CHAPTER 15

ECOLOGY I
(INTERACTIONS IN NATURE I)

ECOLOGY is the study of the relationships of living organisms to each other and their surroundings/environment

There are five levels of ecological organisation
Species
Population
Community
Ecosystem
Biosphere

TYPES OF ECOLOGICAL STUDIES

Autecology:
The study of the relationships of one organisms or population of a single species with the environment

Synecology:
The study of the relationships of communities (more than one species) with the environment.

ZONES OF THE EARTH

Biosphere:
Refers to the part of the earth that can support life.

Alternatively,
It is the zone of the earth occupied by living organisms

Biosphere includes:
Lithosphere
Hydrosphere and
Atmosphere)

Lithosphere: Solid portion of the earth.
It is the outermost layer of the earth's crust. It is made up of gravel, sand and soil minerals.

Hydrosphere:
It is the aquatic/water portion of the earth.

Examples: Oceans, rivers, lakes, oasis, pools, streams, ponds etc.

Atmosphere: It is the gaseous portion of the earth.

ENVIRONMENT

Environment means: Everything in the surroundings of an organism that affect the life of the organism and other organisms.
Or
Environment is the living and the non-living factors in the surrounding that affect the organism.

HABITAT

Habitat is a particular place within the environment where an organism lives to survive successfully.
There are two main divisions of habitats namely: aquatic and terrestrial habitats

AQUATIC HABITATS (WATER HABITATS)

These are subdivided into three divisions namely, fresh water, marine and estuarine.

1. **Fresh water**
   This has low salt concentration (low salinity) and includes
   Examples of freshwater habitats
   Ponds, rivers, streams, lakes etc.

2. **Marine**
   This refers to the sea. The marine habitat is characterized with its high salt concentration (high salinity).
   Example: Sea

3. **Estuarine**
   This refers to where salt and fresh water meet.
   Example: Estuary (the mouth of a river) and Coastal Lagoons.

Water in estuarine is called **brackish water**

TERRESTRIAL HABITATS

These include;

- Arboreal (air and trees) e.g. monkeys, green mamba
- Ground e.g. sheep, goat, man etc.
- Underground (soil) e.g. earthworms, centipedes, termites, ants, woodlouse bacteria etc.

Microhabitat

A particular location within a habitat which has its special condition and in which an organism can be found.

Microclimate

The climate of the immediate surroundings of an organism.

Examples of microhabitats

(a) In Marine habitat:
Splash zone, intertidal zone, subtidal zone, crevices of rocks etc.

(b) In Terrestrial Habitat:
Grain weevil – grain
Fern – trunk of trees
Ant – bark of trees etc.
Cockroach – dark cupboards

POPULATION

Population refers to the total number of individuals of a single species living in a particular habitat.

Note: This definition is not the same as in other subjects. A biologist deals with all living things and not only human beings hence a definition without the term 'a single species' is not correct.

Examples of population

Population of monkeys in a forest
Population of water lettuce in a pond
Population of lizards in the laboratory

POPULATION DENSITY

Population density is treated under ecology II.

COMMUNITY

Community refers to all populations of different species interacting with each other in a given habitat/environment.

Alternatively
Community refers to an association of all plants and animals interacting together in a given habitat/environment.

Note: That community here is referring to interdependence of all living things in a habitat.

Example of a Community

A forest is a community
Plants, animals and bacteria in a forest form a community of different populations.

In order to explain this in an essay in exams:
Put all the different populations in the forest under three groups.
There are diffent types of plant species (populations of plants)
Also different populations of bacteria and fungi
Several populations of animals also exist.

1. Populations of all plants are considerd as producers
2. Fungi and bacteria as decomposers
3. Animals as consumers of different categories (primary, secondary etc.)

Question:

Describe the forest as a community
Alt:
Describe the interdependence of populations in a named habitat

Hint:

Plants, animals and bacteria in a forest form a community of different populations

They occur in three basic nutritional groups namely **producers**, **consumers** and **decomposers**.

How they interact

- Green plants are the producers
- Animals are mainly the consumers
- Bacteria and fungi are the decomposers
- Green plants manufacture food by photosynthesis and directly or indirectly

provide food for consumers which are mostly animals
- The plants also provide shelter
- Animals produce carbon (IV) oxide which is utilized by plants for photosynthesis.
- Animals release nitrogenous wastes which are utilised by plants as nutrients.
- Dead bodies of animals and their waste are broken down by decomposers to release nutrients
- back into the soil for plants use.

ECOSYSTEMS

Ecosystem refers interaction between all living and non living things in a given environment to produce a stable system

- Ecosystem means the interaction between the community (all living things) and non-living components of the environment/habitat.
- It also means the interaction between the biotic and abiotic components of the environment/habitat.

Categories of organisms in ecosystems
All ecosystems have the same three categories of organisms namely, producers, consumers and decomposers.

PRODUCERS
These are autotrophic organisms, which trap energy from sunlight and convert it to chemical energy in the form of organic compounds using simple inorganic substances as raw materials and serve as the origin of food chains
Alternatively,
These are autotrophic organisms, which use simple inorganic substances as raw materials to synthesise organic substances used as the basic source of food in the ecosystem.

Producers are green plants, algae and autotrophic bacteria

CONSUMERS
These are heterotrophic organisms which depend directly or indirectly on primary producers for energy in the form of food nutrients.

Organisms which feed directly on primary producers are called primary consumers whil those which feed on herbivores are secondar consumers.
Consumers are animals parasitic plants and carnivorous plants

DECOMPOSERS
These are fungi and bacteria which acquire energy and nutrients by breaking decompose complex organic molecules into simple ones resulting in recycling of nutrients
Decomposers include fungi and bacteria

Importance of decomposers
1. Recycle nutrients to prevent being locked in organisms
2. Remove waste
3. Produce humus
4. Bring about decay

Note:
- An ecosystem can persist without consumers
- A natural ecosystem is self-sufficient. Because it does not require external sou of materials such as fertilizers

How do decomposers recycle nutrients?

Recycling is continuous movement of chemicals throughout the ecosystem.
In the natural environment, recycling involves stage called decomposition which is carried o by decomposers
Micro organisms are important in recycling nutrients because
They obtain energy (food) from dead tissues saprophytes.
In this process, They secret enzymes
Which break down complex substances in organic matter (dead tissues) into simpler ones/mineral elements
which are released into the soil
To be absorbed/ reused by plants
In other words, they release locked up nutrie in organic materials into the soil

Example: humus contain nitrogen.

- Nitrogen content of humus is released into the soil as follows:
- Putrefying bacteria and fungi break down humus into ammonia
- Some plants absorb ammonia.
- The rest of ammonia is converted into nitrates in a process called nitrification by another group of bacteria called nitrifying bacteria
- This is also reabsorbed by plants

EXAMPLES OF ECOSYSTEMS

Example 1

A pond is an ecosystem

(a) Water weeds (made up of plants and algae), bacteria, protozoa and animals form the community (living components)
(b) Sunlight and inorganic materials such as water, carbon (IV) oxide and mineral salts are the non-living components/abiotic factors

How they interact

- Producers are mostly green plants and algae
- They use sunlight, inorganic materials such as water and carbon (IV) oxide to provide food for consumers which are mainly animals
- The plants also provide shelter to animals
- Plants give out oxygen during photosynthesis which animals use to respire.
- Animals produce CO_2 which the producers use in photosynthesis
- Animals also release nitrogenous wastes
- Dead bodies of animals, plants and their wastes are recycled by decomposers to release nutrients for plants use

As a result, a natural ecosystem is said to be self-sustaining because it does not need food by artificial means.

Example 2

- A forest/mountain is an ecosystem .
- Green plants (algae may not be mentioned here) and animals such as monkeys form the community (i.e. living component/biotic factors).
- Producers are mostly green plants and autotrophic bacteria which use light energy and inorganic materials to synthesise food for consumers.
- They also provide shelter and recycle oxygen and carbon dioxide.
- Consumers are mostly animals and parasitic plants and consists of herbivores, carnivores and omnivores. Herbivores and omnivores feed on green plants while carnivores and omnivores feed on herbivores.
- The animals provide nitrogen to the plants by means of their wastes.
- The animals also provide CO_2 from respiration.
- When both plants and animals die, decomposers which are mostly made up of bacteria and fungi recycle nutrients.

Question:
How do animals depend on plants in a community or an ecosystem?

Hint

- Plants provide the following
  a. Food,
  b. Oxygen,
  c. Remove CO_2
  d. Provide shelter

- Plants depend on animals as follows:
  a. Animals produce CO_2 for photosynthesis
  b. Animals pollinate and disperse plants
  c. Nitrogenous wastes of animals are useful nutrients to plants.
  d. Animals help in vegetative propagation of plants.

Note:

A pond is still an example of a habitat for an organism

A pond as an ecosystem means several smaller habitats such as: bottom (catfish), upper surface of water(algae, water lettuce) etc.

A pond is also an example of a community as well as example for an ecosystem. The difference is with the factors you consider in your explanation.

To name the pond as a habitat, it is because a particular organism leaves there successfully.

To explain the pond as a community, think of only the interactions between all living things which would be grouped into three main groups namely producers, consumers and decomposers.

To explain the pond as an ecosystem: consider how the three categories of living things interact with non-living components such as water, carbon dioxide, sunlight for photosynthesis by producers and mineral salts used by producers etc

A forest is also an example of a habitat, a community as well as an ecosystem. The difference is that: you don't include carbon dioxide, water, sunlight and mineral salts in the soil when explaining the forest as a community.

Populations form communities
Communities and physical factors form ecosystem
Ecosystems form the biosphere

ECOLOGICAL FACTORS

Ecological factors are those factors in the environment of an organism which affect the life and distribution of organisms.
Ecological factors may be biotic or abiotic.

ABIOTIC FACTORS

Abiotic factors are the non-living components of the ecosystem which affect living things in their environment.

Abiotic factors may be grouped into climatic, edaphic, topographic, salinity, tidal action etc.

Note:

1. Abiotic factors affecting all habitats are climatic which will be expanded later.
2. Abiotic factors affecting terrestrial habitat are.
   a) Climatic Factors (Rainfall, Temperature)
   b) Physiographic (altitude), mountains etc.
   c) Edaphic Factors (concerning the soil).
3. Abiotic factors affecting aquatic habitat include
   a) Salinity
   b) Tidal action
   c) Turbidity
   d) Waves
   e) Currents
   f) pH
   g) Oxygen concentration.

ABIOTIC FACTORS AFFECTING ALL HABITATS

These are climatic factors and include Rainfall, temperature, light intensity, wind spe wind direction and pressure.

RAINFALL (General)

Water is the most important ecological factor i terrestrial habitat

Importance of water

1. Makes water available/source of water for organisms
2. Rainfall patterns affects distribution of organisms (determines vegetation type an for that matter the type of animals found there).
3. It affects (lowers) temperature and affects movement of organisms
4. It affects humidity which also affects transpiration
5. It determines the level of soil erosion
6. It affects (reduces) light intensity and affects activities of organisms
7. It affects breeding season in organisms such as termites, toads, frogs, mosquitoes etc.
8. It determines the level of water table and subsequent availability of water to plants.
9. Rainfall variations cause droughts or floods which affect density of organisms.
10. It determines water level in bodies (such as rivers, streams etc) which affect life of organisms.
11. It determines turbidity of water bodies
12. It determines salinity of aquatic habitats (water bodies).

