show
(a) Mesophytism (b) Halophytism
(c) Xerophytism (d) Luxuriant growth

32. Which of the following rain forest is home to more than 40,000 species of plants, 3,000 of fishes, 1,300 of birds, 427 of mammals, 427 of amphibians, 378 of reptiles and more that 1,25,000 invertebrates **[AIIMS 2009]**

Or

Which is referred to as 'Lungs of the Planet Earth' **[Kerala PMT 2001]**

(a) Amazonian (b) Tropical
(c) Arctic tundra (d) Temperate

33. The region consisting of long and severe winters and growing season consisting of few months of summers constitutes **[Pb. PMT 1998]**

(a) Savannah ecosystem (b) Tiaga ecosystem
(c) Tundra ecosystem (d) None of the above

34. A large regional unit characterized by a major vegetation type and associated fauna found in a specific climatic zone constitutes **[DPMT 2007; DUMET 2010]**

Or

Deserts, grasslands, forests and tundra are the examples of **[DUMET 2009]**

(a) Ecosystem (b) Biological community
(c) Biome (d) Habitat

35. Which one of the following is correct matching of a plant, its habit and the forest type where it normally occurs **[AIIMS 2005]**

(a) *Prosopis*, tree, scrub
(b) *Saccharum*, grass, forest
(c) *Shorea robusta*, herb, tropical rain forest
(d) *Acacia catechu*, tree, coniferous forest

36. Savannah is found commonly in **[Pb. PMT 2000]**

(a) U.S.A. (b) U.S.S.R.
(c) Australia (d) India

37. They are dominant plants of the cold desert **[GUJCET 2007]**

(a) Shrub and small trees
(b) Low stature shrub and perennial grass
(c) Tall trees and herbaceous plants
(d) Low stature shrub and herbaceous plants

38. Tropical dense forest is due to **[CPMT 2002; RPMT 2005]**

(a) High temperature and excess rain
(b) Low temperature and excess rain
(c) High temperature and lesser rain
(d) Wild animals (tigers, lions, bears etc.)

39. Which one is not dangerous for life and atmosphere **[MP PMT 1998]**

(a) Biopollutants (b) Ozone layer
(c) Nuclear blast (d) Deforestation

40. Treeless biome of cold climates is **[AFMC 1999; KCET 2000]**

(a) Savannah biome (b) Chapparal biome
(c) Temperate biome (d) Tundra biome

41. Terai forest is **[Pb. PMT 2000]**

(a) Tropical (b) Coniferous
(c) Deciduous (d) Temperate deciduous

42. The organisms dwelling at the bottom of a lake are called **[MP PMT 2000; AFMC 2001]**

(a) Phytoplanktons (b) Zooplanktons
(c) Nektons (d) Benthos

43. The salinity of the oceans is **[RPMT 1997]**

(a) Increasing
(b) Decreasing
(c) Constant
(d) Decreasing now but was increasing in past

44. Which of the following communities is more vulnerable to invasion by outsides animals and plants **[CBSE PMT 1998]**

(a) Mangroves
(b) Tropical evergreen forests
(c) Temperate forests
(d) Oceanic island communities

45. In desert grasslands, which type of animals are relatively more abundant **[CBSE PMT 1998]**

(a) Diurnal (b) Arboreal
(c) Aquatic (d) Fossorial

46. Moderate rainfall during summer produces **[AIIMS 1998]**

(a) Desert (b) Grasslands
(c) Scrub forests (d) Deciduous forests

47. The forest that colours in autumn is

(a) Temperate evergreen forest
(b) Temperate deciduous forest
(c) Tropical evergreen forest
(d) Tropical deciduous forest

48. Relative to roots, the shoots are massive in plants of

(a) Deserts (b) Moist temperate
(c) Tundra (d) Moist tropical forests

49. Which one has the maximum biomass **[Haryana PMT 1993; DPMT 1999; Odisha JEE 2004]**

Or

Which part of the world has a high diversity of organisms **[CBSE PMT 1999]**

Or

Which one of the following ecosystem types has the highest annual net primary productivity **[NCERT; DPMT 2003; BVP 2004; CBSE PMT 2007; DUMET 2010; MP PMT 2010, 12; BHU 2012]**

Or

Presence of plants arranged into well defined vertical layers depending on their height can be seen best in **[NEET 2017]**

