**BIOLOGY SS 2**

**FIRST TERM**

**SCHEME OF WORK**

**WEEKS TOPIC**

1. Aquatic Habitat
2. Terrestrial Habitat
3. Food Production and Storage
4. Nutrient Cycling in Nature
5. Nutrient Cycling in Nature (Cont’d)
6. Pollution
7. Conservation of Natural Resources
8. Ecological Management and Tolerance
9. Adaptation
10. Adaptation (Cont’d)

**REFERENCES**

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**WEEK ONE**

**AQUATIC HABITAT**

**CONTENT**

* Habitat (Aquatic habitat)
* Marine Habitat
* Horizontal and Vertical Zonation of Marine Habitats
* Distribution of Organisms and Adaptations to Marine Habitat
* Estuarine Habitat
* Freshwater Habitat

**HABITAT (AQUATIC HABITAT)**

Habitat is a place where organisms (plants, microorganisms and animals) are naturally found e. g. the habitat of tadpole is the bottom of fresh water ponds or streams

There are three main types of habitats, namely; aquatic habitat (in or around water), terrestrial habitat (in or on land) and arboreal habitat (in or on trees)

There are three kinds of aquatic habitat;

1. marine/salt water habitat e.g. ocean, seas
2. brackish water habitat (where salt and fresh water mix) e.g. delta, lagoon, bay
3. Fresh water habitat (contain little or no salt) e.g. lakes, rivers, streams.

**MARINE HABITATS**

Characteristics of marine habitats are as follow:

1. The marine habitats constitute the largest habitat in the biosphere (70% of the earth’s area)
2. They do not undergo sudden or rapid changes in physical factors such as temperature, PH and specific gravity. Hence they show the greatest stability of all habitats.
3. Chemical composition :- marine water consists of many kinds of dissolved ions including Na+, K+, Mg2+, Ca2+, Pb43-, I-, NO3- e. t. c.
4. Hydrogen (H+) concentration (PH): - salt water is alkaline in nature with PH of about 8.0 – 9.0 near the surface.
5. Salinity (salt concentration of water). The seawater has a high salinity. The average salinity of seawater is 35 parts per thousand.
6. Density of marine water is high. It is about 1.028 while that of fresh water is 1.0. This allows many organisms to float in it.
7. The temperature of the sea changes less quickly than that of the land. However, the temperature falls with increase in the depth of the sea.
8. Oxygen concentration is highest at the surface where the atmospheric oxygen dissolved in water. The concentration of oxygen decreases with depth.
9. Waves are temporary movement of surface water of the sea which occurs in any direction. They are caused by wind blowing against the surface of water. They also bring about the mixing of seawater. Waves can also beat against the shore and sometime caused it to be eroded.
10. Tides are alternate rise and fall of the surface of the sea at least twice daily. Tides are caused by water distribution resulting from the combined gravitational pull of the earth by the sun and moon.

**EVALUATION**

1. What is a habitat?
2. With two examples each, state the three kinds of aquatic habitats.

**ZONATION OF MARINE HABITAT**

**HORIZONTAL ZONATION**

The marine habitat is made up of the sea shore and open sea. The major zones of the marine habitat are generally as follow

1. Supratidal or splash zone is the exposed zone with occasional moisture being the area where water splashes when waves breaks at the shore.
2. Intertidal or neritic zone is the planktonic zone which is exposed at low tide or covered by water at high tide. This zone has high photosynthetic activities because of abundant sun shine. Water temperature fluctuates.
3. Subtidal or littoral zone is about 200m deep, constantly under water, with abundant sunlight and nutrient.
4. Benthic zone is about 500m deep with low light penetration and low nutrients. The water is dark, cold and with little oxygen. Hence, it is unfavourable for life.
5. Abyssal or palegic zone is about 7000m deep with low light penetration, low temperature and high pressure. The low light leads to low photosynthetic activities. Hence food production is primarily by chemosynthesis.
6. Hadal or aphotic zone is the deepest, over 7000m deep. This forms the floor or the bed of the ocean. No light penetration or photosynthesis

**VERTICAL ZONATION**

Based on light penetration or depth, the marine habitat can be zoned into three ;

1. Euphotic zone is the area in direct contact with sun shine. Hence, there is enough light penetration for photosynthesis. Therefore producers, consumers and decomposer are all present.
2. Disphotic zone is a region of dim light. Light penetrate the water with low too intensity for photosynthesis to take place. Consumers and decomposers are found in this zone.
3. Aphotic zone is the bottom or bed of the seas and oceans. It is characterized by cold dark water without light penetration and very few living organisms.

**EVALUATION**

1. State the major zones of marine habitat
2. Differentiate between splash and hadal zones

**DISTRIBUTION OF ORGANISMS AND ADAPTATION TO MARINE HABITAT**

* Organisms of the splash zone include periwinkles; crustaceans e.g. ghost crab, seaweeds and sargassum (algae).
* Those of intertidal zone include starfish, sea anemones, sponges, sea urchin, annelids, mollusca and barnacles.
* In the subtidal zone are snails, crabs, lobsters and crayfish.
* The benthic zone is unfavourable for life. The producers are absent, only few saprophytic animals are present.
* The neritic zone house plankton (microscopic floating organisms e.g. diatom, algae, protozoa, crustacean and worms) and nekton (e.g. fishes, crabs, prawns and whales).
* Oceanic water house sharks, croaker, sea cat fish, mackerel, bonga fish e.t.c.

**ADAPTATION OF ANIMALS TO MARINE HABITAT**

Animals including barnacles, fishes, crustaceans e.t.c. found surviving in marine habitat do so with the following adaptive features;

* Barnacles have i. protection mantle for attachment to rock shore and water retention ii. Cilia for feeding. Iii. Shell that prevents dessication (drying up)
* Fishes possess i. reduced or no kidney to retain urea in their body to cope with high salinity e.g. cartilaginous fishes like shark, dogfish etc. ii. Salt secreting glands in their gills or eyes for maintaining osmoregulation (salt balance) e.g. bony fishes like tilapia, herring etc. iii. Tube feet which enable them to hold on to rock shores and hard shell to prevent desiccation e.g. starfish, whales.
* Whale has i. fins for stability in water ii. An organ in front of the nostril for detecting pressure changes in water. Iii. A thick layer of dermal fat insulation or food reservoir.
* Shrimps possess powerful claws for holding food or prey.
* Periwinkles possess lungs for breathing and foot for attachment.
* Crabs burrow fast into the mud to protect them against predators, strong waves or hide.

**ADAPTATION OF PLANTS TO MARINE HABITAT**

Plants such as seaweeds, algae, sesuvium and diatoms are naturally found in marine habitat with the following adaptive features;

* Seaweeds have i. hold–fast for attachment. ii. mucillagenous cover to prevent desiccation. iii. Divided leaves or floating devices for buoyancy.
* Algae (e.g sargassum) have i. chlorophyll for photosynthesis. ii. Small size or large surface area for floating in water.
* Planktons (e.g. diatoms) possess; i. air space in their tissues ii. Rhizoid for attachment to rocks iii. Air bladder for buoyancy (floating).

Examples of food chain in a marine habitat include

1. Diatom → crabs → tilapia
2. Diatom →zooplankton → tilapia →shark

**EVALUATION**

1. Mention two organisms in the following zones: i. Splash, ii. Neritic, iii. Littoral, iv. Benthic
2. Using 3 plants and 2 animals, explain adaptation in marine habitats.

**ESTUARINE HABITATS (BRACKISH WATER HABITATS)**

An estuary is a body of water formed at the coast where fresh water flowing towards the sea mixes with sea (salt water) flowing inland. Estuarine habitats include deltas, lagoons and bays.

**CHARACTERISTICS OF ESTUARINES**

1. The salinity fluctuates.
2. The specific gravity is less than that of the sea.
3. They have high turbidity due to frequent disturbances. Hence rate of photosynthesis and respiration by organisms reduces.
4. The water is shallow.
5. They have low diversity of species compared to marine habitat.
6. They have high level of nutrients
7. They have low oxygen content, hence anaerobic activities are common.

**PLANTS DISTRIBUTION AND ADAPTATION IN ESTUARINES**

Plants found in estuaries include planktons, algae, red and white mangrove and they have the following adaptive features;

* Planktons (diatoms) have; i. air spaces in their tissues ii. Rhizoid for the attachment to rock shores iii. Air bladder for buoyancy
* Algae have: i. chlorophyll for photosynthesis ii. small size or large surface area for floating in water
* Red mangrove has; i. stilt roots with rootlets that have air-spaces for air conduction to the root tissues and support to prevent washing away of the plant by the tide ii. Seeds which germinate while they are still on the parent plant, thus preventing the carrying away of the seedlings by water current.
* White mangrove has pneumatophores (breathing roots) for gaseous exchange.

**ANIMALS DISTRIBUTION AND ADAPTATION**

Animals including mosquitoes, crustaceans, mollusca, worms, fishes e.t.c. found in estuaries survive possessing the following features;

* Mosquito larvae and pupae possess breathing trumpets for gaseous exchange
* Crustaceans and water snails burrow into the mud against predators, strong waves or tides.
* Worms have strong protective and impermeable covering against high salinity.
* Mudskippers have fins for crawling on land and swimming in water.
* Fishes have fins for movement and swimming bladder for buoyancy.