Trial Questions

1. How does rainfall influence abiotic and biotic life in the following?
   a) Biosphere
   b) Terrestrial habitat
   c) Aquatic habitat

Hint

a) Biosphere: This is general and refers to all the points above
b) Terrestrial: This refers to points 1-9 above.
c) Aquatic: This refers to points 10-12

2. How does rainfall influence other abiotic factors in general (whether terrestrial or aquatic)

Hint

- Turbidity of water bodies
- Relative humidity
- Rate of erosion
- Temperature

Note:

(1) Rainfall is the main abiotic factor that determines the distribution of vegetation.
(2) In West Africa, rainfall determines the seasons and influence the availability and movement of organisms.

a) During wet season burrowing organisms such as the rat remains in the hole for a long time.
b) During dry season
   - Some organisms move towards fresh water bodies
   - Some organisms aestivate.

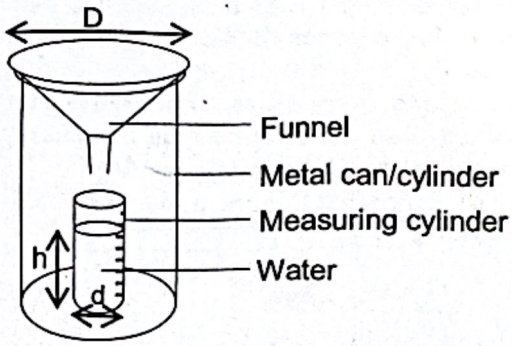
Aestivation

It is a form of dormancy in certain organisms in response to hot period.

Examples of aestivation

- The lungfish aestivates during dry periods
- Amoeba surrounds itself with a protective coat called cyst and becomes inactive during dry periods.

Instrument used to measure the amount of rainfall is the rain gauge.



Rain gauge

Rainfall is measured in millimetres using the equation

How to Measure Rainfall

- The instrument used is the rain gauge.
- Select an open area
- Fit the rain gauge in the soil.
- Leave for 24 hours
- Collect the water and record its volume in mm.
- Calculate the amount of rainfall using the formula

$$\text{Rainfall} = \frac{d^2h}{D^2}$$

Where;
D = diameter of the mouth of funnel
d = diameter of measuring cylinder
h = height of water in measuring cylinder

- Repeat the procedure over a period
- Determine the average

Precautions in using the rain gauge

1. Instrument should be placed in an open space to collect direct rain water
2. The funnel should be well placed above ground level to avoid splashing of water entering it
3. Funnel should be well inserted in the measuring cylinder to ensure accurate measurement of collected water
4. Instrument should be firmly positioned to prevent being blown by wind
5. Reading should be recorded in the morning to avoid evaporation of water before reading.

TEMPERATURE

Temperature is the second most important abiotic factor that determines distribution of vegetation.

> Aquatic habitats have narrow fluctuations in temperature

Temperature is dependent on three factors namely:

- Latitude
- season and
- time of day

Temperature influences metabolic activities (involving enzymes).
Too low or too high temperatures are not good for organisms.

Maximum temperature is the value above which enzymes are denatured and this can kill the organism

Minimum temperature is the one below which enzymes are not activated.

Optimum temperature lies between the two extremes
The Optimum temperature of an organism is the temperature with which its body cells or system works best.

Effects of temperature

1. It increases the rate of evaporation of water bodies and soil
2. It decreases humidity
3. It increases the rate of transpiration in plants.
4. It affects photosynthesis
5. It increases the rate of decomposition/decay of organic matter: high temperatures increases growth rate and metabolic activity of bacteria anf fungi which cause decay
6. It increases the rate of respiration in organisms.
7. It affects distribution and movement of organisms.
8. It affects (increases) growth in some organisms such as housefly, toad and fungi.
9. It affects oxygen concentration in water.
10. Increases the rate of metabolism in some organisms (except homoetherms)

Note:

1. **Hibernation**
   Some organisms (mammals) cannot produce and conserve enough heat to go through the cold period. Such animals undergo hibernation.

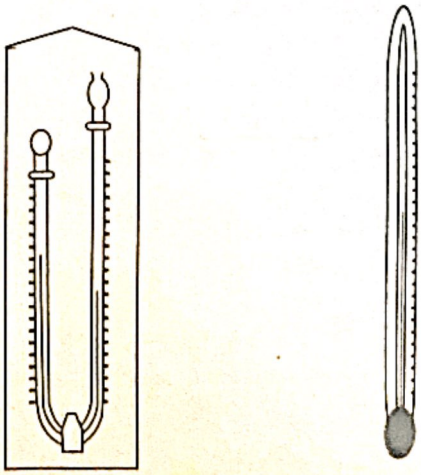
   Hibernation is the period of relatively low metabolic activity associated with periods of low temperature.

   During this period of hibernation, some animals:
   - Sleep in warm places. The rate of metabolism is reduced.
   - Energy from mostly stored fats is used to keep the basic metabolic activities needed to keep the body alive

2. Generally temperature changes does not affect aquatic habitat as the terrestrial habitat because temperature changes in water bodies does not vary as much as observed in terrestrial habitats.

3. Instrument used to measure temperature is the thermometer.

4. Maximum – minimum thermometer is used to determine the (highest) and lowest temperatures reached during the day.



Maximum and minimum thermometer

How to measure Temperature

- The instrument used is the thermometer.
- Select the habitat.
- Place the bulb of thermometer vertically in the medium to be measured.
- Leave for few minutes (between 1 and 5 minutes).
- Read off the level of mercury/liquid in the narrow bore.
- Repeat this for about two times to determine the average of the three readings.

Precautions

1. The stem of the thermometer should not be held in the palm while using the thermometer.
2. The bulb should be clean and dry.
3. The thermometer should be allowed to remain for few minutes before the readings taken.

Trial Question

1. Explain why aquatic environments have more stable temperatures

Hint:

Temperature changes are minimum with less extreme temperature changes
Don't forget that water has a high specific heat capacity hence needs a lot of energy to bring about significant change in temperature

LIGHT

Factors of light which affect the biotic components of the ecosystem are

- Light intensity
- Wavelength
- Duration (photoperiod)

Effects of Light

1. Source of energy for photosynthesis
2. Needed in formation of pigments. e.g. chlorophyll in plants and melanin in human.
3. Needed for vision and movement in some animals. (migration)
4. Affects stomatal opening and as a result affects the rate of transpiration.
5. Ultra-violet ray in sunlight is required to synthesise vitamin D in the skin of mammals.
6. Induces movements (phototropic, photonastic and phototactic movements).
7. Affects growth in some organisms/plants.
8. Affects flowering in plants (photoperiodism).

Photoperiodism

Photoperiodism is the effect of relative length of day and night on physiological activities of some organisms.

Corn plants under street lights will grow faster but do not bear fruits because, the 24-hours light increases the rate of photosynthesis but affects the reproduction cycle
Some plants need some amount of **darkness** for some period of time to flower and bear fruits.

Short day plants: need **longer nights** to produce flowers. These plants flower during the short day season of the year when nights are longer.

e.g. strawberry

Long day plants: need **shorter night** periods to produce flowers. They flower during the long day season of the year when nights are shorter.

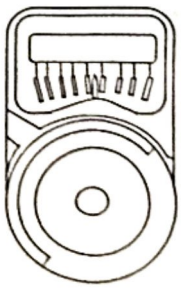
e.g. pear and apple.

Day neutral plants: do not flower in response to light and dark periods.

e.g. tomatoes and carrots

Instruments used to measure light intensity

- Aquatic habitat: Light intensity probe
- Terrestrial habitat: Light meter/photometer



Photometer

Question

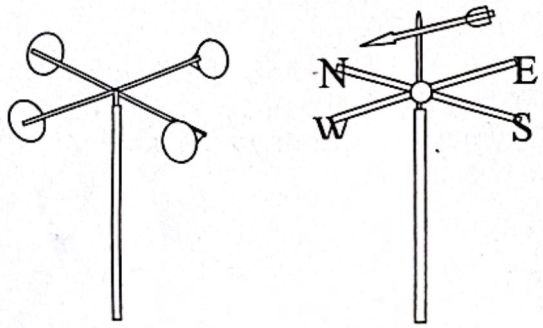
What are the main effects of light on plants and animals.

Hint:
Growth
Photosynthesis
Flowering
Migration

WIND
Wind is air in motion.

1. It affects movement of clouds and rainfall.
2. It affects the rate of erosion.
3. It increases the rate of evaporation of water bodies and soil
4. It affects movement of flying animals
5. It is an agent of pollination and dispersal
6. It increases the rate of transpiration
7. It decreases relative humidity
8. It causes water current and waves
9. Affects distribution of vegetation and other organisms
10. It affects temperature.

Instruments used to measure wind
1. Speed of wind : Anemometer
2. Direction of wind: Wind vane



Anemometer Wind vane

How to measure the direction of wind
- The instrument used is the wind vane
- Observe the direction of the arrow at a particular time
- Record the direction
- Repeat this at 1 hour interval for 6 times.

How to measure the speed of wind
- The instrument used is the anemometer.
- Expose the anemometer into an open field
- Count the number of times the arm swings in 1 minute / a specified time interval
- Repeat for six times

PRESSURE
Pressure is the force acting on a unit area of a surface
1. It affects distribution of organisms e.g. organisms at deeper layers of the ocean leave in condition of high pressure and adapted to suit this condition. However, such organisms cannot survive near the surface waters.
2. It affects concentration or availability of gases
3. It affects the rate of transpiration i.e. Transpiration rate decreases with increasing pressure.
4. It affects breathing rate. Rate of breathing increases as atmospheric pressure decreases

Instrument used to measure pressure
- Barometer
  Pressure is measured in Pascals (Pa)

ABIOTIC FACTORS AFFECTING TERRESTRIAL HABITATS ONLY

These include: humidity, physiographic and edaphic factors.

HUMIDITY
Note that humidity is the only factor that does not directly affect aquatic habitat but affects terrestrial habitat only.

Humidity refers to the measure of amount of moisture in the atmosphere.

Relative Humidity (RH) is the percentage ratio of the moisture in the air to the amount the air can hold if it were saturated at the same temperature and pressure.

Alternatively,
It is The amount of water vapour in the air compared with the amount the air can hold at that temperature and pressure

Effects of relative humidity
1. It affects transpiration: High humidity decreases the rate of transpiration
2. It affects distribution of organisms
3. It affects evaporation of water bodies and soil

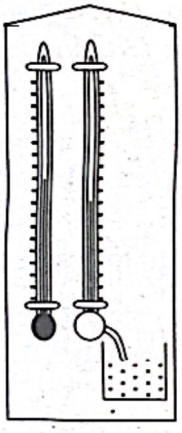
4. It affects the rate of water loss from the body of organisms
5. It increases the rate of decomposition because high humidity increases growth of fungi and bacteria responsible for decomposition/decay.

Adaptive Features of some organisms to reduce water loss in the presence of low humidity:

1. Plants – cuticle
2. Mammals- hair/fur
3. Birds – feathers
4. Reptiles – scales
5. Insects – chitinous exoskeleton

Note: Organisms which lack such devices are restricted to humid environment e.g. the moss and termites.

Instrument used to measure humidity is the hygrometer.



Wet and dry bulb hygrometer

Description

Hygrometer is made up of
Wet and dry bulb thermometers
Two thermometers mounted side by side
The bulb of one is surrounded by the air in the surrounding
The bulb of the second thermometer is wrapped in a moist cloth with its base immersed into a liquid in a container below it.
Because of the different conditions, that is, dry air and wet cloth in direct contact with the two different bulbs, the thermometers will show different readings in temperature at any time with the wet bulb showing the least value at all times.