(a) Temperate forest (b) Tropical rain forest
(c) Alpine vegetation (d) Taiga

50. Temperate evergreen forests are found in **[MP PMT 1994]**

(a) Himalayan ranges (b) Western ghats
(c) Aravalli ranges (d) Assam

51. Desert biome does not support much vegetation as it lacks **[Haryana PMT 1994; RPMT 2006]**

(a) Sufficient light (b) Favourable temperature
(c) Sufficient water (d) Sufficient nutrients

52. Stratifications is more common in **[Haryana PMT 1994; DPMT 2001, 04]**

(a) Tropical rain forest (b) Deciduous forest
(c) Temperate forest (d) Tropical savannah

53. Deciduous forests have **[AIIMS 1996; AFMC 2004]**

(a) Variety of grasses (b) Broad-leaved trees
(c) Narrow-leaved trees (d) Variety of crocodiles

54. In which of the following habitats does the diurnal temperature of soil surface vary most **[CBSE PMT 2004; Odisha JEE 2008]**

(a) Desert (b) Grassland
(c) Shrub land (d) Forest

55. In India tropical wet evergreen rain forests are not found in **[AIIMS 1998]**

(a) Tamil Nadu (b) Andaman
(c) West Bengal (d) Madhya Pradesh

56. Inverted pyramid of biomass can be traced in one of the following ecosystems **[Chd. CET 1998]**

(a) Rain forest (b) Desert
(c) Ocean (d) Tundra

Bio-Geochemical cycle

1. The limiting factor in nitrification of soil is **[AIIMS 2000]**

(a) *pH* (b) Temperature
(c) Light (d) Air

2. Which one of the following is not a gaseous biogeochemical cycle in ecosystem **[CBSE PMT (Pre.) 2012]**

Or

In which of the following cycles does the reservoir of the nutrient exist in material from **[VITEEE 2008]**

(a) Sulphur cycle (b) Phosphorus cycle
(c) Nitrogen cycle (d) Carbon cycle

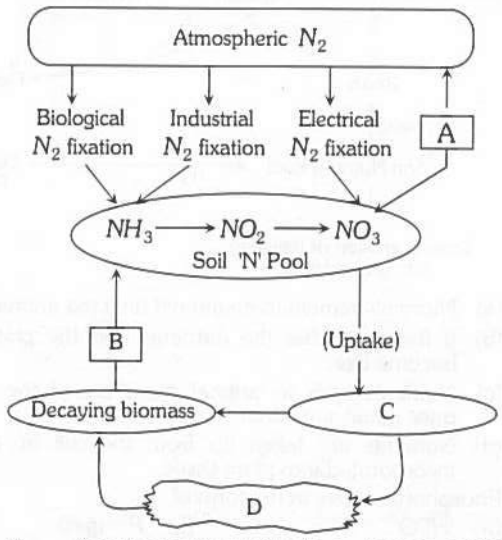
3. In nitrogen cycle, which of the following plays an important role

(a) *Rhizopus* (b) *Nitrobacter*
(c) *Mucor* (d) All green algae

4. Biochemical cycle with gaseous phase is **[DPMT 2001]**

(a) Carbon (b) Sodium
(c) Phosphorus (d) Magnesium

5. Study the cycle shown below and select the option which gives correct words for all the four blanks A, B, C and D.



Options: [NCERT; CBSE PMT (Mains) 2010; AIIMS 2011]

	A	B	C	D
(a)	Nitrification	Ammonification	Animals	Plants
(b)	Denitrification	Ammonification	Plants	Animals
(c)	Nitrification	Denitrification	Animals	Plants
(d)	Denitrification	Nitrification	Plants	Animals

6. In which of the following both pairs have correct combination **[AIPMT 2015]**

(a)	Gaseous nutrient cycle	Carbon and sulphur
	Sedimentary nutrient cycle	Nitrogen and phosphorus
(b)	Gaseous nutrient cycle	Nitrogen and sulphur
	Sedimentary nutrient cycle	Carbon and phosphorus
(c)	Gaseous nutrient cycle	Sulphur and phosphorus
	Sedimentary nutrient cycle	Carbon and nitrogen
(d)	Gaseous nutrient cycle	Carbon and nitrogen
	Sedimentary nutrient cycle	Sulphur and phosphorus