**FOOD CHAIN IN ESTUARINE HABITATS**

1. Detritus → worms → snails → birds
2. Diatoms → shrimps →fishes
3. Diatoms → small fish → sharks → man

**EVALUATION**

1. What is estuarine?
2. List five characteristics of estuarines

**FRESH WATER HABITATS**

This is a body of water formed mainly from inland waters and it contain very low or no salt. Fresh water is of two types based on its mobility;

1. Lotic fresh waters: - These are running waters flowing continuously in a specific direction e.g. rivers, springs, streams
2. Lentic fresh waters: - These are stagnant waters which do not flow e.g. lakes, ponds, puddles, swamps and dams

**CHARACTERISTICS OF FRESH WATER HABITATS**

1. It contains little or no salt. Salinity is 5 parts per thousand i.e. 0.5%.
2. It is small in size.
3. Oxygen concentration is high, being available in all parts of the water body, especially at the surface.
4. The water is shallow, hence sunlight penetrate to the bottom.
5. The temperature varies with seasons and depth.
6. It has seasonal variation; decreasing or drying up in dry season and increasing in rainy season
7. Water currents affect distribution of organisms, salts and gases, especially in lotic fresh waters

**PLANTS DISTRIBUTION AND ADAPTATION IN FRESH WATER**

Plants of fresh water include water lily, spirogyra, water lettuce, water weeds e.t.c. and they have the following adaptive features;

* Water lily has i. air bladder ii. Expanded tips and light weight which keep it afloat.
* Spirogyra has mucillagenous cover for protection
* Water lettuce has hairs in leaves to trap air and keep it afloat
* Water weed (elodea) has a long and flexible petiole for swinging with water currents.

**ANIMALS DISTRIBUTION AND ADAPTATION**

Animals of fresh water habitats include protozoa, duck, pondskatters, hydra, fishes e.t.c. their adaptive features include

* Protozoa have contractile vacuole for osmoregulation in water.
* Duck has webbed feet for locomotion and serrated beak for sieving food in water into its mouth.
* Hydra has slippery surface, hooks and suckers for attachment to water particles.
* Pondskatters has long legs for skating on water surface
* Fishes have swim bladders for buoyancy and gills for respiration

**FOOD CHAIN IN FRESH WATER HABITATS**

1. Diatoms → fish fry →tilapia
2. Spirogyra → tad poles → carps → king fish
3. Algae → mosquito larva → small fish

**EVALUATION**

1. State five characteristics of freshwater habitats
2. With three examples each describe plants and animals adaptation to freshwater habitats

**GENERAL EVALUATION**

* 1. Give two examples of food chain in marine habitats
  2. How do organisms adapt to life in estuary?
  3. What is a fresh water habitat?
  4. Differentiate between lotic and lentic fresh water habitats
  5. Differentiate between waves and tides.
  6. According to light penetration, zone marine habitat.

**WEEKEND ASSIGNMENT**

1. Buoyancy in salt water is ensured by the following **except** A. divided leaves B. chlorophyll C. floating devices D. air bladder

2. The mucilaginous cover in sea weed and spirogyra is mainly for A. protection B. osmoregulation C. avoiding desiccation D. feeding

3. Which of the following is **not** a fresh water habitat? A. puddle B. swamp C. stream D. sea

4. Which of these is not an adaptive feature in a marine habitat? A. bladder for floating B. hold fast for attachment C. fur to prevent water loss D. rhizoid for attachment to rock

5. The following are characteristics of fresh water habitats **except** A. low salt content B. high salinity C. shallow water D. can be stagnant or running water

**THEORY**

* 1. In a tabular form, state five differences between fresh water and a marine habitat
  2. State three adaptive features each of plants and animals to fresh water habitat

**READING ASSIGNMENT**

College Biology, chapter 23, page 499 – 513

**WEEK TWO**

**TERRESTRIAL HABITATS**

**CONTENT**

* Terrestrial Habitats
* Marsh
* Forest
* Grassland
* Arid land

**TERRESTRIAL HABITATS**

Organisms of the land are called terrestrial organisms. They include plants and animals that are found living on the ground and under the ground.

Basically, terrestrial habitat is subdivided into four main parts, namely;

1. marsh
2. forest
3. grassland/ savanna
4. arid land/ desert

**EVALUATION**

* 1. What are terrestrial organisms?
  2. List four types of terrestrial habitats

**MARSH**

Marsh is a low land, flooded in rainy season and usually waterlogged because of poor drainage. The vegetation is predominantly of grasses and shrubs. When trees grow in a marsh, it is called a swamp. Marsh is a transition between the aquatic habitat and terrestrial habitat.

**FORMATION OF A MARSH**

Marshes develop as a result of water overflowing its banks to accumulate on the adjoining coastal or low land area such as flood plains of rivers. This can be enhanced with extensive rainfall.

When ponds and lakes are filled up with soil and organic debris of plants, marshes can also be formed. Marshes formation is therefore a gradual process. Marshes can either be fresh water or salt water marshes.

**CHARACTERISTICS OF A MARSH**

1. A marsh is lowland.
2. It is always flooded, wet and waterlogged.
3. It sometimes has pool of standing water.
4. It has a high relative humidity
5. Its water sometimes contain much decaying organisms
6. The water has a foul smell

**ORGANISMS OF THE MARSH**

There are various plants and animals in this habitat. The plants include algae, grasses, water lettuce, water lilies, white and red mangrove, raphia palms e.t.c.

Animals found in the marsh include mangrove crabs, lagoon crabs, hermit crabs, mud-skippers, fishes, frogs, snakes, crocodiles, mammal e.t.c.

Adaptive features of organisms of the marsh include

1. They must be able to tolerate the salinity of the soil or water
2. They have to tolerate low oxygen concentration in the soil or water

Plants of fresh water marsh have other adaptive features similar to those of fresh water habitat. Likewise the plants of salt water marsh.

Saprophytic organisms (e.g. bacteria) which live on dead organic matter in marshes have to adapt to anaerobic condition.

**FOOD CHAINS IN MARSHES**

1. Flowering plants → insects → frogs → crocodiles
2. Humus → earthworms → frogs → snakes

**EVALUATION**

1. How is a marsh formed
2. State four characteristics of a marsh
3. List four plants and animals found in the marsh

**FORESTS**

A forest is a community of plants in which trees species are dominant. There are different kinds of forest whose distribution is determined mainly by climatic factors such as temperature, rainfall and at times by soil elevation and man’s activities such as farming, lumbering, bush burning, construction of roads and building.

The major type of forest in Nigeria is the rain forest

**CHARACTERISTICS OF A FOREST**

1. The forest is rich in epiphytes and climbers
2. The interior of the forest has high humidity, low light intensity and damp floor.
3. Presence of tall trees with canopies and existing in layers (stratified).
4. Trees are mesophytes with broad leaves.
5. The trees have buttress roots to support their heavy weight and height.
6. The trees have thin barks for gaseous exchange and transpiration.

**PLANTS DISTRIBUTION AND ADAPTATION**

Forest plants (trees) include African walnut, mahogany, teak, obeche, iroko, oil palm, ferns (pteridophytes), bryophytes (mosses and liverwort), epiphytes (orchid), fungi and mistletoe e.t.c. these plants adapt to life in the forest in the following ways;

* Possession of strong tap root systems and buttress roots.
* Possession of tall unbranched trunks
* Possession of broad leaves
* Epiphytes have mechanism (the aerial roots) storing water and absorbing moisture from air while growing on tree branches.
* Mistletoe (plant parasite) develops root system that can penetrate the stem of a plant withdrawing manufactured food directly from phloem vessels of the host plant.

**ANIMALS DISTRIBUTION AND ADAPTATION**

Most forest animals are arboreal (living on trees) and these include bats, monkeys, snakes, squirrels, birds, tree frogs, chameleons. Some live in the soil e.g. earthworms and beetles while others live among the litters on the ground e.g. millipedes, ants, snails.

These animals adapt to the forest in the following ways

* Monkeys have prehensile tails and long limbs for climbing and jumping.
* Bats modify their limbs into wings for flight
* Green snakes have protective colouration to camouflage
* Chameleon has prehensile tail and opposable digits for grasping as well as protective colouration to camouflage
* Apes moves in groups for protection, with high sense of sight
* Earthworms and snails have water permeable cuticle to reduce water loss and prevent desiccation.
* Birds have powerful wings for flight

**FOOD CHAINS IN A FOREST**

1. Green plants → grasshoppers → toads →hawks
2. Green plants → monkeys → lions

**EVALUATION**

* 1. Describe a forest habitat using its characteristics
  2. Give two examples of food chain in a forest

**GRASSLAND [SAVANNA]**

This is a plant community in which grass species are dominant, but trees and shrubs may be present.