Temperature readings of wet bulb thermometer are lower because the cloth uses energy from the bulb to form water vapour
The readings of the wet bulb thermometer depends on the amount of vapour formed which is determined by how much water molecules are in the atmosphere

Method of using the hygrometer:

Two thermometers stand side by side
Dry bulb thermometer has its bulb in open air
Wet bulb thermometer wrapped in a wet cloth
Allow to stand for few minutes
Read the temperatures of the two thermometers
Record their values
Difference in the temperature reading is compared with a standard scale to determine the relative humidity

Precautions

1. Liquid in the container must be air tight so that it doesn't evaporate
2. The dry bulb must not be held with the hand

PHYSIOGRAPHIC FACTORS (TOPOGRAPHY)

These refer to features on the surface of the earth or characteristics of landscape e.g. mountains or altitude, slope angle and aspect etc.

Physiographic factors are:

Altitude
Slope: Angle of slope and Aspect

The main topographic factor is altitude

ALTITUDE

Altitude is the height of a place above sea level

Generally, Altitude affects
Precipitation
Temperature
Breathing
Gases
Transpiration

Effects of Altitude

1. Decreases temperature.
2. Affects distribution of organisms

Example: Thicker population density of vegetation and animals in the valley than the mountain top.

3. Reduces atmospheric pressure and subsequent gas concentration
4. Increases breathing rate and concentration of red blood cells.
5. Increases the rate of transpiration
6. Rainfall: Increases precipitation
7. Leads to speciation

SLOPE

Slope is considered in terms of:
Angle or steepness of slope
and
Aspect: which means direction of slope (with respect to the north, south, east or west)

Angle of Slope

1. Steepness increases drainage and rate of erosion. It reduces water content of soil
2. Steepness promotes well developed roots.
3. Affects distribution of organisms

Generally along a slope

Corse sand at the top
Fine sand at the bottom
Drier soil at the top
Thicker population of plants at the bottom
Sparse population of plants at the top

Instrument used to measure slope is the slope gauge

Aspect: means direction of slope with respect to the north, south, east or west
Does the slope face the north, south, east or west?
Aspect will affect direction of sunshine
Hence the following results:
Affects light intensity (solar radiation).
Solar radiation affects moisture
Aspect affects temperature
Aspect affects vegetation

Trial Question

Name three effects of altitude on abiotic factors

Hint:
High altitude Reduces temperature
High altitude Reduces atmospheric pressure
High altitude Increases formation of rainfall

EDAPHIC FACTORS

These are factors concerning the soil and include the

- nature of the soil particles,
- humus
- mineral content of the soil
- depth of water table.
- pH
- texture
- capillarity

ABIOTIC FACTORS THAT AFFECT AQUATIC HABITATS ONLY

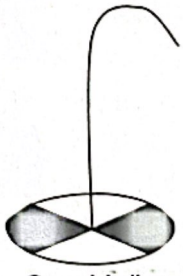
These are salinity, turbidity, tidal action (wave action, ocean current) and amount of dissolved oxygen

Turbidity

This refers to the degree of cloudiness of water bodies as a result of the effect of suspended matter in water.

1. It reduces vision in aquatic animals
2. It reduces light intensity and affects photosynthesis.
3. It affects distribution of organisms

Instrument used to measure turbidity is the Secchi disc



Secchi disc

Measurement of turbidity

The instrument is Secchi disc
Select the water body to be determined
Slowly sink the black and white metal disc into the water body
Note the depth at which the metal just cannot be seen
Record the depth

Repeat for other habitats or parts of the same water body and compare the values

Note: the black and white background provides a good contrast.

Salinity
This refers to the amount of dissolved salt in water.
Salinity affects osmotic balance in organisms.

BIOTIC FACTORS

Biotic factors are living organisms that interact and affect life of an organism in its habitat.

USEFUL BIOTIC FACTORS

1. Insects as agents of pollination.
2. Birds and bats as agents of pollination.
3. Birds and rodents as agents of dispersal.
4. Earthworms burrow and aerate soil.
5. Earthworms and termite break leaf litter to form humus.
6. Bacteria and fungi as decomposers.
7. Trees provide shade and shelter.
8. Nitrogen fixing bacteria in the root nodules of legumes (mutualism).
9. Tall trees supporting epiphytes (epiphytism).

HARMFUL BIOTIC FACTORS

1. Parasitism
2. Predators/carnivores/herbivores (grazers)
3. Cannibalism.
4. Human activities

Human is the most harmful biotic factor.
Examples of human activities that harm the ecosystem include.

- Urbanization: The growth of smaller towns into cities
- Road construction
- Agricultural activities
- Mining
- Bush burning

Effects of agricultural activities on the ecosystem

1. Excessive use of agrochemicals pollute the environment
2. Bush burning encourages desertification.
3. Excessive use of fertilizers
4. Ploughing may cause erosion

Cannibalism
Animals kill and feed on individuals of the same species

QUESTIONS

1. Different populations co-existing within is referred to as...
   A. species
   B. society
   C. community
   D. race.

2. Ecology is the study of ...
   A. different species of organisms in a given area
   B. the interrelationship between plants and animals
   C. interrelationship between organisms and their environment.
   D. the characteristics of habitats.

3. Corn plants under street lights do not bear fruits because.
   A. the corn needs more sunlight
   B. of the light temperature during the night.
   C. the corn needs long period of darkness
   D. the 24-hours light affects the reproduction cycle.

4. Which of the following describes the biosphere?
   A. The dominant species in the community
   B. The non-living parts of the ecosystem
   C. All ecosystems and the organisms which inhabit them.
   D. All the living parts of an ecosystem

5. Which of the following is an abiotic factor?
   A. Parasite
   B. Litter
   C. Predators
   D. Grazers

6. Which of the following factors increases the rate of water loss in animals?
   A. Low humidity
   B. low pH
   C. low temperature

D. high air pressure

7. Day length interferes with
   A. fertilisation
   B. flowering
   C. germination
   D. pollination

8. Organisms in aquatic habitats are not affected by
   A. humidity
   B. rainfall
   C. temperature
   D. turbidity

9. Fish survives in water because it has
   A. scales
   B. gills
   C. tail fin
   D. streamlined body

10. The major problem facing most freshwater organisms is
    A. desiccation
    B. osmotic balance
    C. temperature
    D. floatation

11. The main function of decomposers in an ecosystem is to ...
    A. provide energy for the producers
    B. eliminate waste product
    C. recycle nutrients
    D. provide energy for consumers

12. Breathing is difficult at high altitudes because...
    A. the diaphragm muscles fail to contract
    B. atmospheric air pressure at high altitudes is too low
    C. atmospheric air pressure at high altitudes is too high.
    D. Temperature at high altitude is too low

13. What instrument is used to measure turbidity?
    A. Anemometer
    B. Hydrometer
    C. Hygrometer
    D. Secchi disc

14. The major problem facing organisms living in small water bodies is
    A. drying up
    B. oxygen deficiency
    C. being dislodged
    D. wave action.

15. Communities in ecosystems are named after the
    A. dominant species
    B. habitat
    C. pioneer species
    D. populations

16. A group of organisms of the same species in a given habitat constitutes
    A. a community
    B. an ecosystem
    C. a biome
    D. a population

17. Which of the following arrangements is the correct ranking in terms of increasing size?
    A. Habitat, ecosystem and biosphere
    B. Habitat, biosphere and ecosystem
    C. Biosphere, ecosystem and habitat
    D. Ecosystem, habitat and biosphere

18. Aestivation in animals enables them to
    A. withstand drought
    B. regain energy
    C. undergo internal changes
    D. withstand cold

19. The instrument used to determine relative humidity is the
    A. anemometer
    B. barometer
    C. hygrometer
    D. hydrometer

20. Which of the following factors is **not** associated with aquatic habitat?
    A. Salinity
    B. Turbidity
    C. Temperature
    D. Edaphic

21. Which of the following instruments is used to measure the speed of a stream?
    A. Simple float
    B. Secchi disc
    C. Quadrat frame
    D. Rain gauge

22. Which of the following is **not** regarded among biotic factors in an ecosystem? Effect of
    A. parasites
    B. grazers
    C. rainfall
    D. urbanization

23. Turbidity refers to
    A. thermal stratification of water bodies
    B. the degree of cloudiness of water bodies
    C. the distribution of plants in water bodies.
    D. the degree of faecal pollution of water bodies.

24. The difference between a community and population is
    A. a community is made up of organisms of the same species whilst a population is made up of organisms of different species
    B. a community is made up of populations of living organisms whilst a population is made up of organisms of the same species
    C. an ecological niche does not exist in the community but it does in a population
    D. a community attracts competition but a population does not

25. The maximum and minimum thermometer is used to measure
    A. light intensity
    B. highest and lowest temperature of the day
    C. soil temperature
    D. temperature in aquatic habitat

ANSWERS TO OBJECTIVE TEST

1C 2C 3D 4D 5B 6A 7B 8A 9B 10B 11C 12B 13D 14A 15A 16D 17A 18A 19C 20D 21A 22C 23B 24B 25B

ESSAY

1. Explain the interdependence of plants and animals in a named habitat

Hint:

The habitat is the forest

Obtain the points from the roles played by plants and animals in a forest community excluding decomposers:

- Green plants are the producers
- Animals are mainly the consumers
- Green plants manufacture food by photosynthesis and directly or indirectly provide food for animals
- The plants also provide shelter
- Animals produce carbon (IV) oxide which is utilized by plants for photosynthesis.
- Animals release nitrogenous wastes utilised by plants
- Dead bodies of animals and their wastes are to release into the soil as nutrients for plants use.

2. Explain briefly the following ecological terms:
   (i) Biosphere;
   (ii) Habitat.

CHAPTER 16

ECOLOGY I

THE STUDY AND ADAPTATIONS TO SPECIFIC HABITATS

ADAPTATION

Adaptation is the possession of special physical, physiological and behavioural characteristics which enable an organism to live successfully in its habitat.

Adaptation makes organisms to
1. Obtain food
2. Escape danger/enemies
3. Secure mates
4. Regulate body temperature
5. Conserve water

Why is adaptation necessary?

It is necessary because each habitat has characteristics which pose problems hence the need for organisms living there to adapt themselves in order to be successful

.

Note:
Failure or inability to adapt will result to **extinction** of the organism

Structural Adaptation is the possession of **physical** features on an organism which enable it to live successfully in its habitat.

Examples:
Shape of beak
Bright colours
Feet
Claw
Body covering

Structural adaptstions help organisms to escape danger, cope with weather etc

Examples of structural adaptations to cope with weather conditions:
Fur in mammals,
Feathers in birds,
Scales in reptiles and
Cuticle in plants

These are structural adaptations to cope with temperature.

Behavioural adaptation
Behavioural adaptation is the way an animal **acts** to sustain life or for the benefit of reproduction, cope with weather, escape enemies etc.

Examples of behavioural adaptations
1. Division of labour in social insects
2. Courtship behaviours to attract opposite sex such as communication, singing in birds, display (exhibition of beautiful colours and body movements or dances) territorial behaviours etc.
3. Burrowing to escape extreme climate
4. Basking in the sun by the lizard
5. Territorial behaviour in lizards and birds
6. Communication: such as in insects
7. Moving in groups
8. Migration to warmer regions in winter
9. Defence
10. Rolling or feigning death to avoid danger
11. Nocturnal habit/to avoid danger
12. Hibernation in cold weather
13. Aestivation in (drought) dry environment

Flora: Plant life in a particular habitat
Fauna: Animal life in a particular habitat.