7. About 70% of total global carbon is found in **[CBSE PMT 2008; BHU 2012]**

(a) Oceans (b) Forests
(c) Grasslands (d) Agroecosystems

8. Maximum contribution of O_2 is from

(a) Phytoplankton (b) Grasslands
(c) Herbs and shrubs (d) Dense forest

9. Crystalline rocks are natural source of biogenetic element **[Kerala PMT 2000; NEET 2013]**

(a) Calcium (b) Phosphorus
(c) Magnesium (d) Sodium
(e) Sulphur

10. Amount of nitrogen fixed electrochemically and photochemically is **[Kerala PMT 2000]**

(a) 140 $mg/m^2/yr$ (b) 78 $mg/m^2/yr$
(c) 35 $mg/m^2/yr$ (d) 15 $mg/m^2/yr$
(e) 350 $mg/m^2/yr$

11. Study of Biogeochemical cycles is called Biogeochemistry. Its father is Vernadsky (=Winodgsky). It involves **[CBSE PMT 1999]**

(a) Cycling of energy (b) Cycling of gases
(c) Cycling of nutrients (d) Cycling of water

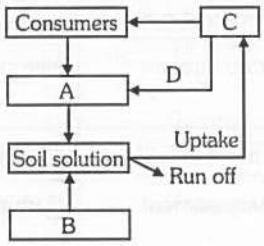
12. In the phosphorus cycle, phosphate becomes available by weathering of rocks first to **[Pb. PMT 2004]**

(a) Consumers (b) Producers
(c) Decomposers (d) None of these

13. Biogeochemical cycles are of

(a) Two types (b) Three types
(c) Four types (d) Five types

14. Given below is a simplified model of phosphorus cycling in a terrestrial ecosystem with four blanks (A-D). Identify the blanks



Options: **[CBSE PMT 2014]**

	A	B	C	D
(a)	Detritus	Rock minerals	Producer	Litter fall
(b)	Producers	Litter fall	Rock minerals	Detritus
(c)	Rock minerals	Detritus	Litter fall	Producers
(d)	Litter fall	Producers	Rock minerals	Detritus

15. Cycling of elements in an ecosystem is called **[MP PMT 1999; CBSE PMT 1999; BHU 2000]**

Or

Which of the following cycle would be affected if decomposers of an ecosystem vanish **[RPMT 1992]**

(a) Chemical cycle (b) Geochemical cycle
(c) Biogeochemical cycle (d) Geological cycle

16. The reservoir pool for gaseous cycles of matter is

(a) Atmosphere (b) Hydrosphere
(c) Both (a) and (b) (d) Lithosphere

17. One way cycle is **[Pb. PMT 1999]**

(a) CO_2 cycle (b) H_2O cycle
(c) Free energy cycle (d) O_2 cycle

18. For recycling of materials which one is most necessary

(a) Producers (b) Consumers
(c) Decomposers (d) None of above

19. Burning of fossil fuels affects

(a) Nitrogen cycle (b) Carbon cycle
(c) Phosphorus cycle (d) Water cycle

20. Which of the following is present in maximum amount in atmosphere **[DPMT 2002]**

(a) Oxygen (b) Nitrogen
(c) Carbon dioxide (d) Hydrogen

21. CO_2 content of atmosphere has increased in the last 150 years from **[AIIMS 1997; AMU (Med.) 2010]**

(a) 25 to 35 ppm (b) 270 to 340 ppm
(c) 0.027 to 0.34 ppm (d) 0.2 to 0.3 ppm

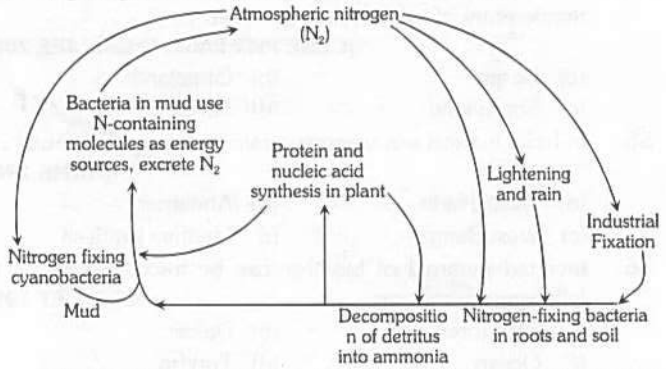
22. The phosphorus rich fertilizer obtained from sea birds along the coast of Chile and Peru, is **[Rohtak 1996]**