**CHARACTERISTICS OF GRASSLAND**

1. Temperature is usually high and sunshine is intense.
2. The relative humidity is low and rainfall scanty (60 – 150cm annual rainfall).
3. Abundant grassland with few short trees sparsely distributed
4. Bush fire is frequent and trees are fire resistant
5. Deciduous plants (plants that shed their leaves in dry seasons) are present.
6. Plants possess underground stems and deep roots to search out for water
7. Trees have modified leaves for adaptation to the environment

**TYPES OF SAVANNA**

Basically, there are four major types of savanna in Nigeria, namely;

1. Southern guinea savanna
2. Northern guinea savanna
3. Sudan savanna
4. Sahel savanna

Southern guinea savanna is the largest biome in Nigeria

**PLANTS DISTRIBUTION AND ADAPTATION IN GRASSLANDS**

The grassland plants include acacia, elephant grass, guinea grass, spear grass, palms, baobab trees e.t.c. their adaptive features include

* Trees have thick corky barks to resist severe fire
* Grasses with underground stems to escape fire and drought
* Leaves with waxy surface in addition to cuticle covering to reduce transpiration
* Reduced or small leaves to reduce transpiration
* Presence of curly leaves to conserve water
* Leaves fall (deciduous) in drying season to conserve water
* Baobab trees have broad and succulent leaves to conserve water

**ANIMALS DISTRIBUTION AND ADAPTATION IN A FOREST**

Animals found in the forest include antelopes, elephants, giraffes, zebras, goats, cattle, grasshoppers, lizards, birds, lions, tigers, leopards, rats, snakes, grass cutters, kangaroos e.t.c. They adapt to this habitat in the following ways

* Termites lived in air conditioned nests called anthills for cooling the animals.
* Rats burrow into the soil to avoid excessive heat and fire
* Zebras and giraffes can camouflage using their colours.
* Lions, tigers and leopards have powerful claws and teeth for attacking animals.
* Kangaroos have long legs to help them escape from danger and also have pocket of flesh to shield their young ones from hot weather and attack.
* Elephants and lion move in groups or herds to achieve strength in number

**FOOD CHAINS IN GRASSLAND**

There are several food chains due to numerous animals

1. Grass → grasshoppers→ lizards → snakes
2. Grass → grasshoppers → toads → birds
3. Grass → zebras → lions

**EVALUATION**

1. Describe a grassland
2. State four characteristics of a grassland
3. List 4 plants and 4 animals of the grassland and explain how each adapt to this habitat

**ARID LANDS [DESERTS]**

These are areas of very low rainfall and high evaporation rate. They are the driest habitats, receiving less than 25cm annual rainfall. Arid lands are of two types;

* Hot deserts e.g. Sahara desert (North Africa), Kalahari desert (South Africa)
* Cold deserts e.g. desert in North America

**CHARACTERISTICS OF A DESERT**

* 1. Water is very scarce
  2. Temperature is very high by the day and very low by the night
  3. Vegetation is very scanty
  4. The soils are sandy or rocky
  5. Strong winds occur frequently and sunshine very intense
  6. Presence of drought resistance plants (xerophytes)

**PLANTS DISTRIBUTION AND ADAPTATION IN DESERTS**

Deserts plants include thorny bushes, cacti, scattered dwarf acacia, date palm, wiring grasses, baobab trees and euphorbia species. They adapt to this habitat in the following ways;

* Plants have thin leaves to reduce transpiration
* Cacti leafless have thorns to reduce transpiration and thick succulent stem to store water
* Acacia (drought resistant) has deep roots which absorb underground water
* Baobab tree has waxy leaves which can be hairy or needle shaped to reduce the rate of transpiration
* Wiring grass has narrow and slender leaves to reduce transpiration.

**ANIMAL DISTRIBUTION AND ADAPTATION IN DSERTS**

The deserts animals include camel, rodents, lizards, snakes, zebras, desert tortoise, grasshoppers, wasps, ants e.t.c. They survive in the following ways;

* Most desert animals excrete solid wastes to conserve water.
* Kangaroos, rats remain in burrows during the day to avoid excessive heat
* Reptiles have scales to reduce water loss
* Camels can survive several days without drinking water. They can withstand a wide range of body temperature up to 40oc.
* Locusts have water-proof bodies and impervious cuticles

**FOOD CHAINS IN ARID LANDS**

1. Plants → desert rats → snakes
2. Plants → ants → scorpions → snakes

**EVALUATION**

* 1. Describe the desert
  2. State four characteristics of tropical arid land

**GENERAL EVALUATION**

* 1. List the two types of arid land with examples.
  2. Mention four plants and four animals of the desert and explain how they adapt to life in this habitat.
  3. List four characteristics each of (i) Trees of the tropical rain forest (ii) Trees / shrubs of the savanna.
  4. State five adaptive features of animals that climb forest trees.
  5. Mention four characteristics of a desert.

**WEEKEND ASSIGNMENT**

1. Marsh is a ……… flooded and waterlogged (a) highland (b) lowland (c) island (d) mountain
2. Marsh is described as a ……… when trees grow there (a) swamp (b) forest (c) puddle (d) desert
3. Dominant plants in the forest are (a) grasses (b) shrubs (c) trees (d) vegetables
4. An examples of forest plants’ parasite is (a) orchid (b) mosses (c) liverwort (d) mistletoe
5. The plants of the forests are described as (a) hydrophytes (b) mesophytes (c) xerophytes (d) neophytes

**THEORY**

1. What is a marsh? State two types of a marsh
2. State five unique features of a forest

**READING ASSIGNMENT**

College Biology, chapter 23, page 507 – 523

**WEEK THREE**

**FOOD PRODUCTION AND STORAGE**

**CONTENT**

* Introduction
* Role of Government in Agricultural Food Production
* Environmental Factors Required for Food Production
* Ways of Improving Crop Production
* Effects of food shortage on population
* Methods of food preservation
* Effects of food storage over population

**Introduction**

Food production depends on the following

1. Role of government in agricultural production
2. Environmental factors required for food production
3. 3Ways of improving crop production

**Role of Government in Agricultural production**

* The role of government in agricultural production include
* Provision of agro-chemicals
* Provision of financial assistance.
* Provision of high quality planting materials
* Provision of tractors and other implements
* Provision of extension services
* Establishment of river basin authorities
* Provision of storage and processing facilities
* Provision of effective transportation network
* Efficient quarantine measures
* Provision of research work

**Environmental Factors Required for Food Production**

Environmental factors affecting food production include the biotic and abiotic factors.

**Abiotic factors include**: I. Rainfall II. Temperature III. Wind IV. Sunlight V. Relative humidity VI. Solar radiation VII. Edaphic factor; soil pH, soil texture, and soil structure.

**Biotic factors affecting food production include**  I. Soil organisms II. Pests III. Parasites IV. Diseases V. Weeds VI. Predators

**Ways of Improving Food Production**

Food production can be improved by

1. crop improvement method,
2. proper timing of plant,
3. adoption of better cultivation methods,
4. control of weeds,
5. use of good crop varieties,
6. use of resistant variety,
7. use of manures and fertilizers,

VIII.control of pests of crops,

1. control of diseases of crops.

**Effects of Food Shortage on Population Size**

There is a direct relationship between population size and food supply. As the population of organisms increases, the quantity of food produced should increase accordingly. However, when there is food shortage due to food wastage, the following result:

* High cost of food making food unavailable to the common man.
* **Competition**: Situation in which the organisms in a population struggle for limited available essential of life e.g. food. This results in survival of the fittest in the population.
* **Cannibalism**: This is an animals feeding on one another.
* **Emigration**: This is the outward movement of organisms from a particular population when there is shortage of food.
* **Increased death rate (which is called mortality):** especially of organisms which could not survive competition or migrate out.

**EVALUATION**

1. What are the effects of food shortage on population size?
2. Define cannibalism.

**Methods of Food Preservation (Storage)**

The methods and principles of preserving food include

**Salting**: This involves coating of the food with table salt or common salt (NaCl).

Principle: The salt on the surface of the food dehydrates it i.e. it removes water from the food.

This form a highly concentrated solution which has osmotic pressure than the cytoplasm of the micro organisms that cause decay. The salts inhibit the growth of the microbe or kill them. This method can be used for fresh meat, fish etc.

**Drying**: Food such as vegetables, maize, cassava, fish, meat etc. can be preserved by drying under the sun.

Principle: Drying reduces water content of the food thus making it unsuitable for the growth of spoilage micro organisms due to increased osmotic concentration of food.

**Smoking**: Involves placing the food over naked fire to dry it. Food preserved this way includes meat, fish, groundnut, plantain etc.

Principle: The smoke creates an oxygen deficient environment that kills micro organisms. The smoke also contains chemicals that are poisonous to the organisms.

**EVALUATION**

* + - 1. List three methods of preserving food.
      2. What are the principles of the methods mentioned above?

**Method of Food Preservation**

1. **Refrigeration/Freezing**: This involves keeping food in the refrigerator or freezer at low temperature. Such food includes fruit, vegetables, milk, bread, fish, meat etc. Low temperature reduces the metabolic rate of microbes. Some can even be killed thus reducing spoilage considerable.

2. **Pasteurization**: This is the heating of some food product to a very high temperature (72OC) for about 10 minutes and its immediate cooling for the purpose of storage. The high temperature destroys the spoilage microbes. Milk, cheese, beef can be preserved this way. Pasteurization usually precedes canning or bottling method of food preservation.

3. **Canning/Bottling**: This is the storage or sealing of processed and consumable food in cans or bottle under special conditions for future consumption. This is used for food like fruit, meat, fish, and beans. etc. Microbes are gradually killed, entrance of new ones is prevented and long storage is ensured.

4. **Irradiation**: This is the subjection of some food e.g. Milk, Canned food, tubers, fruit juices etc, to a high radiation such as ultraviolet rays. The irradiation kills the microbes in the food and also prevents the entrance of new ones.

5. **Chemicals:** This is the addition of harmless chemicals to food e.g. soft drink, vegetables etc.

Principle: The chemical choke spoilage organisms in the food. It also dehydrates or toxicate the microbes.

**EVALUATION**

1. How is pasteurization related to canning or bottling method of preservation?

2. Food storage reduces the effect of natural disaster, explain.

**Effects of Food Storage on Population**

1. **Prevention of hunger and famine**: Hunger or famine that would have resulted from food shortage is averted with preservation of food.

2. **Maintenance of stable price**: During harvest, food is cheap. However food storage ensure the availability of food through out the year. This helps in the maintenance of stable price.