AQUATIC HABITATS

Aquatic habitats cover about 75% of the earth surface

The main subdivisions of aquatic habitat are; freshwater, marine and brackish water.

Recall that, the major abiotic factors affecting aquatic habitats **only** are turbidity, salinity and wave action

Ponds and lakes are most suitable habitats for life due to their stable environmental conditions.

Problems in Aquatic Habitats

1. Tendency of being carried away by waves and water current
2. Problems with drying up in the case of small water bodies.
3. Osmotic balance
4. Oxygen deficiency
5. Low light intensity for primary producers and reduced visibility in animals

Advantages of Aquatic Habitat

1. Provides more stable environmental factors.
2. Water supports organisms.
3. Provides easy contact with food.
4. Provides medium for reproduction.

Introduction to aquatic organisms

Aquatic organisms fall into three categories namely plankton, nekton and benthos.
Surface water organisms are made up of plankton and nekton whilst bottom dwelling ones are referred to as benthos.

Plankton

Small to microscopic organisms on or near the surface waters that are carried along by water waves/current because they are too small to swim against the currents.
Alternatively
Plankton is a collective term for small to microscopic organisms which float.

Plankton consists of phytoplankton and zooplankton.

Phytoplankton

Photosynthetic plankton.
Are all producers.

Examples of phytoplanktons

Diatoms, green algae and golden algae.

Importance of phytoplankton

1. Producers in aquatic habitat
2. Recycle CO_2 in the atmosphere
3. High population can poison aquatic life forms in the ocean.
4. Dead plankton provide shelter for bottom dwelling organisms in estuaries

Zooplankton:

Non photosynthetic plankton
Are consumers.

Examples of zooplankton

It comprises protozoa, small crustaceans, worms, molluscs, eggs and larvae of many animals.

Nekton

Freely swimming animals.
All are consumers.

Examples of nektons

Fishes, crabs and prawns.

FRESH WATER HABITATS

Freshwater habitat means aquatic habitat characterised with low salt concentration (low salinity). Freshwater comprises rivers, streams ponds, lakes etc.

Some problems include availability of gases at low concentrations and in dissolved forms. Also there is a problem of drying up in the case of small water bodies.

However the most stable abiotic factor that in other words least affects the freshwater habitat is **temperature**.

Classification of freshwater ecosystems

Freshwater ecosystems are classified according to the speed of water.

Freshwater **lentic** and freshwater **lotic**

Freshwater **lentic** is the one with nonflowing water of low salinity.

Examples: Lakes and ponds

Freshwater **lotic** is the one with flowing water of low salinity.

Examples: Rivers and streams

PONDS

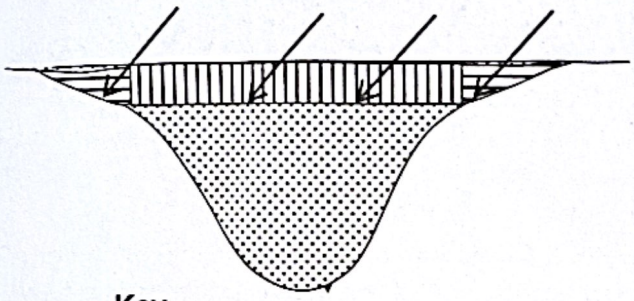
A pond is a smaller shallow depression filled with water.
There is little or no flow of water hence has more stable abiotic factors.

All parts of a pond are penetrated by sunlight hence support plant growth better.

LAKES

A lake is a large water-filled depression in earth's surface

A lake has three ecological zones (or three habitats)



Key

← Sunlight

Littoral zone

Limnetic zone

Profundal zone

1. Littoral zone: Shallow water zone where sunlight penetrates to the bottom
2. Limnetic zone: Mass of water covering the deep water zone, which receives sufficient light.
3. Profundal zone: Zone of deep water which lacks sufficient sunlight for photosynthesis.

- Photic zone: General term for area of aquatic environment where light penetrates and photosynthesis can occur.

Littoral zone + Limnetic zone = Photic zone

Differences between a pond and a lake

Pond	Lake
Shallow	Deep
Small in size (covers smaller area of land)	Large in size (covers large area of land)
Low or no water current or wave action	Higher water current and wave action
Light penetration is high or almost complete	Low light penetration
Low species diversity and Few food webs	High species diversity and More food webs
Small number of niches	Large number of niches

STREAMS

A stream is a seasonal flowing water body smaller than a river.
One major problem of streams is drying up.

Instrument used to determine speed of streams is the simple float

FRESHWATER ANIMALS

Examples of Freshwater Animals

Hydra, Daphnia (water fleas), crabs, water boatman which live under water, Gerris (pond skater) which lives on the surface, Tilapia, frog, tortoise, snakes, lobsters etc.

Problems with freshwater habitat

The major problem facing animals and protists is osmoregulation because they have body fluids hypertonic to freshwater.

Adaptations of Animals to Freshwater Habitat

1. Some possess gills for gaseous exchange in water e.g. Tilapia, crab tadpole
2. Some possess swim bladder for buoyancy.
3. Possession of streamlined shape for easy movement e.g. Tilapia, frog.
4. Some have lateral line to detect vibration in water e.g. Tilapia.
5. Some have fins for swimming e.g. Tilapia.
6. Some have slimy body surface for easy movement e.g. Tilapia.
7. Some possess suckers for attachment onto vegetation in order to avoid being carried away by water waves.
   e.g. Hydra.
8. Some carry air bubbles for gaseous exchange e.g. water boatman, Notonecta corixa.

FRESHWATER PLANTS

Plants which live permanently in water are known as **hydrophytes.**
The major problem is that gases are available in low concentrations and also occur in dissolved forms.

Examples of freshwater Plants

Water lettuce,
Water lily,

Ceratophyllum,
Elodea,
Lemna (duckweed),
Hyacinth and
Vallisneria.

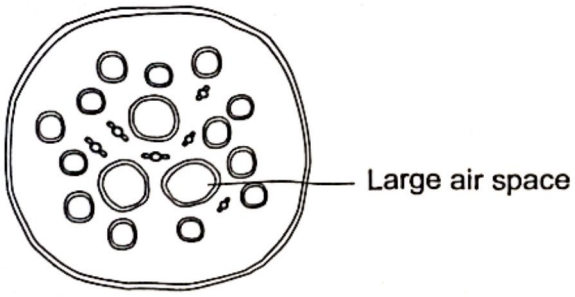
Hydrophytes:
Plants which grow in aquatic habitats

Economic Importance of Hydrophytes

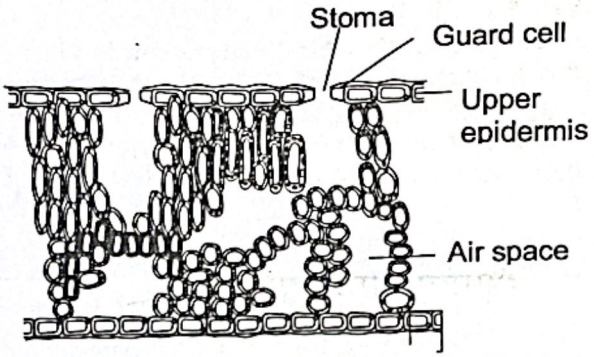
1. Source of food
2. Shelter for some aquatic animals
3. Some are used as fibre for paper e.g. water Hyacinth
4. Some are cultivated as absorbers of pollutant.
5. Obstruct passage of ships
6. Problems in irrigation ditches.
7. Used as green manure
8. Energy production/ biofuel

Adaptations of Hydrophytes to Freshwater Habitats.

1. Large air spaces (lacunae) for buoyancy
2. Stomata on upper surface of floating leaves for effective gaseous exchange .
3. Waxy cuticle to repel water
4. Leaves with large surface area for maximum absorption of water and sunlight.
5. Thin cuticle in submerged plants for absorption of water and mineral salts.
6. Flexible stems and leaves in submerged plants in order to withstand wave action.
7. Flowers are raised above water for easy pollination.

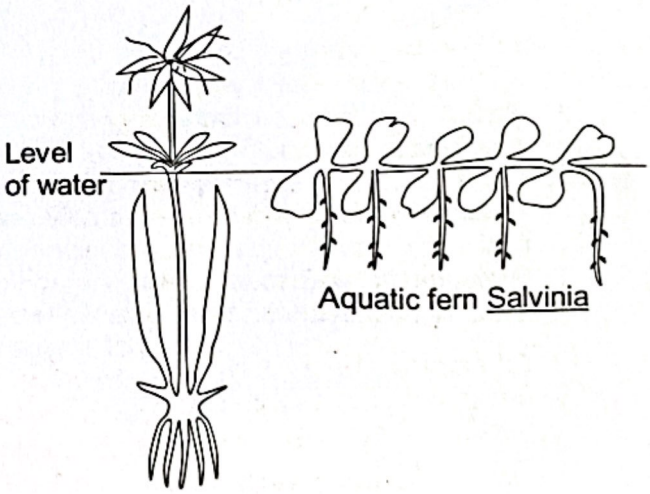


TS of petiole of water plant such as Nymphaea

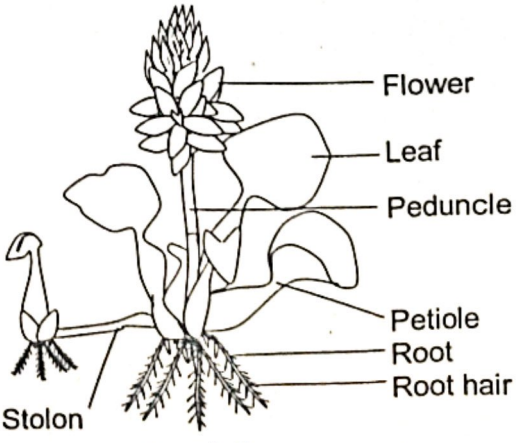


TS of leaf of hydrophyte

Duckweed Lemna



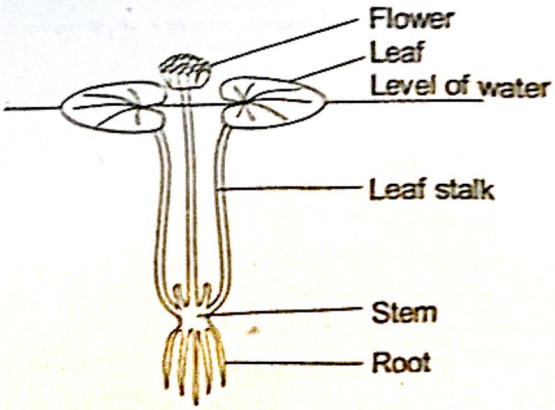
Water spider lily Crinum



Hyacinth

THE WATER LILY (NYMPHAEA sp)

It is a hydrophyte with roots anchored to the bottom of the pond. It has a very short stem. It has very long leaf stalks which carry leaves to float on the surface of water.