(a) Guano (b) Bone meal
(c) Dung (d) Urea

23. Nitrogen is a critical element of the ecosystem because it is **[BHU 1996]**

(a) Essential element (b) Abundant in atmosphere
(c) Labile (d) Fixed by microbes

24. Figure given below refers to the nitrogen cycle



Which of the following is NOT part of the natural nitrogen cycle **[NCERT]**

(a) Fossil fuels (b) Biological fixation
(c) Lightening (d) Decomposition

25. In water receiving regions, what does forest regulate

(a) Hydrological cycle (b) Carbon cycle
(c) Nitrogen cycle (d) Calcium cycle

26. Phosphorus is mostly found in rocks in combination with

(a) Calcium (b) Iron
(c) Aluminium (d) All of these

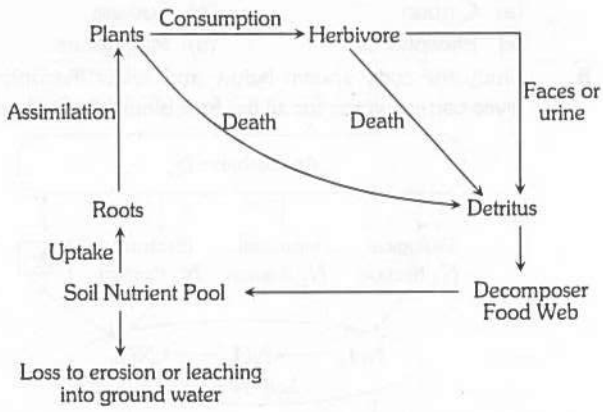
27. Phosphorus cycle is

(a) Gaseous cycle
(b) Perfect cycle
(c) Imperfect cycle
(d) Partly gaseous and partly sedimentary

28. Phosphorus of ocean becomes available to land plants due to

(a) Sea birds (b) Deep sea activities
(c) Ocean spray (d) All of these

29. Which of the following is NOT true for the biogeochemical cycle according to the following cycle **[NCERT]**



(a) Nutrients remain in an animal until the animal's death
(b) If the plant dies the nutrients and the plant biomass become litter
(c) Nutrients pass to animal members of the ecosystem once plants are eaten
(d) Nutrients are taken up from the soil by plants and incorporated into plant tissue

30. Phosphorus cycles in the form of

(a) HPO^{3-} (b) P^2 (gas)
(c) PO_4^{3-} (d) $Al_2(PO_4)_3$

31. Inorganic element that changes food into usable energy is

(a) S (b) P
(c) Ca (d) Mg

32. Degradation of proteins play a part in

(a) Calvin cycle (b) Water cycle
(c) Sulphur cycle (d) Nitrogen cycle

CT Critical Thinking

Objective Questions

1. The slow rate of decomposition of fallen logs in nature is due to their **[CBSE PMT 2008]**
   (a) Anaerobic environment around them
   (b) Low cellulose content
   (c) Low moisture content
   (d) Poor nitrogen content

2. In India, temperate evergreen vegetation occurs mostly in
   (a) Rajasthan and South Punjab
   (b) Eastern and Western Himalayas less than 3500 m
   (c) Western Himalayas above 3500 m
   (d) Western Ghats and Assam

3. The most striking difference between tropical rain forest and temperate forest is that
   (a) The tropical rain forests have preponderance of angiosperms while the temperate one have preponderance of gymnosperms
   (b) The trees of temperate forests are taller than those of tropical rain forests
   (c) Plants of temperate forests are comparatively more mesophytic
   (d) Tropical forests are comparatively more homogeneous

4. Alpine forests of Himalayas have
   (a) Tall evergreen coniferous trees
   (b) Tall broad-leaved evergreen trees
   (c) Tall broad-leaved deciduous trees
   (d) Dwarf shrubby plants

5. Alpine forests occur at altitude
   (a) 3900–6000 m
   (b) 1900–3000 m
   (c) 1000–1500 m
   (d) 500–1000 m

6. The reservoir for the gaseous type of bio-geo chemical cycle exists in **[NCERT]**
   (a) Stratosphere (b) Atmosphere
   (c) Ionosphere (d) Lithosphere