3. Reduce the effect of natural disaster, flood, earthquake, pest attack and even war cause farm crop failure or destroy entrance farm activities. Food already stored etc. harvest will save people from starvation in the period of scarcity.

4. Food storage provides employment for workers especially in food processing company.

**EVALUATION**

1. What are the effects of food storage on population?

2. Highlight ways of improving food production.

3. Mention four abiotic factors that affect food production.

4. List the edaphic factors that affect food production.

5. What is pasteurization?

**READING ASSIGNMENT**

College Biology by Idodo Umeh. Chapter 20, page 448

**WEEKEND ASSIGNMENT**

1. The following except one results from food shortage (a) Competition (b) Reduced mortality rate (c) Emigration (d) Increased mortality rate.
2. Food shortage makes the population size

(a) increase (b) decrease (c) stabilize (d) fluctuate

1. Food storage results in

(a) stability of price (b) Natural disaster (c) high natality rate (d) overpopulation

1. These are methods of storing and preserving food except

(a) Silos (b) barns (c) refrigeration (d) Marketing.

1. The biggest factor that affects food production in Africa is (a) improper food storage (b) drought (c) low utilization of land (d) static farming technology.

**THEORY**

1. a. List three methods of preserving food.

b. Explain the principle involved in the method listed above

2. State five ways of improving crop yield.

**WEEK FOUR**

**NUTRIENT CYCLING IN NATURE**

**CONTENT**

* Definition
* Carbon Cycle
* Process of Cycling
* Importance of Carbon
* Carbon-oxygen balance

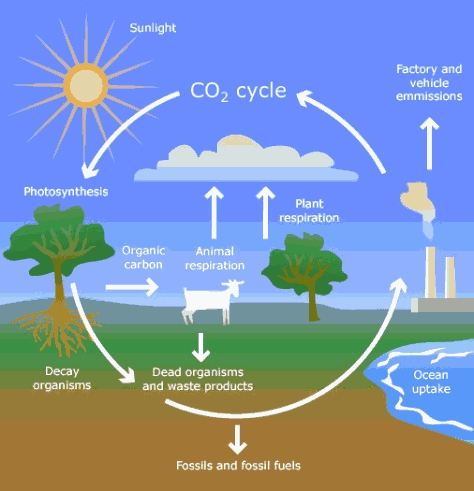
**Meaning**

Nutrient cycling refers to the movement of certain nutrients like nitrogen, carbon, water, oxygen and other elements from the environment into various organisms and back into the environment. The path along which the atoms or elements pass is called a cycle. The popular well known nutrients cycles are nitrogen cycle, carbon cycle, water cycle and decomposition in nature.

**Carbon Cycle**

Carbon Cycle is the cycle of carbon usage by which energy flows through Earth’s ecosystem. The basic cycle begins when photosynthesizing plants use carbon dioxide (CO2) found in the atmosphere or dissolved in water.

The atmosphere gains carbon dioxide through:

1. Combustion of organic materials such as coal, wood and petroleum
2. The action of volcanoes which releases carbon dioxide
3. The respiration by plant and animals
4. The death, decay and putrefaction of plants and animals
5. Diffusion of carbon dioxide from seas and other bodies of water acting as reservoir of carbon dioxide

**CARBON CYCLE**

**Evaluation**

1. Define carbon cycle.
2. Mention three ways atmosphere gain carbon dioxide.

**Importance of Carbon in Nature**

1. Plant uses carbon dioxide obtained from the air to manufacture their food during photosynthesis.
2. It provides carbon which is the major building block of all organic matter.
3. It helps to purify the atmosphere and maintain atmospheric level of carbon dioxide
4. Organic matter which is made from carbon helps to replenish soil nutrient.

**CARBON-OXYGEN BALANCE**

Oxygen constitutes 21% of the gases in the atmosphere. Respiration, decay and combustion are the processes which remove oxygen from the atmosphere while photosynthesis is the process that releases oxygen into the atmosphere. Human activities such as deforestation lead to the release of less oxygen into the atmosphere while less carbon dioxide is removed from atmosphere. Increase in the combustion of fuel, respiration and decay leads to the removal of more oxygen from the atmosphere while more carbon dioxide is added As a result of the activities mentioned above, oxygen level in the atmosphere decreases while carbon dioxide level increases. A decrease in the atmospheric oxygen level by 2-8% do not cause any significant effect but a slight increase in the atmospheric carbon dioxide may cause green house effect, i.e., increase in-the retention of the sun's radiant (heat) energy. This result in the warming of the atmosphere of the earth. So to prevent this, there is the need to balance the carbon-oxygen level in the atmosphere.

**EVALUATION**

1. What is the importance of carbon?

2. Explain carbon-oxygen balance.

**Water Cycle**

**Definition**: Water cycle is the continuous movement of water from the earth to the atmosphere by evaporation, transpiration and perspiration and back from the atmosphere to the earth by precipitation.

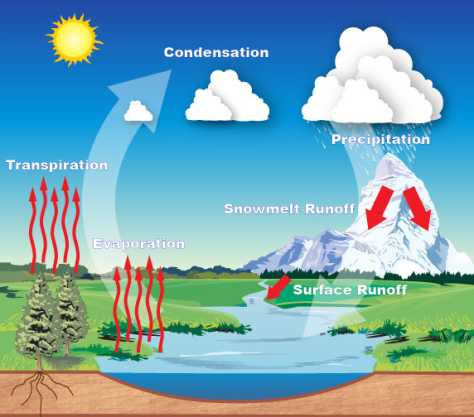
**Process of Water Cycling in Nature**

The solar energy causes water to evaporate from the hydrosphere into the atmosphere. When the water vapour cools, it condenses. At high altitude, the condensed water form clouds. The clouds precipitate as rain returning to the hydrosphere.

**Evaluation**

1. Define water cycle.

2. State the major processes that bring about water cycle.



**WATER CYCLE**

**Importance of Water to plants**

Water is very important to living organisms, both plants and animals, in number of ways:

* Water provides the medium for absorption of dissolved mineral salts by plants.
* Water is an essential raw material in the process of photosynthesis.
* It acts as a medium of transport for plants nutrients.
* It maintains osmotic content of body tissues.
* Water is the main component of plant protoplasm.
* Water is required for germination.

**Importance of Water to animal**

* It acts as a solvent for soluble food substances in digestion of food.
* it constitutes a large portion of the blood.
* Water aids excretion-of waste products by animals.
* Water regulates body temperature.
* Water provides a natural habit for aquatic organisms.

**General Evaluation**

**1.** Mention three processes that involve carbon.

2. Mention three importance of water to animals.

3. Explain the following terms: Hypertonic, Hypotonic and Isotonic solution.

4. Outline the process of water cycle in nature.

5. List the constituents of air in nature.

**Reading Assignment**

College Biology by Idodo Umeh. Chapter 23, page 553-555

**WEEKEND ASSIGNMENT**

1. Which of the following processes removes water from the water cycle? (a) Condensation (b) Perspiration (c) Photosynthesis (d) Transpiration.

2. What type of energy causes water to evaporate from the hydrosphere (a) mechanical energy (b) chemical energy (c) solar energy (d) hydro-electric power.

3. Water is returned to the atmosphere from animals through the following processes except (a) excretion (b) respiration (c) condensation (d) perspiration.

4. When organisms die, water returns to the atmosphere by (a) decay (b) sweating (c) respiration (d) condensation.

5. Atmosphere gains carbon through the following processes except (a) Photosynthesis (b) Decay (c) Respiration (d) Volcano

**THEORY**

1. Water is essential for living organism, discuss.

2. Describe the process of carbon cycling in nature.

**WEEK 5**

**NITROGEN CYCLE**

**CONTENT**

* Definition
* Process of cycling
* Importance of Nitrogen
* Decomposition in nature
* Types of decomposers (Micro and Macro decomposers)
* Roles of decomposers

**Nitrogen Cycle**

Nitrogen is an abundant element in the atmosphere. It is an essential constituent of proteins, a group of substances found in all living cells. About 78% of air is composed of gaseous nitrogen. Plants cannot incorporate nitrogen gas into organic compound and therefore depend on various types of bacteria to make nitrogen available for them in a global cycle called the nitrogen cycle. In nature, nitrogen is constantly being removed from the soil and returned to it via the nitrogen cycle.

**Conversion of Gaseous Nitrogen into Nitrogenous Compounds**

Gaseous nitrogen is converted into nitrates in the following ways

1. The action of thunderstorms
2. Nitrogen-fixing microorganisms

During thunderstorms, nitrogen reacts with oxygen to form nitric oxide. The nitric oxide is oxidized to nitrogen peroxide which dissolves in rainwater to form nitric nitrous acids. When these acids enter the soil, they combine with mineral salts to form nitrates. The nitrates then dissolve in soil water and are absorbed by the plants. These nitrates are converted into plant proteins and become part of the plant body (assimilated). The organisms capable of splitting the nitrogen molecule and use it to form nitrites or nitrates is known as **nitrogen fixation**. Some microorganisms are able to change gaseous nitrogen directly into proteins.

**Types of Nitrogen-fixing Microorganism**

* + - 1. Free living organism.

1. Symbiotic organism.

Azotobacter and Clostridium are free living bacteria. They are able to absorb nitrogen from the atmosphere and change it into amino compounds and proteins. Energy needed for these processes is obtained from the breakdown of carbohydrates in humus. Symbiotic bacteria like the Rhizobium which are found in the root nodules of leguminous plants use gaseous nitrogen to manufacture amino compounds and proteins which they share with the host plants. These bacteria get the energy needed for nitrogen fixation from the breakdown of carbohydrates in the host's tissues. When the host plants die, the amino compounds and proteins in the root nodules are converted to soil nitrates.