Water lily Nymphaea sp

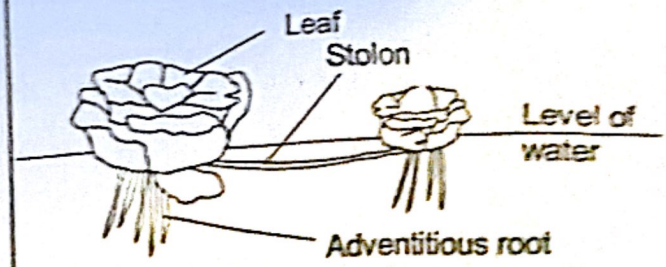
Adaptive Features of Nymphaea

1. Stomata on the upper surface of leaves for gaseous exchange.
2. Waxy cuticle on upper surface of leaves repel water. (Waxy cuticle prevents entering of water which is capable of reducing the rate of carbon dioxide absorption).
3. Large air spaces (called lacunae) in leaf stalk (petiole) which enable floating of leaves and efficient gaseous exchange in the roots.
4. Broad leaves for efficient gaseous exchange.
5. Flexible leaf stalk to withstand wave action.
6. Long leaf stalk to carry leaves on the surface of water to receive maximum sunlight and diffusion of carbon dioxide for photosynthesis.
7. Flowers are raised above water to enable pollination

THE WATER LETTUCE

(A surface dwelling hydrophyte)

It is a hydrophyte found in ponds and lakes. It floats on the surface of water. The leaves are not submerged and the roots are not anchored to the bottom of the pond.



Water lettuce Pistia stratiotes

Adaptive features of water lettuce to habitat

1. Spongy leaves (leaves with large air spaces) for buoyancy
2. Presence of water repelling hairs to prevent entering of water.
3. Waxy cuticle on leaves prevents entering of water.
4. Adventitious roots for absorption of water and mineral salts.

CERATOPHYLLUM

Free floating but submerged hydrophyte. The entire plant is submerged but not rooted to the bottom. Unlike the *Nymphaea sp*, it may be found in flowing water bodies

Have numerous compound leaves with pin-like leaflets (or it has small but numerous pin-like leaves).

Ceratophyllum

Adaptive features of Ceratophyllum to habitat

1. Flexible stem and leaves to withstand wave action.
2. Thin cuticle for absorption of water and mineral salts.
3. Pin-like leaves allow movement in water.
4. Numerous leaves provide large surface area for absorption of water, mineral salts and sunlight.
5. Presence of nodes and buds for vegetative propagation.

MARINE HABITAT

Marine habitat is made up of the shore, ocean, estuary and lagoon.

BASIC TERMS

Shore: zone of contact between the land and the sea. It comprises the splash zone and the intertidal zone/littoral zone.

Splash zone: The region just above the high tide mark.

Inter-tidal zone: the region between the high and low tide marks.

ABIOTIC FACTORS AFFECTING MARINE HABITAT

Salinity, pressure, density of sea water, turbidity, waves, tides, current, temperature, and low gas concentration.

TIDES

Changes in water level as it is observed along the shore around the earth.

Definition: Tides are periodic rise and fall of ocean water approximately two times a day (occurring about every twelve hours) in response the pull of the moon and the sun.

High tide: Maximum water mark/level reached during the day/highest level of tide. It occurs twice a day.

Low tide: Minimum water mark/level during the day/lowest level of tide.
Low tide occurs between the time intervals of two high tides.

Causes of Tides

Tides are caused by the gravitational pull of the moon and the sun on ocean waters and the spinning action of the earth.
However, the moon has a greater effect because it is closer to the earth than the sun is.

Tides depend on the position of the moon.

On the side of the earth facing the moon, ocean water is pulled towards the moon making water to form a tidal bulge.
At the same time the point of the earth facing away from the moon experiences a high tide (its maximum water level). This one being caused by the rotation of the earth and inertia of water.

This implies two high tides occur at each point in time on the surface of the earth.
Also due to rotation of the earth, each point of the earth experiences high tide twice a day (in one rotation). The two tides occur at a uniform time interval.

Low tide occurs between the two high tides.

Spring Tides and Neap Tides

The heights of high tide and low tide vary from day to day as a result of the changing effect of the pull of the moon and the sun.
A high tide is at its highest point level when the sun and the moon are in a straight line with the earth (in phase). Twice a month at new and full moon the sun and the moon occur in a straight line with the earth (are in phase) and their effects combine to produce higher than normal tides. These are called spring tides. At these times, low tides are lower than the normal.

Twice a month in the first and third quarter phases of the moon, the moon and the sun are at right angles, high tides are lower than the normal and there is a little difference between high and low tides.

Spring tide is the highest level of high tide formed when the moon and the sun are in phase to produce the maximum combined effect.

It occurs twice a month, at new and full moon when the moon and the sun are in phase with the earth

Neap tide is the lowest level of high tide formed when the moon and the sun are at right angles to each other.
It occurs twice a month, in the first and third quarter phases of the moon when the moon and the sun are at right angles

OCEAN WAVES

Most of the constant motion of ocean water is in the form of waves.

Definition: Water wave is the turbulent movement of water as a result of wind moving over the water.

Explanation

Waves are caused by wind. When wind blows over the surface it causes water to flow with it, but because water flows slower than wind, the water piles up forming a wave.

As waves move nearer the shore, water is shallow and wave touches the bottom. When water wave touches the floor, its speed slows down, but height increases.

When wave height becomes too great, the crest breaks and water is thrown forward.

OCEAN CURRENT

Water current means water flowing in one direction.

There are two components of ocean current namely, surface ocean current and deep ocean current

Surface current is the horizontal movement. It is caused by planetary winds and rotation of the earth

Deep current is about vertical movement of water.

It is caused by difference in density of water.

Explanation

Planetary winds cause surface water to move. However, rotation of the earth causes it to move in a particular direction thereby generating surface current.

Surface current involves the horizontal movement of water. This is initiated by planetary winds which cause surface water to move. Moving water is made to move in a particular direction by the earth's rotation.

Deep water current is about vertical movement of water to replace moving water by horizontal water current. Deep water current (vertical movement of water) is caused by difference in density between the surface and deeper waters. Density difference between surface and deeper waters is determined by temperature and salinity.

When water at the surface cools, it becomes denser and sinks

SALINITY

Salinity means: Concentration of salt solution in oceans.

Average salinity of oceans is 35.2 per 1000

Factors Affecting Salinity of Ocean

1. The rate of evaporation
2. Amount of added freshwater by rainfall and rivers etc.
3. The degree of water mixing with ocean currents.

LIGHT

Light is needed for photosynthesis

There is maximum light penetration to the floor of the continental shelf(200m deep)

Light intensity decreases down in deep sea zone (beyond a depth of 200m).

As a result, there is a reduced photosynthetic activity in deeper zones leading to low oxygen concentration

Photic zone refers to the area of the ocean where there is maximum light penetration and photosynthesis.

Aphotic zone refers to the area of the ocean where light does not reach and there is no photosynthesis.

TEMPERATURE

Temperature of water decreases in deeper waters.

DIVISION OF MARINE ENVIRONMENT

There are two basic divisions: water environment and botto interface

- Pelagic zone: Areas within the waters.
- Benthic zone: Areas within the ocean floor.

(a) Pelagic zone may be subdivided into neritic waters and oceanic waters.
Pelagic zone above the continental shelf is called neritic waters
Pelagic zone above the open sea/deep sea zone is the oceanic waters

- **Neritic water**: refers to water covering the shallow zone to about 200m.deep and covers a horizontal land mass of between 50km and 100km.

  The margin of land covered by the neritic water is called the continental shelf

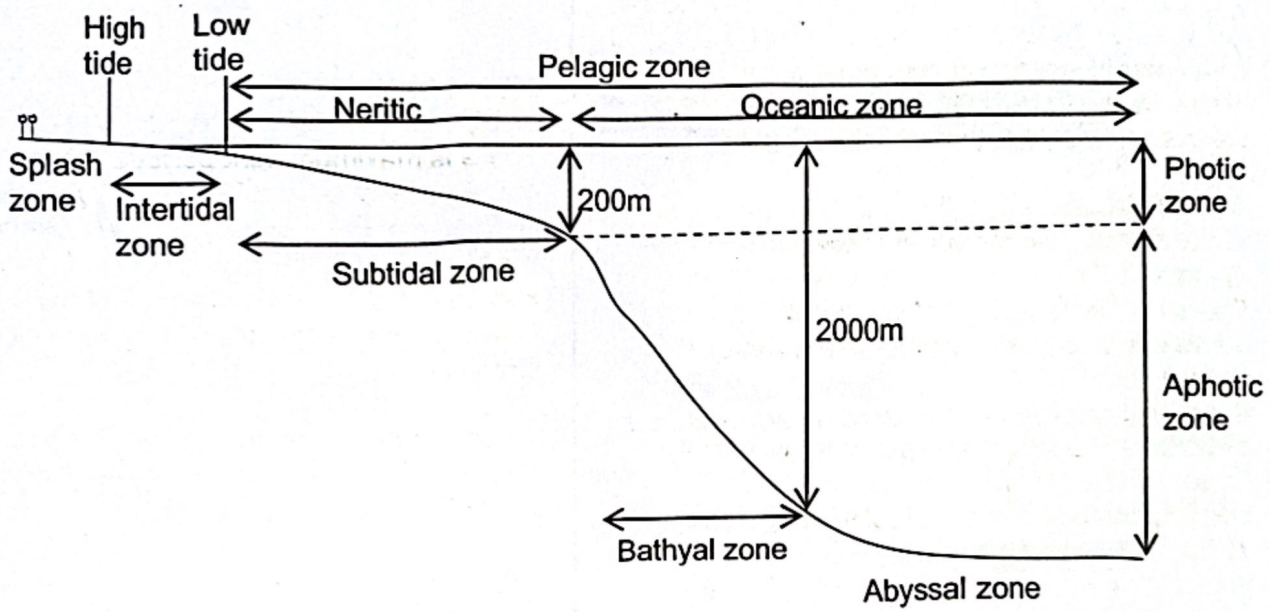
  Alternatively, **neritic water** may be referred to as water mass above the continental shelves.

- **Ocean waters**: water mass covering the deep sea zone/beyond the depth of 200m.

  Alternatively, it is the water mass beyond the continental shelves.

(b) Benthic zone: may be subdivided into intertidal, bathyal and abyssal.

As a result of this system of division, we have:
supralittoral/splash zone, littoral or intertidal zone, sub littoral or subtidal, bathyal, abyssal, neritic and oceanic



DIVISION OF MARINE ENVIRONMENT IN TERMS OF HABITAT

1. **Splash zone / Supralittoral zone / Spray zone**

- it is the region just above the high tide mark.
- it is wetted by the spray from breaking waves.
- it is covered only at extreme high tides or by Tsunami.
- Plants living here have salt gland

Examples of animals found here are: Periwinkle snail (Littorina), limpets such as Patella, ghost crab and shore louse

2. **Intertidal zone/Littoral zone**

- It is the region between high and low tide marks.
- It is covered with water during the high tide and exposed to air during the low tide.
- It is characterised by wave actions
- There is a fluctuation between aquatic conditions at high tide and terrestrial conditions at low tide (drying).
- Also there is the tendency of organisms being carried away by wave action.
- Wide fluctuation in temperature and
- salinity.
- It is the hardest zone

However the zone has maximum light penetration.
Organisms have holdfast to prevent being carried away by tides.
The zone has the maximum population.
Population of organisms increases towards the low tide mark.

Examples of organisms in the intertidal zone are: Clams, barnacles, limpets, mussels (a two-

shelled mollusc), sea anemone, sea urchins, sea stars(porpularly referred to as star fish), algae.

3. **Subtidal/Sublittoral Zone/neritic zone**
It is the region of the bottom of the ocean that extends from the low tide mark to a depth of about 200m.
Mostly covered with water and only exposed during extreme low tides
This is the continental shelf
Light is present for photosynthesis hence no food problem
Most animals in the intertidal zone are also found here.