7. A treeless biome is **[AFMC 1999; MP PMT 2000]**
   (a) Tundra (b) Grassland
   (c) Desert (d) All the above

8. More than half of the earth's flora and fauna is found in **[HP PMT 2001]**
   (a) Tropical rain forests
   (b) Montane temperate forests
   (c) Deciduous forests
   (d) Alpine forests

9. Among the following bio-geo-chemical cycles which one does not have losses due to respiration **[NCERT]**
   (a) Phosphorus (b) Nitrogen
   (c) Sulphur (d) All of the above

AR Assertion & Reason

Read the assertion and reason carefully to mark the correct option out of the options given below :

(a) If both the assertion and the reason are true and the reason is a correct explanation of the assertion
(b) If both the assertion and reason are true but the reason is not a correct explanation of the assertion
(c) If the assertion is true but the reason is false
(d) If both the assertion and reason are false
(e) If the assertion is false but reason is true

1. Assertion : Biomes are the major ecosystem of the world.
   Reason : Tundra is an example of biome.
2. Assertion : Taiga is also called North coniferous forest.
   Reason : The ground flora is absent in Taiga.
3. Assertion : Temperate deciduous forest is two – storeyed forest.
   Reason : Two stories are formed of soft – wood and hard – wood trees.
4. Assertion : When the rain forest is removed, grasslands appear.
   Reason : In rain forest, nutrient cycling is slow.
5. Assertion : Chapparal is also called "shrub forest".
   Reason : Trees are totally absent in chapparal.
6. Assertion : Savannahs show rich species diversity.
   Reason : The biome is prone to fires.
7. Assertion : Excess of sulphur reaches to reservoir pool.
   Reason : *Thiobacillus* and *Desulpho vibrio* convert elemental sulphur into the sulphate.
8. Assertion : The whole of biogenetic nutrients show circulation.
   Reason : Biogeochemicals cycles operate in the biosphere.
9. Assertion : Tropical rain forests are disappearing fast from developing countries such as India.
   Reason : No value is attached to these forests because these are poor in biodiversity.

[AIIMS 2003, 07]

Answers

Biomes

1	c	2	c	3	a	4	b	5	b
6	d	7	a	8	b	9	a	10	c
11	a	12	c	13	e	14	c	15	d
16	c	17	b	18	b	19	a	20	a
21	b	22	d	23	a	24	c	25	c
26	b	27	c	28	b	29	a	30	b

31	c	32	a	33	c	34	c	35	a
36	c	37	d	38	a	39	b	40	d
41	a	42	d	43	d	44	b	45	d
46	d	47	b	48	d	49	b	50	a
51	c	52	a	53	b	54	a	55	d
56	b								

Bio-Geochemical cycle

1	a	2	b	3	b	4	a	5	b
6	d	7	a	8	a	9	b	10	c
11	c	12	b	13	a	14	a	15	c
16	c	17	c	18	c	19	b	20	b
21	b	22	a	23	c	24	a	25	a
26	d	27	c	28	a	29	a	30	c
31	b	32	d						

Critical Thinking Questions

1	c	2	b	3	a	4	d	5	a
6	b	7	d	8	a	9	d		

Assertion and Reason

1	b	2	c	3	d	4	d	5	c
6	e	7	c	8	e	9	c		

AS Answers and Solutions

Biomes

8. (b) Because for the environmental balance, communities of organisms and plants depend upon each other.

9. (a) The tropical dry deciduous forest biomes develop in the region where moisture relation are intermediate between desert and savanna. These are found in South-east Asia, Central and South America, India and Northern Australia. Teak and sal are major large tree.

11. (a) Estuary is the tidal mouth of river or coastal bay where there is mixing of fresh and sea water. It is also one of the most productive ecosystem due to rapid circulation of nutrients and quick removal of waste product.

12. (c) Tundra receives very little precipitation, around 25 *cm/year*, mostly in the form of snow. The area is covered by snow for most part of the year. The highest summer temperature is 10°C. It is unable to melt snow except for the upper 10-20 *cm*. The remaining part of the soil is in permanently frozen (permafrost) condition.

14. (c) Prairies contain tall grasses and shrubs.

15. (d) The taiga or northern temperate coniferous forest or boreal forests consist of evergreen, cone bearing trees.

17. (b) The biome occurs in equatorial or sub equatorial regions where both rainfall and warmth are abundant. Rainfall is above 140 *cm/yr* usually between 200-500 *cm/yr*. It may be upto 1000 *cm*. Rain occurs through major parts of the year.