**Evaluation**

1. What is nitrogen cycle?

2. Explain the types of nitrogen fixation.

**Putrefaction**: Plants are the food producers in nature; animals feed on plants and convert plant proteins; to animal proteins. When these animals are eaten by carnivorous animals, more animal proteins are formed. Proteins are decomposed through amino acids to ammonia when an organism dies. The nitrogen that is trapped in the bodies of all these living organisms re-enter the nitrogen cycle through putrefaction or decay. When living organisms die, they decay and the excretory product also decays.

**Ammonification**: The putrefying bacteria and fungi are responsible for decay. These saprophytic organisms convert plant and animal materials into simple substances like carbon dioxide, water, and ammonia. This breakdown of protein into ammonia is known **ammonification.**

**Nitrification**: Animal wastes and excreta are decomposed and the chemosynthetic bacteria then oxidize ammonia to nitrites and the nitrites are converted to nitrates by nitrifying bacteria. This process is called **nitrification**.

**Denitrification**: Denitrifying bacteria in the soil convert nitrates into gaseous nitrogen which escapes into the atmosphere. This reduces the nitrogen content and fertility of the soil.

**Evaluation**

1. What is nitrification?

2. Explain denitrification.

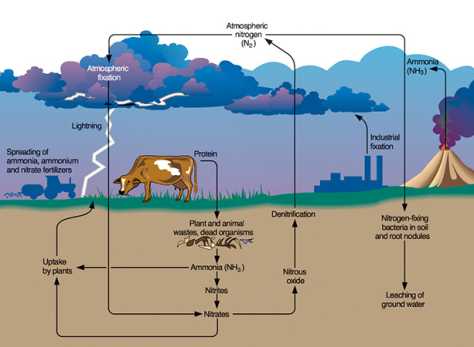
**Decomposition in Nature**

Decomposition is the process by which organisms, mainly bacteria and saprophytes break down dead organic materials which could be of plant or animal origin.

**Types of Decomposers**

1. **Micro decomposers:** These are small or microscopic organisms that can cause decay e.g. certain bacteria and fungi.

**2.** **Macro decomposers**: These are bigger organisms that can cause decay of dead organic materials e.g. earthworms, termites, snails, mushroom, toad stools, etc.

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**NITROGEN CYCLE**

**Process of Decomposition**

The decomposers secrete enzymes onto their food source such as a decaying dead organisms. These enzymes break down complex organic compounds (food) like carbohydrates into simple soluble inorganic Compounds. A lot of the chemical energy in the compounds Is lost as unstable heat energy. The decomposers only absorb a small amount of nutrients and energy for their use. The rest is released into the soil, air and water. When decomposers die, other decomposers feed on them, the nutrient released are used by plants to manufacture their food. Products released during decomposition are gases such as carbon dioxide, hydrogen sulphide, ammonia and water vapour. Others are heat energy and nutrients such as nitrates, sulphates, phosphate, ions, etc.

**Role of Decomposers**

* + - 1. They enrich the soil with nutrients required for plant growth.

1. They contribute to environmental pollution.
2. Decomposition is useful in the making of cheese and yoghurt.
3. They allow the ecosystem to function by enabling the recycling of nutrients.
4. They also prevent an unsightly accumulation of remains and wastes of living organisms on earth surface.

**General Evaluation**

1. Write on the two types of decomposers.

2. State the roles of decomposers.

3. What is autotrophic nutrition?

4. List the two modes of autotrophic nutrition.

5. Differentiate between the two modes listed above.

**Reading Assignment**

College Biology by idodo Umeh. Chapter 23, page 556-558

**WEEKEND ASSIGNMENT**

1. Legumes incorporate nitrogen gas into their proteins because (a). of the presence of *Azotobacter* in their roots (b) they posses root nodules containing *Rhizobium* (c) they have a well developed root system (d) they are autotrophic.
2. Thunderstorm can be beneficial to plants because (a) it kills the pest that attacks crops (b) it destroys some of the major crops (c) it adds nitrate to the soil (d) it makes rain water available to plants.
3. Which of the following is responsible for the conversion of nitrites to nitrates?(a) Denitrifying bacteria (b) Nitrifying bacteria (c) Lightening (d) Fungi.
4. Which of the folloowing is a nitrifying bacterium? (a) Nitrobacter (b) Rhizobium (c) Azotobacter (d) Nitrosomonas.
5. Bacteria inhabiting legume root nodules and which add atmospheric nitrogen to the soil are referred to as (a) denitrifying bacteria (b) nitrifying bacteria (c) nitrogen-fixing bacteria (d) nitrogen putrefying bacteria.

**THEORY**

* + - 1. Explain the types of nitrogen fixing mechanisms.
      2. Explain the following a. Nitrification b. Ammonification.

**WEEK 6**

**ENVIRONMENTAL POLLUTION**

**CONTENT**

* Definition of Pollution
* Air Pollution
* Noise Pollution
* Land Pollution
* Water Pollution

**POLLUTION**

**Definition**: Pollution is defined as the release of toxic or harmful substances into the environment by their natural forces or man and other animals to an extent that causes biological damage to man and his resources. In other words, pollution is the release of harmful substances into the environment, i.e., water, air and land in quantities or to the level that are harmful to man, animals and plants.

The harmful substances that cause pollution in the environment are called pollutants.

There are four main types of pollution. These are

**(a)Air pollution**

**(b)Noise pollution**

**(c) Land pollution**

**(d) Water pollution**

**The major air pollutants, their sources, harmful effects and their control**

|  |  |  |
| --- | --- | --- |
| **Air Pollutants** | **Sources** | **Effects** |
| Carbon monoxide | Burning of fuel in cars  other combustion engines  and some industrial processes | It causes suffocation because it combine  with haemoglobin and reduces its ability  to carry oxygen which results in death |
| Sulphur dioxide | Burning from vehicle's exhaust,  coal mining and cement factory | It causes impaired health such as the  irritation of eyes, lungs and other respiratory tract diseases. It can cause acid rain. |
| Nitrogen oxides | Electrical discharge in air and  Industrial processes | It forms nitric acid with water in air form acid rain which corrodes metallic objects. It irritates the skin and respiratory system. |
| Smoke and soots | Burning of substances from industries, machines and coal into the air. | Particles can damage lungs and cause discomfort. Soot can cover the leaves of plant thereby reducing photosynthesis. Smoke reduces visibility. It makes buildings black. |
| Dust particles | Mining, quarries, machines and industrial processes | It irritates respiratory system and cause respiratory diseases such as catarrh and cough.  It reduces visibility. Pollen grains containing dust can affect the lungs resulting in asthma. |

**Control of Air Pollution**

* Conditions must be created for complete combustion of fuel in internal combustion engines.
* Chemical waste should be discharged into the air through fumes chambers.
* Industries should be sited far away from residential areas.
* There should be provision of filters or absorbers to be worn around mining and industrial areas so as to reduce pollution from waste gases.
* Legislation should be made against indiscriminate burning that may bring about smoke.

**Evaluation**

1. What is environmental pollution?

2. Mention five sources of air pollution.

**Noise pollution**

Noise Sources include

* Factory or industrial noise.
* Airplane or aviation noise.
* Rail way engine noise.
* Car horns and sirens.
* High pitched musical sound from loud speakers.
* Noise from heavy guns or cannon shots.
* Thunder noise.
* Noise from generators.

**Effects of Noise Pollution**

* It causes loss of hearing or deafness.
* Noise can cause emotional disorder, anxiety.

or lack of concentration.

* Noise can also cause high blood pressure or hypertension.
* It causes gene;ral irritation or short temperedness.
* It can also cause changes in behaviour.

**Control of Noise**

* There should be reduction of noise from loud speakers and sirens.
* Legislation should be made against the use of loudspeakers in public places
* Installation of soundproof in industries.
* Heavy guns must be banned.
* Railways and airports should be sited far away from residential areas.

|  |  |  |
| --- | --- | --- |
| **Land Pollutants** | **Sources** | **Effects** |
| (1) Refuse | Home, offices, industries and markets | (i) It causes offensive odour when the decay. |
| (2) Sewage | Homes and offices | (i) It can cause respiratory disorder.  (ii) It results in offensive odour.  (iii) It serves as breeding ground for disease causing organisms. |
| (3) Metal Scraps | Abandoned vehicles and machines | 1. It occupies land space 2. It prevents proper land us. |
| (4) Pesticides and fertilizes | Pesticides sprayed on crops and fertilizers used in soils | (i) They destroy useful soil organisms.  (ii). Excess fertilizers can cause soil acidity.  (iii). It can cause the death of aquatic organisms, e.g. fishes |
| (5) Chemicals, eg. Toxic waste | Chemical waste from industries | (i) These are poisonous to plants and animals |
| (6) Glass particles | Glass manufacturing or industries using bottles | (i) It can cause injury to human skin or body  (ii). It does not decay hence it prevents proper land use. |
| (7) Crude oil (Oil spillage) | Oil drilling, loading or unloading of oil tankers | (i) It destroys soil and renders it infertile.  (ii). It destroys plants and animals’ life in water. |

**Control of Land Pollution**

* Refuse should be burnt in incinerators.
* Urban wastes should be properly burnt or buried
* Metal scraps, tin cans, bottles, motor vehicle parts and other related materials should be recycled.
* Pesticides and fertilizers should be applied as instructed.
* Legislation should be made against dumping of harmful wastes.
* Proper treatment of sewage before disposal.
* Proper maintenance and checking of oil pipelines.