Examples of animals in this zone are snails, crabs, lobsters, **corals**(cnidarians).
Refer to Cnidaria under classification II

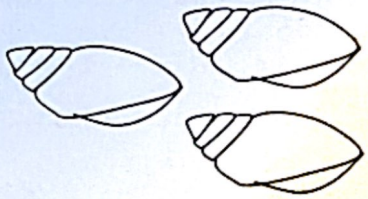
4. **Bathyal zone**: It is the region of the bottom of the ocean beyond the continental shelf (a depth of 200m) to the depth of about 2000m.
There is little or no light in this zone
It has lower but constant temperatures than waters above
It has higher pressure because of large volume of water above
Organisms exhibit bioluminescence to communicate
The zone is unfavourable for life.

Animals found there include: octopus, shark etc.

5. Abyssal zone: It is the region of the bottom of the ocean beyond the depth of 2000m to the ocean floor.
The zone is characterised with darkness, very cold waters, high pressure, very little oxygen, still waters and very little food. Since there is no light, the food is detritus from above.
No plant life in this zone

Examples of animals in this zone are sea cucumbers (echinoderm), sea urchins, clams, worms, shark, cat-fish, and whales.

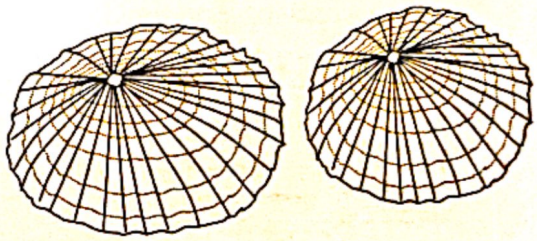
Note:
Waters covering the continental shelf/subtidal zone is called **neritic**
Waters covering the region beyond the continental shelf the deeper part is referred to as **oceanic** or **open sea zone**



Littorina (periwinkle snail

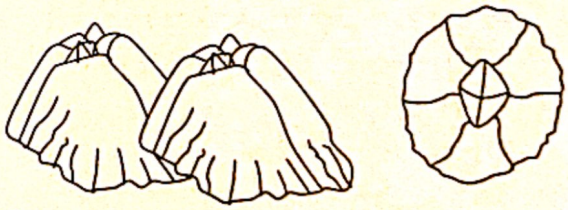
Clam

Limpets are a group of marine rock clinging conical shell mollusc.
Example is Patella



Patella as example of Limpets

Banarcles are crustaceans. Ref to Classification of Phylum Arthropoda

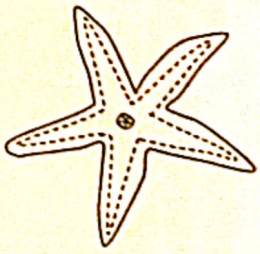


Lateral view top view

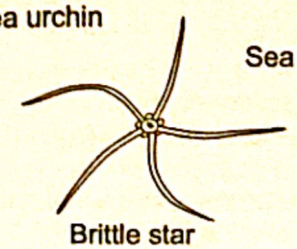
Barnacles

Sea urchin, sea star or starfish and brittle star are Echinoderms

Sea urchin



Sea star (starfish)



Brittle star

CHANGES/VARIATIONS IN THE OCEAN AS DEPTH INCREASES.

1. No light
   - so no plant life since photosynthesis is not possible.
   - As a result, organisms feed on one another and left over food from upper waters (most organisms are detritivores)
2. Still waters, hence no adaptive features for swimming.
3. Oxygen level decreases down because of the following reasons.
   i) No photosynthesis
   ii) Bacteria use oxygen to decompose leftover food/organisms from upper waters.
4. Temperature decreases and becomes more constant throughout the year.
5. Water pressure increases

BRACKISH WATER

Brackish water is the collective term for estuaries and lagoons
Plants are halophytes and possess salt glands which excrete excess salt. e.g. mangroves

General Problems of brackish water

1. Fluctuations in salinity.
2. Tidal effect.
3. Unstable substratum.
4. Low oxygen concentration.

ESTUARIES

Special characteristic

Stratification of water: Freshwater flowing from the river is of low density and flows on top
Sea water has a high salinity hence it is dense and flows below freshwater.
The ability of fresh and salt water to mix in estuary is the basis for classifying estuaries.

LIFE IN THE SEASHORE

Problems Associated with Organisms in the Intertidal zone

1. Fluctuationsof marine and terrestrial conditions: Organisms are covered with water at high tide and exposed to air at low tide
2. The tendency of organisms being carried away by tides.
3. Turbidity.

THE ROCKY SHORE

Characteristics of Rocky Shore

- Presence of rock pools which are tiny reservoirs of water.
- Fluctuations of marine and terrestrial conditions at high and low tide respectively.
- Wave actions
- Presence of seaweeds (absent on sandy shore)
- Presence of rock clinging animals.

Problems encountered by algae and other organisms in the intertidal zone

1. Drying out when tides recede (at low tides)
2. Fluctuations in tempereature
3. Changes in salinity (changes during rain or evaporation in a rock pool)
4. Tendency of carrying away by tide and wave
5. Large waves can carry stones and crash the algae

Organisms on the rocky shore

These are made up of animals and multicellular algae (seaweeds)

Animals on the rocky shore

1. Barnacles – type of crustacean
2. Mussel - type of bivalve (two shelled mollusc)
3. Limpets – very small single coiled shell rock clinging molluscs such as *Patella*
4. Starfish
5. Hermit crab
6. Sea anemone
7. Sea urchin

Adaptations of animals on the rocky shore

1. Some animals cling to rock surface to prevent being carried away. e.g. barnacles, mussels and limpets
2. Some animals live in rocky pools at low tides. e.g. crabs, barnacles, mussels and starfish.
3. Some animals withdraw into their shell which they enclose with water to prevent drying up at low tides e.g. limpets and barnacles.

4. Some animals are permanently cemented to the rock e.g. sea anemone and sea urchin
5. Some animals have flat bodies which enable them to move easily into rock crevices at low tide. e.g. crab

SEAWEEDS

Seaweeds are larger multicellular form of algae. Found on a rocky shore but absent on a sandy beach.

Types of seaweeds
The main types of seaweed are
green algae, brown algae and red algae.

Examples of seaweeds (large multicellular algae)
Green algae – Ulva (sea lettuce)
Brown algae – Sargassum, Fucus, Laminaria
Red algae – Palmaria

Habitat of seaweeds
In the intertidal zone of a rocky shore

General Adaptations of Seaweeds
1. Have holdfast that attach them to the rock surface in water to prevent being carried away wave action.
2. Possess air bladder for buoyancy in order to receive maximum sunlight at high tide.
3. Body covered with mucilage (gelatinous sheath) to resist desiccation at low tide.
4. Have flexible body to wisthstand wave action.
5. Possess chloroplast with pigments for photosynthesis.

Ecological importance of seaweeds
1. Source of oxygen in water and terrestrial habitats.
2. Absorbs carbon dioxide thereby reducing carbon dioxide concentration in the environment
3. Source of food (are aquatic primary producers).
4. Provide shelter (habitat) for some marine organisms.
5. Indicators of environmental problems in aquatic ecosystems.
6. High population can cause algal bloom causing oxygen deficiency in water bodies.

GREEN ALGAE (most numerous)

Dominant pigment is chlorophyll
Found in lakes and oceans

In marine environment they are found near the high tide mark of the intertidal rocky shore

e.g. Ulva (sea lettuce)

Ulva sp

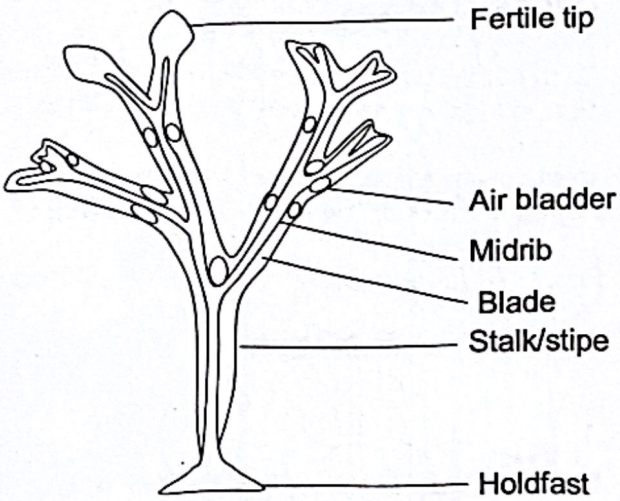
BROWN ALGAE

Predominant pigment **fucoxanthin** is brown in colour.

Found in the middle of the low and high tide mark of the intertidal rocky shore

e.g. Fucus, Sargassum and Laminaria
Fucoxanthin absorbs blue light which penetrates water much faster to effect photosynthesis

Sargassum vulgare



Fucus sp

Structure of Fucus

A thallus is made up of the blade and midrib through it

The hold fast is the base which provides anchorage to a stem-like stipe/stalk. The stipe is made up of mainly the midrib.

The stipe supports a dichotomous branching body (thallus).

Air bladders occur normally in pairs on each side of the midrib

Inside the fertile tip of some fronds are conceptacles which develop sex organs

.

Adaptations of Fucus

1. Presence of holdfast to provide anchorage
2. Presence of stipe to withstand wave action
3. Dichotomous branching in one plane minimizes resistance to water flow
4. Reproductive part carried above for easy fertilization and dispersal
5. Presence of air bladder to provide buoyancy for efficient photosynthesis.
6. Presence of midrib to strengthen the thallus

RED ALGAE

Dominant pigment **phycoerythrin** is red colour

Deepest – dwelling algae e.g. Palmaria

Question:

a) Explain the statement adaptation of an organism to its environment

b) State the ecological importance of seaweeds.

c) Two seaweed, *Sargassum* and *Ulva*, occupy two different levels at the rocky shores of West Africa. One of them occurs at the uppermost level and it is exposed daily at low tide. The other seaweed occurs at the lowest level and is always submerged. Plants of the two seaweed were collected and blotted with filter paper to remove water on the surface, samples of each seaweed were used to determine the total moisture content of the plants. The rest were suspended on a horizontal wire fixed at a height of two metres at the shore. Samples of the suspended weeds were taken at known intervals and their water contents also determined. The percentage of the original total water content remaining was then calculated. The results obtained are shown in the table below.

Time after hanging of the seaweed (hours)	Percentage of the total water content remaining	
	Sargassum	*Ulva*
½	25	75
1	16	52
2	6	25
3	2	21
4	2	20
5	2	19
6	2	18

i. Use the data to plot graphs on the same graph paper

ii. Describe the graphs

iii. Explain the results obtained and assign the two seaweed to their positions on the rocky shores

Hint:

iii)

Rate of water loss is higher in *Sargassum* than In *Ulva*. Because the percentage of water remaining in *Sargassum* after exposure was lower than as observed in *Ulva*.

This implies Ulva has more water holding capacity hence can survive in that part of the habitat that is more frequently exposed than *Sargassum*.

Hence *Ulva* can be found in the uppermost level which is exposed frequently and *Sargassum*

would inhabit the lowest level which is mostly submerged

TERRESTRIAL HABITATS

Terrestrial habitat is characterised with vegetation.
Vegetation type is determined by three main factors namely:
1. Rainfall (most important),
2. Temperature and
3. soil type.

Vegetation determines the type of animals found in an area.

Problems faced by organisms in terrestrial habitat
1. Availability of water
2. Temperature control

A biome is a large geographic area in the terrestrial habitat that has the same major (distinct) forms of life that are adapted to live in that area.