18. (b) Because abiotic (non-living) and biotic (living) components together constitute the biosphere and abiotic component is composed of the air (atmosphere), earth (lithosphere) and water (hydrosphere).

19. (a) Deforestation is the depletion of forest resources. It's main cause is the explosion of human and livestock population with the increased demand requirements of the basic needs. The major effect of deforestation is the loss of precious wild life, rare species of flora and fauna. Directly or indirectly, deforestation caused intensified soil erosion, accentuated floods, drought and the worst pollution.

20. (a) It is a broad leaved evergreen shrub forest of hard and thick-leaved small trees and shrubs which usually contain resin but are resistant to fires. Both plants and animals are adapted to frequent and long periods of drought.

21. (b) Flora of thorn forests include *Prosopis cineraria, Acacia senagal, Capparis decidua, Salvadora oleoides, Asparagus racemosus, Ephedra foliata.*

22. (d) Lianas and epiphytes are more common in tropical rain forest.

23. (a) Tropical rain forests are mainly found in central America along Amazon and Orinoco rivers. South East Asia including India. In India, tropical rain forests occur in Western Ghats, Assam and Andamans.

24. (c) Succulent plants are characteristics of deserts. Succulents plants store water. They have mucilage to retain water. Stomata are sunken and usually open during night only *e.g., Opuntia, Euphorbia.*

25. (c) Woody plants (trees and shrubs) also occur in grasslands as scattered individuals or in belts. These are called a 'Savannah'.

26. (b) Himalayan coniferous forests are altitudinal forests which occur in the Himalayas at the altitude of 1700-3000*m*.

29. (a) Man and Biosphere programme was formally launched by UNESCO in 1971. It is an inter disciplinary programme of research and training with emphasis on ecological approach to the study of interrelationship between man and his environment.

30. (b) Plankton's are passively drifting or floating organisms. Most of these minute organisms, plankton includes photosynthesizing organisms as well as heterotrophic organisms.

33. (c) Tundra biome is characterised by desert like levels of precipitation (less than 25 *cm* annually), extremely long and cold winters and short warmer summers.

36. (c) Savannah occurs in North Australia, India, Central and Southern Africa including east central S. Africa.

37. (d) Cold deserts are areas which record very sparse rainfall and deep rooted plants. The winters are extremely long and cold. *Eg.*, Gobi and Tibet desert. The vegetation includes herbacious plants, small shrubs, lichens and mosses.

38. (a) In the tropical rain forests of south America, Africa and the Indo-Malayan region near the equator, there is plenty rainfall (minimum 190 *cm/yr*) and weather is always warm (20-25°*C*).

39. (b) Ozone layer is the ultraviolet rays protector of earth.

40. (d) Because desert lands are included in this biome.

42. (d) Benthonic organisms are found along the floor of the sea bed, bottom of a lake and include creeping, crawling or sessile organisms. The benthonic region has scavengers and decomposers.

45. (d) Fossorial animals are abundant in desert grassland which are adapted to live underground inside burrows (in low temperature).

49 (b) Tropical rain forest are found on those are as where favourable conditions like optimum light intensity, Rainfall etc. Productivity of the tropical rain forest is very high 12000 $Kcal/m^2/yr$. as compared to 3000 $Kcal/m^2/yr$. for temperate deciduous, 2000 *Kcal* for taiga and only 200 $Kcal/m^2/yr$ for tundra. Tropical rain forest shows maximum biodiversity on land and it is estimated that one half to two-thirds of all species of terrestrial plants and insects live in tropical forests.

52. (a) Vegetation of tropical rain forests show stratification. Stratification is the grouping of plants in a forest into two or more well defined layers depending upon their height like tall tress, medium sized trees, small trees, bushes, herbs, etc.

53. (b) Its dominant climax vegetation consists of broad-leaved hardwood (dicot) tree like Oak, Elm, Maple, Birch, etc.

Bio-Geochemical Cycle

2. (b) Phosphorus cycle – Purely sedimentary cycle.

3. (b) *Nitrobacter* is a N_2 fixing organism, it fixes atmospheric free N_2 into soluble salts like nitrites and nitrates. The fixed N_2 is absorbed by plants when herbivores feed on these plants, the N_2 flows on the carnivores through food chain hence it is important for the N_2 cycle.