**Evaluation**

1. Mention five common land pollutants.

2. Suggest ways of controlling the pollutants mentioned

|  |  |  |
| --- | --- | --- |
| **Water Pollutants** | **Sources** | **Effects** |
| (1) Sewage | City sewage system | (i). It supports the growth of pathogens that can cause diseases, eg. Cholera.  (ii). It make water unfit for human consumption.  (iii). It can kill aquatic organisms.  (iv). It produces unpleasant odours. |
| (2) Pesticides and Fertilizers | Washed by erosion from farms to rivers, streams or ponds | (i) It makes water unfit for human consumption.  (ii). It leads to rapid vegetative growth of water plants which makes fishing and movement impossible, eg. Algae bloom.  (iii). It can destroy aquatic organisms, eg. Fish and sea birds. |
| (3) Chemical Wastes | Industries and ships at harbours | (i). It can kill aquatic organisms.  (ii). It makes water unfit for human consumption.  (iii). It can accumulate in human body and become toxic later, eg. Lead and mercury. |
| (4) Excreta or faeces | Humans and animals | (i). It produces unpleasant odour  (ii). It serves as a medium for the breeding of pathogens |
| (5). Crude oil (Oil spillage) | Oil drilling, loading and unloading of oil tankers | (i) It destroys aquatic plants and animals.  (ii). It makes water unfit for human consumption.  (iii). Food chain is affected.  (iv). It leads to migration of animals. |

**Control of Water Pollution**

(I) There should be efficient and proper sewage disposal system.

(ii) Dumping of refuse or petro-chemical byproducts into rivers, streams or seas should be avoided.

(iii) There should be efficient techniques to deal with or prevent oil spillage.

(iv) Industries should be sited far away from residential areas.

(v) Government or local authorities should strictly monitor all industrial wastes.

(vi) There should be public enlightenment on waste disposal.

(vii) Industrial effluents should be recycled.

**Methods of Purifying Water**

Methods involved in purifying water include: (i) Boiling (ii) Addition of chemicals, e.g. alum or chlorine (iii) Filtration (iv) Distillation (v) Sterilization using UV light (vi) Boiling (vii) Sedimentation

**General Evaluation**

1. Define the term pollution.

2. State four types of pollution.

3. Mention three air and noise pollution.

4. State the effect of air and land pollution.

5. What is sewage?

**Weekend Assignment**

1. The unfavorable alteration of environment due to the addition of impurities is A. pollution B. pollutant C. global warming D. poisoning

2. These are causes of water pollution except A. Insects B. Fertilizers C. Sewage D. Petroleum.

3. Which of the following air pollutant depletes the ozone layer? A. Oxides of sulphur B. Carbon dioxide C. Dust D. Chlorofluorocarbons (CFC)

4. These are the effects of noise except A. Calmness B. Anxiety C. Short temper D. High blood pressure.

5. Which of the following pollutants cause suffocation? A. CO2 B. No2 C. CFC D. sewage.

**Theory**

1. What are the effects of the following pollution on man? (a) carbon monoxide (b) dust (c) sewage
2. Highlight five dangers of water pollution.

**Reading Assignment**: College Biology by idodo Umeh. Chapter 24 page 565-572

**WEEK SEVEN**

**CONSERVATION OF NATURAL RESOURCES**

**CONTENT**

* Definition
* Need for Conservation
* Natural Resources that Needs to be Conserved
* Methods of Conserving Natural Resources
* Importance of Conservation of Natural Resources
* Ways of Ensuring the Conservation of Natural Resources

**CONSERVATION OF NATURAL RESOURCES**

**Definition**: Conservation is defined as the planned, control exploitation or judicious use of natural resources to ensure their continuous availability and to preserve the quality or original nature of the environment. In other words, conservation is the preservation of natural resources from loss, waste or exploitation through rational use and to ensure their continued use or availability and preserve the quality or original nature of the natural resources

Natural resources can be renewable or non-renewable.

**(i) Renewable natural resources**: These are natural resources that are recoverable. Examples are rain, animals, plants, water, and food and soil.

**(ii)Non-renewable natural resources**: These are resources which when exhausted cannot be replaced or recovered. Examples are mainly mineral resources like petroleum, coal, tin, copper etc.

**Need or Reasons for Conservation**

(i) To prevent destruction of natural environment or to allow for continued use of natural resources for man's benefits

(ii) To preserve rare and valuable species of plants and animals for the future generation or to save them from extinction or permanent destruction.

(iii) To preserve naturally beautiful sceneries for their aesthetic values

(iv) To promote the recycling of some scarce mineral resources, e.g. water

(v) To prevent the destruction of natural ecosystem; this will allow the organisms in the ecosystem to survive.

(vi) Forest which provides medicinal materials must be conserved to ensure easy availability and continued existence.

(vii) Natural resources, e.g. wild life, forest, minerals etc provide basis for research purposes.

**Natural Resources that Need to be Conserved**

Natural resources that need to be conserved include wildlife, water, forest, soil, air and mineral resources.

**Evaluation**

1. What is conservation of natural resources?

2. State five needs for conservation.

**Methods of Conserving Natural Resources**

1. **Methods of Conserving Wildlife**

i) Establishment of game or forest reserves

ii) Establishment of zoological gardens.

iii) Control of hunting to prevent extinction of some animal species

iv) Prohibition of killing or poaching of animals in game reserves.

v) Prohibition of bush burning as this may lead to migration or displacement of wildlife.

vi) Prohibition of deforestation and encouragement of afforestation or reafforestation.

vii) Creation of awareness on the values of wildlife.

(viii) Prevention of pollution to prevent the destruction of aquatic life.

2. **Methods of Conserving Forest**

(i) Cutting of trees without destroying the undergrowth

ii) Reafforestation or encouraging the planting of trees.

iii) Prevention of bush burning or careless forest fires.

iv) Prevention of plant pests and diseases.

v) Establishment of forest reserves.

vi) Educating the public on the value of forests and the importance of conservation.

3. **Methods of Conserving Soil**

i) Prevention of overgrazing which may cause soil erosion.

ii) Prevention of indiscriminate felling of trees or deforestation which exposes the soil to erosion.

iii) Adoption of better farming practices, e.g. crop rotation so as to prevent erosion, leaching, water logging or acidity.

iv) Prevention of pollution of land so as not to destroy useful soil organisms

(v) Avoidance of clean clearing which may expose the soil to

erosion

(VI) Prevention of bush burning which may expose the soil to erosion.

**4. Methods of Conserving Air**

i) Prevention of effluents from factories or factory chimneys which may pollute the air or cause acid rain

ii) Prevention of fumes from automobile or thermal plants which may affect aerial life

iii) Proper treatment and disposal of sewage

iv) Proper burning of wastes so as to prevent smoke or soot from polluting the air

**5. Methods of Conserving Mineral**

Mineral resources, unlike other resources are non-renewable resources because once they are exhausted, they cannot be replaced hence the need to conserve. The methods of conserving mineral resources are:

1. There should be legislation against indiscriminate mining of mineral resources.

2. Effective and efficient extraction of mineral should be adopted to prevent wastages.

3. There should be effective and efficient utilization of available mineral resources for man's use.

4. Over dependence on a particular mineral resource should be discouraged as this can lead to the depletion of such mineral resource.

5. There should be proper pricing of mineral resources and their by-products to ensure maximum value for the mineral products.

**Evaluation**

1. State five methods of conserving forest.

2. Suggest five ways of preventing depletion of soil.

**Importance or Benefits of Conservation Of Natural Resources**

**Benefits of Wildlife Resources Conservation**

1. It provides food for human consumption

2. It can serve as tourist centres for pleasure and relaxation.

3. It serves as sources of food supply, e.g. fish, prawns, crayfish etc.

4. It is used for Hydro-Electric Power (H.E.P.) generation which provides electricity, e.g. Kainji dam.

5. Water is useful for agricultural purposes, i.e., irrigation.

6. Water serves as a medium of transportation in rivers, lakes and oceans.

7. Water is important for domestic and industrial uses, e.g. drinking, washing, cooking etc.

8. Water can be used for recreational and tourist purposes.

9. Water provides employment for people, e.g. fishermen, canoe or ship builders etc.

**Benefits of Forest Resources Conservation**

1. Forests are sources of food supply, e.g. fruit, vegetables, meat etc.

2. Forests are sources of timber for construction purposes.

3. Forests provide medicinal herbs.

4. They are sources of firewood used for cooking.

5. Forests are the home or habitat of wild animals which can serve as game reserves.

6. Forests provide employment for some people, e.g. forest guards, lumbermen and hunters.

7. Forest provides raw materials for industries, e.g. cotton, rubber, ropes and twine, latex, timber, etc.

8. Forests can serve as centers of tourism.

9. Forests can also serve as wind break.

**Benefits of Soil Resources Conservation**

1. Soil supports agricultural or farming.

2. It supports the growth of valuable wood for building and furniture making.

3. Buildings are erected on the soil.

4. Mineral resources are obtained from the soil.

**Benefits of Air Resources Conservation**

1. Air provides oxygen used in respiration by plants and animals.

2. It provides carbon dioxide used by plants for photosynthesis.

3. Air also provides gaseous nitrogen used by plant to manufacture proteins.

4. Air is the habitat of most organisms, e.g. birds, insects etc.

5. It makes life more meaningful and comfortable.

**Benefits of Mineral Resources Conservation**

1. Mineral resources provide fuel, e.g. coal, petroleum and natural gas, for use.

2. They are used for construction purposes, e.g. iron, zinc, aluminium.

3. Some are used for industrial development, e.g. diamond, iron, copper, silver etc.

4. Some are sources of ornaments, e.g. gold, silver, bronze etc.

5. Minerals are sources of foreign exchange.

6. They also provide employment, e.g. miners, drillers, marketers etc.

**Evaluation**

**1.** State three benefits of conserving soil.

2. Mention two benefits of conserving petroleum in Nigeria.

**Ways of Ensuring the Conservation of Natural Resources**

(1) Establishment of agencies for conservation: Agencies are established ensure that these natural resources are conserved, e.g. preservation of wildlife forest resources, water resources, air, soil and mineral resources. Agencies for conservation are:

(i) Nigerian Conservation Foundation.