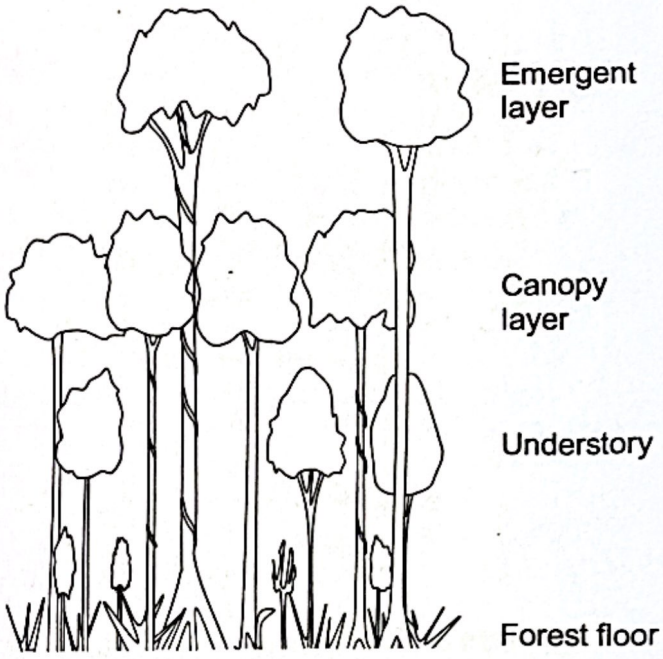
There are three biomes (or major ecosystems) in the terrestrial habitat namely:
Forest,
Savanna and
Desert.

THE TROPICAL RAINFOREST

It is characterised with high rainfall and temperatures throughout the year (it is wet and warm throughout the year)
Plants are made up of trees, shrubs and herbs. However trees are the most abundant plant species.
Rainforests are the most biologically diverse ecosystems (have most plant and animal species) because of their ideal conditions of life.

THE STRUCTURE OF THE TROPICAL RAINFOREST

Plants in the forest form layers called strata (singular = stratum) or storeys.
The layers are the emergent, canopy, understory and forest floor.



The structure of the Tropical Rainforest

Emergent layer
The uppermost layer
Tallest trees
Trees are above 30m high
Not interlocking meaning they do not form a continuous layer and are called emergents, which mean they occur at intervals.
There is maximum amount of sunlight.
Hottest and less conducive
Flying and gliding animals are found here
Bird, bat, sloths, some monkeys, butterfly

Canopy layer
Layer below the emergent layer
Trees are about 30m tall
Tree crowns form a continuous interlocking (dense canopy).
Most primary production/**food** is produced in this layer hence,
There is a diverse community of animals in this layer.

Note:
Epiphytes and lianes are found in the canopy and emergent layers

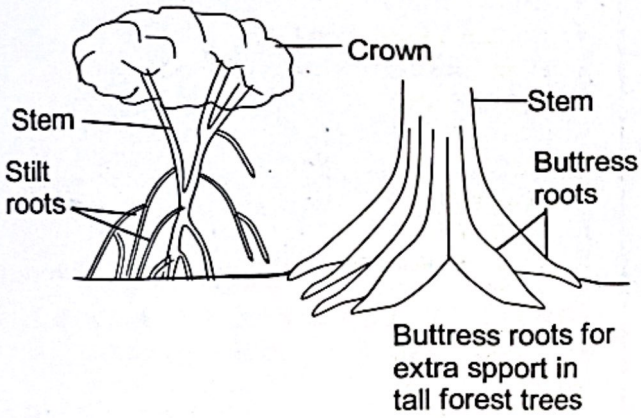
Understory
Found immediately below the canopy layer
Short trees
Hot damp and humid

Little light
Trees with broad leaves to capture sunlight since it is minimum

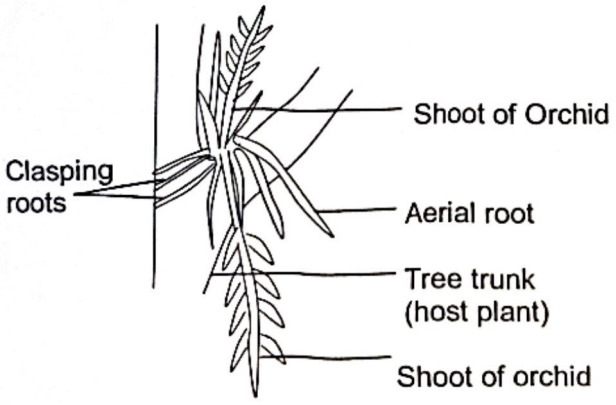
Forest floor
The bottommost layer
Dark and dump and hot
Little or no sunlight light intensity
Dead leaves
Made up of seedlings,
Herbs, ferns and shade loving plants.
There are also buttress and stilt roots of tall plants

COMMON FEATURES OF THE TROPICAL RAINFORESTS
Common features of the tropical rainforests are epiphytes, lianes and climbers.
Epiphytes are found in the upper and middle layers on the branches of tall trees.

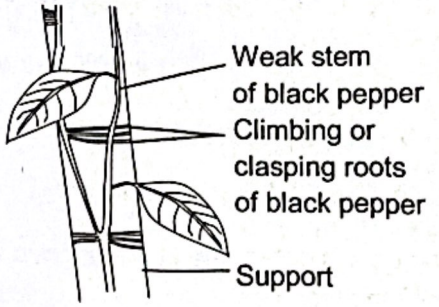
Examples of epiphytes are ferns such as staghorn fern Platycerium and the epiphytic orchid.



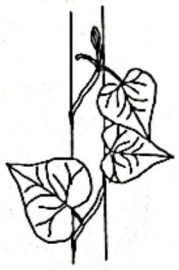
Buttress roots for extra spport in tall forest trees



Clasping roots and aerial roots in epiphytic orchid



Climber climbing with Climbing roots


Climber climbing by twinning

ADAPTATIONS OF EPIPHYTES
1. Their position high above enables them to receive maximum sunlight
2. Their leaves are photosynthetic
3. They grow on rotten materials in the angle of branches.
4. Some have spongy roots to absorb water running down the trunk
5. Have clasping roots which spread round the host for firmer attachment.
6. Some roots hang freely to absorb water moisture.
7. Some have leathery leaves to reduce water loss.

CHARACTERISTICS OF THE TROPICAL RAIN FOREST
1. Heavy rainfall, high humidity
2. Low light intensities and little undergrowth
3. Epiphytes, climbers
4. Trees occur in layers (are stratified)
5. Trees are tall with slender trunks that develop branches near the crown.
6. Some have buttress and stilt root to support tall trees against wind e.g. kapok has buttress roots.
7. Trees form continuous canopy/crown.
8. Have thin and smooth bark.
9. Have broad and leathery leaves.
10. Leaves with drip tip to enhance transpiration.
11. Plants exhibit cauliflory (where flowers or fruits are borne on the main trunk).
12. Flowers are small and inconspicuous.

MORPHOLOGICAL ADAPTATIONS OF FOREST PLANTS.

1. Trees are tall and unbranched. This enables them to compete for adequate sunlight.
2. Tall trees have buttress or stilt roots to provide extra support against wind.
3. Trees have thin and smooth bark. Thin barks facilitate water loss through transpiration.
4. Have broad leaves to enhance water loss through transpiration.
5. Leaves have drip tips to enhance water loss through transpiration.

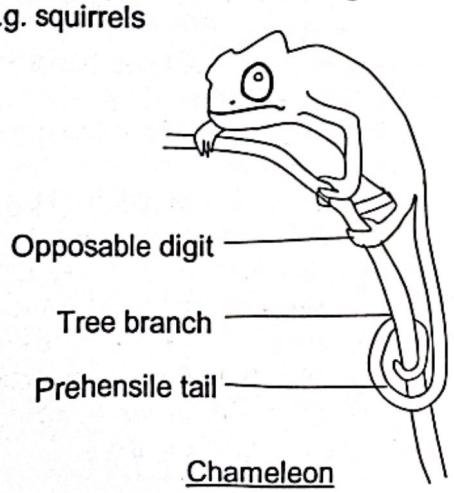
ANIMALS IN THE RAIN FOREST

Examples of forest animals are: ants, bats, monkeys, leopards, geckos, chameleons, green mamba (snake), squirrels, pangolins, frogs and elephants.

Note:
The most numerous forest animals are insects.

ADAPTATIONS OF CLIMBING ANIMALS IN THE TROPICAL RAIN FOREST

1. Opposable digits for climbing and grasping
   e.g. chameleon and monkeys
2. Prehensile tail for extra support while climbing
   e.g. chameleon, monkeys and pangolins
3. Adhesive discs on feet to enable climbing on smooth surfaces
   e.g. geckos
4. Grasping scales for climbing
   e.g. snakes
5. Grasping pads for climbing
   e.g. tree frogs
6. Long sharp claws for climbing
   e.g. squirrels



Chameleon

Opposable digits means the thumb is placed opposite the other fingers of the same limb and can touch all other fingers. It enables the hand to grasp.
Monkeys and humans have opposable digits.

Prehensile tail is the one adapted to hold on to something or to grasp something.
Prehensile tail is found in chameleon and monkey

IMPORTANCE OF RAIN FOREST

1. Induces rainfall (precipitation).
2. Checks erosion of soil.
3. Reduces greenhouse effect.
4. Source of food.
5. Provides shade/shelter.
6. Source of medicine/herbal plants.
7. Source of timber.

SAVANNA

Savanna is characterised with

- Very Low Rainfall
- Annual Burning Of Vegetation.
- Sparse Vegetation,
- High Day Temperatures And
- Cold nights

STRUCTURE

The vegetation is dominated by grasses (herbaceous plants)
Few trees found there are short and scattered.

There are three types of savanna in West Africa. These are the Guinea Savanna, Sudan Savanna and Sahel Savanna.
The Guinea Savanna borders the forest belt and has the tallest woody plants and grasses. The Sahel Savanna borders the desert and is the least vegetated.

CHARACTERISTICS OF SAVANNA PLANTS/VEGETATION

1. Trees are scattered and do not form canopies.
2. Leaves are narrow or reduced with few stomata.
3. Leaves have thick cuticle with sunken stomata
4. Most trees are deciduous (meaning they shed their leaves during the dry season) to reduce water loss through transpiration.

5. Trees have long tap roots and extensive root systems.
6. Trees are short
7. Trees have twisted or crooked trunks
8. Trees have thick/corky/thorny barks.

EXAMPLES OF SAVANNA PLANTS (Xerophytes)

Acacia,
shea-butter,
Baobab,
Opuntia and
Cactus

EXAMPLES OF SAVANNA ANIMALS

Zebras, antelopes, giraffes, elephants, rhinoceroses, lions, leopards, cobra, goats, cows, ostrich, vultures, ants, grasshoppers, locusts and termites.

MORPHOLOGICAL ADAPTATIONS OF SAVANNA PLANTS (XEROPHYTES)

1. Most grasses grow in thick tufts which protect the inner bud against fire and other harsh conditions.
2. Some herbaceous plants have underground stem which enables the plants to survive dry season and fire outbreak.
3. Long and extensive twisted roots to facilitate absorption of water.
4. Trees possess thick thorny barks to resist fire and also reduce water loss by transpiration.
5. Possession of narrow and reduced leaf size with few stomata reduce water loss by transpiration.
   e.g. leaves reduced to spines as in Cactus, scales or tiny leaves.
6. Leaves with thick waxy cuticle to reduce transpiration rate.
7. Some plants store water in succulent stems and leaves e.g. Succulent stem as in Cactus or Commelina, succulent leaves as in Bryophyllum and Aloe vera.
8. Leaves with toothed margins to promote heat loss by convection (as this increases turbulent air flow over the surface).e.g. Tridax
9. Sunken stomata as in Casuarina and Nerium oleander
10. Possession of curled leaves,
    e.g. marram grass

PHYSIOLOGICAL ADAPTATIONS OF SAVANNA PLANTS

1. Trees are deciduous and shed their leaves in dry periods to reduce the rate of transpiration.
2. Some herbaceous plants are annuals and produce seeds which can germinate in the following year.