5. (b) A- Denitrification, B-Ammonification, C-Plants, D-Animals

8. (a) Major source of O_2 liberation is photosynthesis and about 90% of total photosynthesis is done by phytoplankton.

9. (b) The main source of phosphorus is rocks. Through erosion and weathering phosphorus is made available in the soil.

12. (b) In the phosphorus cycle, weathering makes phosphate available to the soil from where plants or producers get them first.

13. (a) The biogeochemical cycles are classified into 2 types namely gaseous cycles and sedimentary cycles.

14. (a) A – Detritus
B – Rock minerals
C – Producer
D – Litter fall.

15. (c) Recycling of material is carried out by decomposers. If decomposers of an ecosystem vanish recycling of materials are stopped.

16. (c) In gaseous cycles of matter the materials involved in circulation between biotic and abiotic components of biosphere are gases or vapours and the reservoir pool is atmosphere or hydrosphere. *e.g.*, C, H, O_2, N_2 and H_2O.

18. (c) The decomposers are heterotroph organisms that break up the dead bodies of plants and their waste products into smaller bits or molecules. The reducers release molecules to the environment as chemical to be used again by the producers.

19. (b) Because burning of fossil fuel release a lot of CO_2.

20. (b) 78.03% of the atmosphere consists of nitrogen. Some is being added to it through volcanic eruptions, erosion of sedimentary rocks and denitrification.

21. (b) CO_2 conc. was about 270 ppm in 1750 and 368 ppm in 2000. The rise has been due to large scale deforestation (for grazing land, cropland or urban estates), change in land use and large scale combustion of fossil fuels.

22. (a) The excess of phosphate in the bodies of animals is excreted out through faces. The bird guano (excreta) contains a large amount of phosphate.

27. (c) Because atmosphere or gaseous cycle is absent.

30. (c) Phosphorus is obtained from soil as orthophosphate (PO_4^{3-}). Organic phosphorus circulates in nature from plants to animals. Phosphate is released by decomposers (Phosphatising bacteria) back to soil.

31. (b) Usable energy is ATP in which phorphorus is present.

32. (d) Plants and animals contain nitrogen in their body protein. After death, the proteins of dead bodies are decomposed into amino acids and ammonia. This ammonia may be converted into nitrates or free nitrogen.

Critical Thinking Questions

2. (b) They are altitudinal forests which occur in the Himalayas at the altitude of 1700-3000*m*. They are evergreen because the needle shaped leaves of the coniferous plants persist for 2-7 *yrs*.

5. (a) Alpine is a treeless area on high mountains (above 3500 *m*) which has snow for long months.

8. (a) Diversity of life is so high that a hectare of the forest may have as many as 200 species of trees, 70-80% of all insects and 80-85% of all birds are known from tropical forests.

Assertion and Reason

1. (b) A biome is defined as a large natural ecosystem which is distinct in its climate conditions and has its specific type of plant and animal life. Biomes are two types – terrestrial and aquatic. The major terrestrial biomes are – tundra, taiga, deciduous forest, tropical rain forest, chapparal, tropical savannah, grassland and desert.

2. (c) Taiga biome occurs just South of tundra across North America, Europe and Asia It is also found in the Southern hemisphere (*e.g.*, – parts of New Zealand). Dominant vegetation consists of evergreen conifers which are able to tolerate wide fluctuation of temperature, light and soil. They are pine, fir, hemlock, spruce, jumper, yew, larch, deodar. The ground flora consists of herbs, ferns, mosses and lichens.

3. (d) Temperate deciduous forest are four – storeyed. The top stratum is occupied by trees reaching a height of 30–40 m. There is an understorey of small trees, an intermediate stratum of shrubs and a ground stratum made of herbs, grasses, ferns, mosses and lichens. Vines are found here and there. A few soft – wood trees (conifers) may occur at places interspersed with hard – wood trees.

4. (d) When the rain forest is removed, a secondary forest often develops that includes soft – wood trees such as *Musanga* (Africa), *Cecropia* (America) and *Macoranga* (Malaysia). Efficient direct nutrient cycling by mutualistic micro – organisms is a remarkable property of rain forests that enable them to be as luxuriant on poor soils as on more fertile sites.