(ii) Federal Environmental Protection Agency (FEPA)

(iii) River Basin Development Authorities (RBDA).

(iv) Ministries of Agricultural.

(v) Department of wildlife Conservation.

(2) **Establishment of Game Reserves or National Parks**: The game reserves or national parks serve for the protection of wildlife, rare or endangered species and for recreational purposes as well as scientific purposes.

Some game reserves in Nigeria include:

(i) Yankari game reserve in Bauchi.

(ii) Borgu game reserve in Niger State.

(iii) Shasha river forest in Ogun State.

(iv) Olomu forest reserve in Kwara State.

(v) Mamu river forest reserve in Anambra State.

(vi) Zamfara forest reserve in Zamfara State.

(3) **Making of conservation laws, edicts or decrees**: These laws, edicts or decrees are made bygovernment to regulate the felling of trees, hunting or exploitation of endangered species or indiscriminate exploitation of mineral resources. These laws must be obeyed.

**(4) Conservation education**: Conservation education serves to inform the populace about the need to conserve natural resources and the consequences of extermination or exhaustion of such resources like trees, wildlife and minerals.

**Problems Associated with Conservation**

The following are challenges encountered in the process of conserving resources:

(i) Soil erosion caused by natural wind, rainfall and run-offs.

(ii) Land, air and water pollution.

(iii) Occurrence of natural disaster such as earthquakes and floods.

(iv) Overgrazing caused by domestic livestock.

(v) Indiscriminate hunting leading to wildlife disappearance.

(vi) Indiscriminate bush burning and felling of timber leading to disappearance of wild plants and animals.

(vii) indiscriminate fishing leading to depletion of aquatic life.;

(viii) Adoption of poor farming methods, e.g. bush fallowing, shifting cultivation and continuous cropping which leads to depletion of soil nutrients.

(ix) Problem of oil spillage which leads to loss of terrestrial and aquatic life.

**General Evaluation**

1. What is conservation?

2. Mention five factors affecting conservation of natural resources.

3. List five conservation agencies in Nigeria.

4. State five benefits of conserving resources.

5. Give five natural resources that need to be conserved.

**Weekend Assignment**

1. The planned use of natural resources to ensure the continuous availability is A. Preservation B. Conservation C. Storage D. Exploitation.

2. These are examples of renewable natural resources except A. Rain B. Petroleum C. Plants D. Soil

3. The following are agencies for conservation except A. FEPA B. RBDA C. Ministry of Agriculture D. VMA

4. Borgu game reserve can be found in A. Abia B. Benue C. Niger D. Anambra

5. The following farm practices lead to depletion of soil nutrients except A. Bush fallowing B. Shifting cultivation C. Continuous cropping D. Crop rotation

**Theory**

1. (a) Define the term "Conservation".

(b) State three reasons for conservation.

2. List two methods of conserving each of the following (a) Water (b) wildlife (c) forest

**Reading Assignment**

College Biology by idodo Umeh. Chapter 25, page 573-576

**WEEK 8**

**ECOLOGICAL MANAGEMENT**

**CONTENT**

* Biological Association
* Tolerance
* Tolerance Range
* Geographic Range

**Biological Association**

In a community, there exist different kinds of biological associations between organisms of different species. Some of these biological associations are beneficial, some are neutral while others are harmful.

**Types of Associations**

**Symbiosis**

Definition: This is a close association between two organisms in which one or both of them benefit from each other. Symbiosis is a beneficial association and each member is called a symbiont. This association can be further divided into 1. Mutualism 2. Commensalism

**Mutualism**

Mutualism is the association between two organisms in which both of them benefit from each other.

**Examples of mutualism include:** Algae and fungi in lichen; Protozoa in the intestine of termites; Nitrogen fixing bacteria in the root nodules of leguminous plants; Bacteria in the rumen of ruminants.

**Evaluation**

1. Mention five different types of biological associations.

2. What is mutualism?

**Commensalism**

Commensalism is a relationship between two organisms of different species, in which one (comensal) benefits while the other (host) neither gains nor loses.

**Examples of Commensalism**

Remora fish and the shark, oyster and crab, man and intestinal bacteria

**Parasitism**

Parasitism is a close association between two organisms in which one, known as the parasite, lives in or on the body of another; the host, deriving benefits from and causing harm to it while the host loses in the process. The parasite benefits from the association while the host usually suffers harm or may die.

**Examples of Parasitism**

Man and the tapeworm: Mistletoe and flowering plant:

**Competition**

Competition involves the interactions among two organisms of the same or different species in which one outgrows the other and survives.

Competition is often based on limited environmental resources which can be in short supply such as food, water, nutrients, gases, light and space. During competition, one organism controls one or more of these resources which enable it to grow and survive while the other neither grow nor survive leading to its elimination.

When the competition is between members of the same species, it is called **intra-specific** competition while it is called **inter-specific** competition if it is between members of different species.

Examples of Competitive Associations the (a) Flowering plants and grasses: flowering plants due to its size and numerous branches and leaves are capable of eliminating the grasses by depriving the grasses of nutrients, space and sunlight. The grasses may eventually be eliminated

**Predation**

Predation is a type of association between two organisms in which the predator kills the other, called the prey and directly feeds on it. The predator which is usually larger in size and always stronger than the prey benefits by deriving its food while the prey is completely eliminated.

**Examples of Predation**

The hawk and chicks of domestic fowls, the leopard and antelope, the lion and gazelle

**Evaluation**

1. What is commensalism?

2. Differentiate between parasitism and symbiosis.

**Tolerance**

Tolerance is the ability of living organisms to withstand a little unfavorable change in the environment which affect there survival. Abiotic factors play important role in the distribution of living organisms in the various terrestrial and aquatic habitats of the world. Some of these factors include temperature, rainfall (availability of moisture),light intensity salinity and edaphic factors. Each of these factors occurs over a range in the various habitats.

**Tolerance Range**

Tolerance range is the range between the minimum and maximum limits to which organisms can tolerate certain changes in their environment so as to survive. Organisms can only live within certain minimum and maximum limits for each abiotic factors. The range between the upper and lower limits is known as the tolerance range for the factors. For example, for most animals, the minimum temperature limit is 0c while the maximum limit is 42cDeath occurs beyond this range.

**Geographic Range**

It refers to the areas where a species of organism can only be found within the minimum and maximum limits of its tolerance. For example, the geographic range of the tropical rainforest is within the equator as a result of high rainfall and temperatures, whereas tropical rainforest cannot be found at the Northern and Southern poles because of low rainfall and temperature.

**General Evaluation**

1. Define tolerance.

2. Differentiate between a parasite and a commensal.

3. State the two forms of parasitism.

4. What is tolerance range?

5. Explain Geographic Range.

**Weekend Assignment**

1. Lichen are made up of two organisms, they are A. algae and fungi B. algae and bacteria C. fungi and bacteria D. protozoa and algae.

2. Bacteria in the rumen of ruminants is an association called A. symbiosis B. parasitism C. predation D. competition.

3. The minimum temperature limit for most animals is A. 0oC B. -10oC C. 5oC D. -10oC.

4. The following abiotic factors are responsible for geographical boundaries except A. Light intensity B. Rainfall C. Temperature D. Competition.

5. An example of a plant parasite is A. venus B. mistletoe C. cactus D. xerophite

**Theory**

1. Define a) mutualism b) commensalism c) predation

2. Give example each of the following above.

**Reading Assignment**: College Biology by idodo Umeh. Chapter 23, page 556-558

**WEEK NINE & TEN**

**ADAPTATION**

**CONTENT**

* Definition of Adaptation
* Adaptation of animals
* Adaptation of plants
* Adaptation of animals in marine habitat
* Adaptation of Plants in Aquatic Habitat
* Estuarine habitat
* Characteristics of estuarine habitat
* Plants and animals distribution in estuarine habitat

**ADAPTATION**

Adaptation is defined as the ability of an organism to live successfully in a particular habitat as a result of its structure, appearance and behaviour. It is expected that every organism must adapt to its environment in order to survive. Plants and animals possess certain features which enable them to adapt to either aquatic or terrestrial habitats.

**Animal Adaptation**

(1) **Adaptation of Animals to Aquatic Habitat**

(i) Possession of streamlined body for easy movement in water, e.g. Tilapia fish and toad.

(ii) Possession of fins for movement as in the case of fish and webbed toes as in toad

(iii) Possession of gills for gaseous exchange in fish and tadpoles.

(iv) Possession of swim bladder for the purpose of buoyancy in water, e.g. Tilapia fish.

(v) Possession of tail for swimming, e.g. tadpoles.

(vi) Possession of sticky undersurface for attachment to surfaces of objects, e.g. snails and flatworms.

(vii) Possession of suckers or hairs for attachment to vegetation so as to avoid being swept away by water current,

e.g. leeches.

(2) **Adaptation of Animals to Terrestrial Habitat**

(i) Possession of powerful limbs for movement, e.g. mammals.

(ii) Possession of lungs for gaseous exchange, e.g. mammals, birds, reptiles and amphibians.

(iii) Possession of sweat gland for excretion and cooling, e.g. mammals (iv)Possession of hair as in mammals and that of feathers as in birds for body temperature regulation.

(v) Possession of skin as in mammals and cuticle by insects to protect and prevent drying up and injury.

**Evaluation**

1. What is evaluation?

2. Describe how tilapia adapts to water.

(3) **Adaptation of Animals to Aboreal Habitat**

{i) Possession of wings for flight, e.g. birds.

(ii) Possession of hollow bones to make them light, e.g. birds.

(iii) Possession of bright colour as well as camouflage, e.g. chameleon.

(iv) Possession of powerful limbs, claws and tails for climbing and piercing, e.g. birds, monkeys and baboons.

(v) Possession of streamlined body for easy flight, e.g. bird

(vi) Possession of strong muscles and tendon to ease flight, e.g. birds.

(vii) Feeding mainly on grains to provide energy required for flight, e.g. birds.

**Plants Adaptation**

**Adaptation of Plants to Aquatic Habitat**

(i) Possession of waxy cuticles on leaves to prevent wetting, e.g. water lettuce

(ii) Possession of long stem and flower stalk to expose the flowers and leaves e.g. water lily.

(iii) Possession of adventitious roots, e.g. water lettuce.

(iv) Possession of air floats in the leaves and stems for buoyancy, e.g. water hyacinth.

(v) Possession of breathing roots for gaseous exchange, e.g. white mangrove

(vi) possession of air spaces in the tissues for buoyancy, e.g. water lettuce.

**Adaptation of Plants to Terrestrial Habitat**

(i) Possession of extensive root system for anchorage and water absorption, e.g. mahogany.

(ii) Possession of thick barks on the stems to protect internal tissues.

(iii)Possession of numerous leaves to enhance better photosynthesis.

(iv)Possession of succulent stems by desert plants to enable them store excess water.

(v) Possession of tiny and scanty leaves by desert plants to reduce water loss through transpiration.

(vi) Possession of thick, waxy cuticles on leaves to prevent water loss through transpiration.

**Evaluation**

1. Mention the features that adapt hydrophytes to water.

2. Mention five adaptive features of arboreal.

**Special Adaptation of Some Organisms**

**1. Adaptation of Tilapia Fish for Movement**

These adaptive features are:

(i) Possession of fins for movement in water.

(ii) Presence of streamlined body for easy movement.

(iii) Possession of lateral line system for detection of vibration in water.

(iv) Possession of powerful tail which is used for propelling the fish forward.

(v) The direction of the fins and scales backward aid easy movement through water.

(vi) Possession of large eyes without eyelids which enables it to see predators and preys easily.

(vii) Possession of swim bladder which aids its buoyancy in water.

(viii) The silvery-white colour of the body below and black above prevent it from being seen by enemies.

**2**. **Adaptation of Birds for Flight**

These adaptive features are:

i) Possession of light body weight to ease flight.

II) Possession of feathers for protection.

ii) Possession of wings for flight.

v) Streamlined shape of the body to ease flight.

**3**. **Adaptation of Toad or Frog for** **Food, Protection and Movement**

**For Food**

(i) It possesses special olfactory organ in the head for smelling/perceiving the odour of its food.

(ii) It has the ability to draw eyes in so that they make bulges in the root of the mouth which help to prevent their prey from escaping and help in swallowing.

(iii)The tongue is attached at the front of the mouth which can be rapidly extended to capture/trap prey.

(iv)The tongue is long and sticky to hold prey.

(v) The tongue which is long helps in catching prey.

**For Protection**

(i) The skin is slimy with mucous gland which makes the animal difficult to be caught by predators.

(ii) Slimy fluid keeps the skin moist and prevents the skin from drying up.

(ii)Toad has poison glands on the skin which is poisonous and distasteful to the predators.

(iii) Brownish colour or cryptic colouration helps to blend with the colour of the surroundings and this prevents them from being noticed by predators.

(iv) Ability to alter colour to blend with the background

**For Movement**

i)A toad has long hind limb with powerful muscles which enables it to hop or jump efficiently.

ii) Absence of tail enhances hopping or jumping movement.

iii) Webbed hind limb can be used as Paddle for efficient swimming in water.

iv)The stout and short nature of fore limb absorbs shock on landing.

v) It possesses streamlined body for easy movement and swimming.

**Evaluation**

1. Highlight the adaptation of birds for flight.

2. Mention the features of toad and their uses

**Adaptation of Animals in Marine Habitat**

Animals including barnacles, fishes, crustaceans etc. found surviving in marine habitat do so with the following adaptive features;

1. Barnacles have i. protection mantle for attachment to rock shore and water retention ii. Cilia for feeding. iii. Shell that prevents dessication (drying up)
2. Fishes possess i. reduced or no kidney to retain urea in their body to cope with high salinity e.g. cartilaginous fishes like shark, dogfish e. t. c. ii. Salt secreting glands in their gills or eyes for maintaining osmoregulation (salt balance) e.g. bony fishes like tilapia, herring e. t. c. iii. Tube feet which enable them to hold on to rock shores and hard shell to prevent dessication e.g. starfish, whales.
3. Whale has i. flippers for stability in water ii. An organ in front of the nostril for detecting pressure changes in water. iii. A thick layer of dermal fat insulation or food reservoir.
4. Shrimps possess powerful claws for holding food or prey.
5. Periwinkles possess lungs for breathing and foot for attachment.
6. Crabs burrow fast into the mud to protect them against predators, strong waves or hide.

**Adaptation of Plants to Marine Habitat**

Plants such as seaweeds, algae, and diatoms are naturally found in marine habitat with the following adaptive features;

1. Seaweeds have i. hold–fast for attachment. ii. mucillagenous cover to prevent dessication. iii. Divided leaves or floating devices for buoyancy.
2. Algae (e.g sargassum) have i. chlorophyll for photosynthesis. ii. Small size or large surface area for floating in water.
3. Planktons (e.g. diatoms) possess; i. air space in their tissues ii. Rhizoid for attachment to rocks iii. Air bladder for buoyancy (floating).

**Plants Adaptation in Estuarine**

Plants found in estuaries include planktons, algae, red and white mangrove. They have the following adaptive features;

1. Planktons (diatoms) have; i. air spaces in their tissues ii. rhizoid for the attachment to rock shores iii. air bladder for buoyancy
2. Algae have: i. chlorophyll for photosynthesis ii. small size or large surface area for floating in water.
3. Red mangrove has; i. stilt roots with rootlets that have air-spaces for air conduction to the root tissues and support to prevent washing away of the plant by the tide ii. Seeds which germinate while they are still on the parent plant, thus preventing the carrying away of the seedlings by water current.
4. White mangrove has pneumatophores (breathing roots) for gaseous exchange.

**Animal Adaptation**

Animals including mosquitoes, crustaceans, mollusks, worms, fishes e.t.c. found in estuaries ;survive possessing the following features;

1. Mosquito larvae and pupae possess breathing trumpets for gaseous exchange
2. Crustaceans and water snails burrow into the mud against predators, strong waves or tides.
3. Worms have strong protective and impermeable covering against high salinity.
4. Mudskippers have fins for crawling on land and swimming in water.
5. Fishes have fins for movement and swimming bladder for buoyancy.

**Evaluation:**

1. What is a fresh water habitat?
2. Mention five animals dwelling in estuary.

**Plant Adaptation in Fresh Water**

Plants of fresh water include water lily, spirogyra, water lettuce, water weeds e.t.c. and they have the following adaptive features;

1. Water lily has i. air bladder ii. expanded tips and light weight which keep it afloat.
2. Spirogyra has mucillagenous cover for protection
3. Water lettuce has hairs in leaves to trap air and keep it afloat
4. Water weed (elodea) has a long and flexible petiole for swinging with water currents.

**Animal Adaptation**

Animals of fresh water habitats include protozoa, duck, pondskatters, hydra, fishes e.t.c. Their adaptive features include

1. Protozoa have contractile vacuole for osmoregulation in water.
2. Duck has webbed feet for locomotion and serrated beak for sieving food in water into its mouth.
3. Hydra has slippery surface, hooks and suckers for attachment to water particles.
4. Pondskatters has long legs for skating on water surface.
5. Fishes have swim bladders for buoyancy and gills for respiration.

**General Evaluation**

1. Using three plants and two animals, explain adaptation in marine habitats.

2. Give two examples of food chain in marine habitats.

3. Define an estuary.

4. State four characteristics of an estuary.

5. How do organisms adapt to life in estuary?

**Weekend Assignment**

1. Buoyancy in salt water is ensured by the following except A. divided leaves B. chlorophyll C. floating devices D. air bladder.
2. The mucillagenous cover in sea weed and spirogyra is mainly for A. protection B. osmoregulation C. avoiding dessication D. feeding.
3. Which of the following is not a fresh water habitat? A. puddle B. swamp C. stream D. sea.
4. Which of these is not an adaptive feature in a marine habitat? A. bladder for floating B. hold fast for attachment C. fur to prevent water loss D. rhizoid for attachment to rocks.
5. The following are characteristics of fresh water habitats except A. low salt content B. high salinity C. shallow water D. can be stagnant or running water.

**THEORY**

1. List five characteristics of an estuary.
2. State five adaptive features of animals in a fresh water habitat and their functions.

**Reading Assignment**

College Biology by idodo Umeh. Chapter 23, page 558-560