5. (c) Chapparal is a broad – leaved evergreen shrub forest of hard and thick leaved small trees and shrubs which usually contain resin but are resistant to fires. The common plants of chapparal are *Arctostaphylos, Adenostema, Oak* and *Eucalyptus*.

6. (e) Tropical savannahs are grasslands with scattered trees or clumps of trees. The areas of tropical savannah have one or two prolonged dry seasons when fires are an important part of the environment. Since both trees and grass must be resistant to drought and fire, the number of species in the vegetation is not large.

7. (c) Some bacteria and fungi can change H_2S and elemental sulphur to sulphate state (*e.g., Beggiotoa, Thiobacillus, Penicillium, Neurospora*). Reverse can also occur (*e.g., Aerobacter, Desulpho vibrio*) Leaching *Delsulpho vibrio* bacteria are ecologically important, because they give SO_4 in deep segments and in anoxic waters, such as the Black Sea to H_2S gas and precipitation of sulphur take out some sulphur from circulating pool and convert into part of reservoir pool.

8. (e) Circulation of biogenetic materials between the living and the non-living worlds is called cycles of matter of biogeochemical cycling. The important biogeochemical cycles that operates in biosphere are carbon cycle, sulphur cycle, O_2 cycle, N_2 cycle, etc. The whole of biogenetic nutrients are not always in circulation. For example, rocks from which nutrients are very slowly transferred to the cycling pool.

9. (c) Tropical rain forests are located in the equatorial regions wherever the annual rainfall exceeds 140 *cm*. They are also called jungles and cover one twelveth of earth's surface but contain more than half of the earths flora and fauna (*i.e.*, rich in biodiversity). Now-a-days these forests are becoming disappearing due to excessive use in domestic purposes like fuel, furniture, accommodations, cloths, resin, gum, etc.

Biome and Biogeochemical cycles

SET Self Evaluation Test

1. What determines the limits of a biome
   (a) Temperature and rainfall
   (b) Type of soil and presence of barrier
   (c) Altitude and latitude
   (d) All the above

2. Concentration of nitrogen remains constant by **[AFMC 2001]**
   (a) Nitrogen cycle (b) Thundering and light
   (c) Enzymes (d) Both (a) and (b)

3. Annual rainfall in the area of a tropical deciduous forest is
   (a) Over 300 *cm* (b) 200-250 *cm*
   (c) 100-150 *cm* (d) 50-75 *cm*

4. *Acacia*, *Euphorbia* and *Cenchrus* grass are characteristics of **[CBSE PMT 1998]**
   (a) Grassland biome (b) Desert biome
   (c) Chapparal biome (d) Temperate biome

5. Which one of the following pairs is a sedimentary type of biogeochemical cycle **[CBSE PMT 1995; BHU 2000; Kerala PMT 2001, 10; MP PMT 2013]**
   (a) Phosphorus and carbon dioxide
   (b) Oxygen and nitrogen
   (c) Phosphorus and nitrogen
   (d) Phosphorus and sulphur

6. In sedimentary cycles, the reserve pool is
   (a) Air
   (b) Water
   (c) Lithosphere
   (d) Lithosphere and atmosphere

7. A long term global cycle which is linked by water and in which sea floor rising play an important role is
   (a) Water cycle (b) Carbon cycle
   (c) Phosphorus cycle (d) Carbon and nitrogen cycle

8. If there was no CO_2 in the earth's atmosphere, the temperature of earth's surface would be **[CBSE PMT 1998]**
   (a) As such
   (b) Less than the present level
   (c) Increase from present level
   (d) Dependent upon oxygen amount of the environment

* * *

AS Answers and Solutions

1	c	2	d	3	c	4	b	5	d
6	c	7	c	8	b				

1. (c) Because according to altitude and latitude, geological conditions are changed.

3. (c) Climatic conditions of tropical deciduous forest are annual temperature 22-32°*C*, annual rainfall 90-160 *cm* and dry months are 6-8.

5. (d) In sedimentary cycles of matter, materials involved in circulation between biotic and abiotic components of biosphere are non gaseous and the reservoir pool is lithosphere *e.g.*, phosphorus, calcium, magnesium. Sulphur has both sedimentary and gaseous phases.

6. (c) Lithosphere is the solid components of the earth crust, rocks, soil and minerals.

8. (b) CO_2 layer around earth surface acts as insulator and does not allow heat of the earth to escape into space thus keeping the earth warm.