DIFFERENCES BETWEEN FOREST AND SAVANNA PLANTS

Forest plants	Savanna plants
Smooth and thin barks	Thick thorny barks
Tall trees	Short trees
Trees form layers	Trees do not form layers
Trees are densely populated	Trees are scattered
Broad and leathery leaves	Narrow leaves

DESERTS

Temperatures are extremely high with little or no rainfall

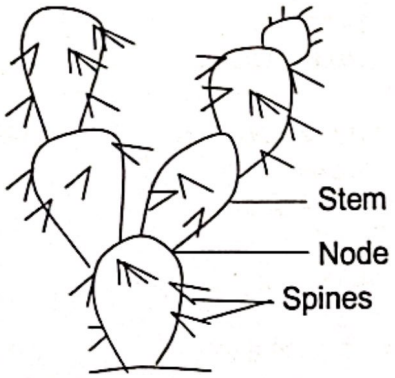
Examples of desert animals are kangaroo rat and camel.

Adaptations of Desert Animal to conserve water

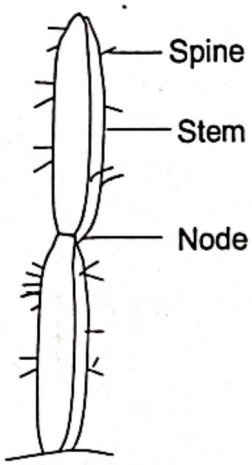
1. Burrow in holes
2. Nocturnal lifestyles.

NOTE:

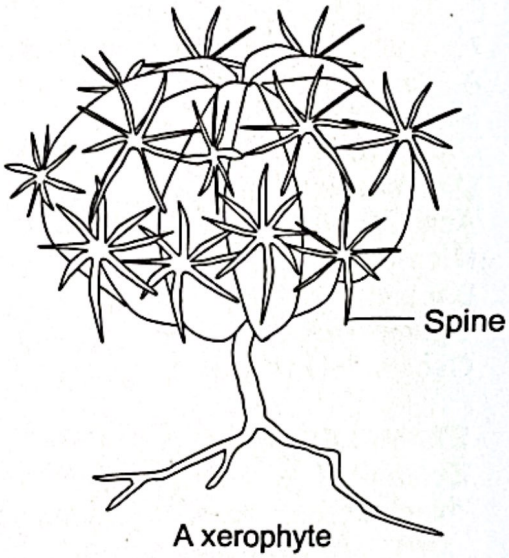
1. Forest plants are adapted to heat loss by **evaporation.**
2. Savanna and desert plants are adapted to heat loss by **convection**
3. **Hydrophytes:** Plants which grow in aquatic habitats
4. **Xerophytes:** These are plants, which grow in dry environments because they can survive long periods of drought. Are found in habitats such as savanna and deserts.
5. **Mesophytes:** These are plants inhabiting areas with adequate water supply.
6. **Halophytes**: Plants which grow in salty conditions e.g. mangroves



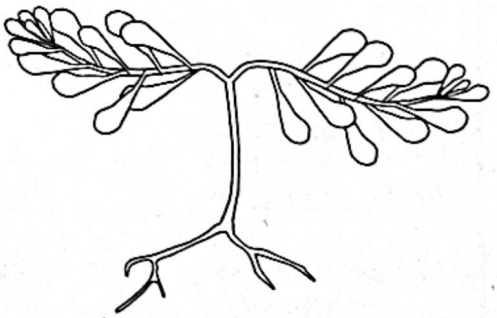
Opuntia (stem swollen for water storage)



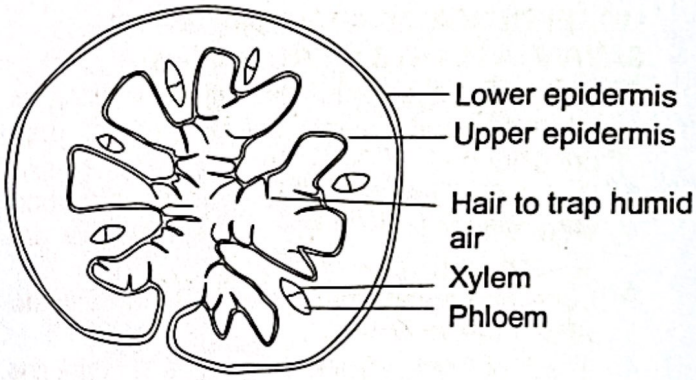
Cactus (water storage stem)



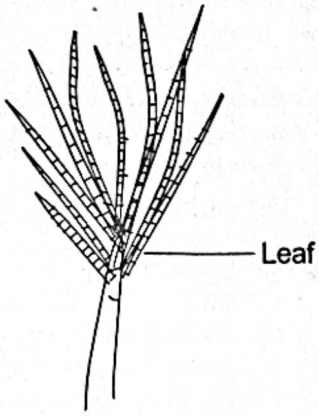
A xerophyte



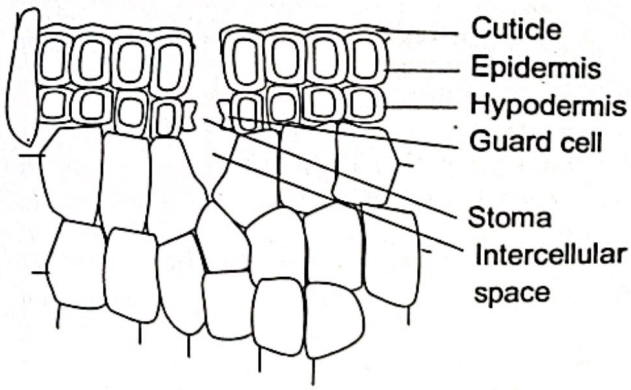
A Xerophyte with succulent leaves to store water



TS of the xeromorphic leaf of marram grass



Casuarina (whistling pine)



Vertical section through a single (sunken) stoma and multiple epidermal layers of a xeromorphic leaf

Xeromorphic features in desert and savanna plants (xerophytes)

QUESTIONS

1. The most diverse habitat in the sea is the...
   A. Intertidal zone
   B. splash zone
   C. abyssal zone
   D. bathyal zone

2. The most determining factor of vegetation of an area is...
   A. climate
   B. soil
   C. animals
   D. evolution

3. The most important climatic factor determining vegetation type of an area is...
   A. rainfall
   B. wind
   C. sunlight
   D. atmospheric pressure

4. Tropical rainforest occurs in areas with
   A. wet and warm climates
   B. dry and hot climate
   C. wet and cold climate
   D. wet climates only

5. The most diverse community in the rainforest is in the
   A. middle storey
   B. forest floor
   C. upper storey
   D. lower storey.

6. The most diverse ecosystem is the
   A. savanna
   B. ocean
   C. tropical rainforest
   D. lake

7. The habitat that supports most herbivores is the
   A. tropical rainforest
   B. savanna
   C. desert
   D. lake

8. Which of the following is adaptation of xeromorphic leaves?
   A. Toothed margins
   B. Drip tip
   C. Broad
   D. Numerous stomata

9. Epiphytism is an adaptation to receive
   A. water
   B. nutrients
   C. light
   D. CO_2

10. During low tides,
    A. organisms are washed to the shore
    B. some organisms are exposed to their predators
    C. wave action becomes very strong
    D. the substratum at the shore becomes unstable

11. Forest plants are adapted to heat loss by
    A. evaporation
    B. convection
    C. radiation
    D. conduction

12. Savanna and desert plants are adapted to heat loss by
    A. convection
    B. evaporation
    C. radiation
    D. conduction

13. Plants growing in and around brackish water may possess
    A. extensive root system
    B. sunken stomata
    C. hairy leaves
    D. salt glands

14. Leaves of Nymphaea float on water surface because
    A. stem is not needed in the bed of the water
    B. petiole contains numerous lacunae
    C. petioles are very long and flexible
    D. upper surfaces are coarsed with waxy cuticle

15. In a freshwater habitat, the ecological factor which least affects organisms is
    A. oxygen content
    B. temperature
    C. turbidity
    D. wind

16. The tide of the sea is highest when
    A. many flooding rivers flow into the sea
    B. several organisms swim towards the shore
    C. heavy rains cause storms
    D. the pull on the land by moon and the sun is in the same phase

17. Which of the following features is an adaptation of xerophytes?
    A. Possession of salt glands
    B. Development of drip tips
    C. Possession of sunken stomata
    D. Development of thin bark

18. All the following characteristics are examples of adaptation to the environment **except...**
    A. possession of fins by fishes
    B. development of big muscles by weight
    C. possession of succulent stems in desert plants
    D. possession of three body divisions

19. Which of the following terms ensures the survival of an organism in its environment?
    A. Hibernation
    B. Succession
    C. Adaptation
    D. Competition.

20. Which of the following habitats has more stable abiotic factors?
    A. River
    B. Pond
    C. Sea
    D. Estuary

21. Which of the following is **not** essential in the studying of the ecological factors that directly affect plants?
    A. Wind
    B. Temperature
    C. Herbivores
    D. Carnivores

Use the information below to answer questions 22 - 27

I - Mesophytes
II – Hydrophytes
III – Halophytes
IV –Xerophytes

22. Plants which grow in aquatic habitats are generally referred to as
    A. I
    B. II
    C. III
    D. IV

23. Plants which grow in brackish water are referred to as
    A. I
    B. II
    C. III
    D. IV

24. Plants which grow in salty conditions are
    A. I
    B. II
    C. III
    D. IV

25. Plants which grow in adequate water
    A. I
    B. II
    C. III
    D. IV

26. Plants which grow in dry environment.
    A. I
    B. II
    C. III
    D. IV

27. Possession of strong adhesives is a feature of animals living in/on
    A. sandy beaches
    B. rocky shores
    C. benthic zones
    D. deserts

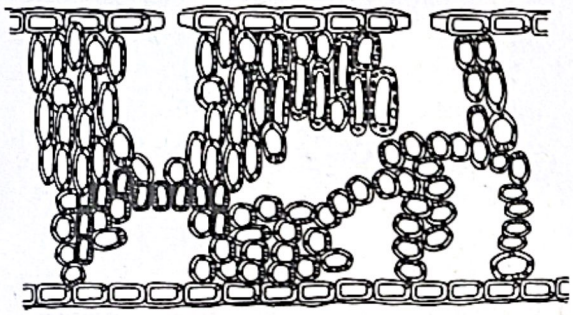
28. Organisms which excrete ammonia as the main nitrogenous waste live
    A. on the desert
    B. in water
    C. in the soil
    D. on moist soil

29. Which of the following structures does **not** reduce water loss in plants?
    A. Hairy leaf surface
    B. Leaf epidermal layer

C. Leaf drip tip
D. Serrated leaf margin

30. In the marine environment coral reefs are found in the
A. intertidal zone
B. subtidal zone
C. abyssal zone
D. splash zone

The diagram below shows the internal structure of a leaf of a plant which has reduced xylem tissues and large intercellular air spaces in the palisade mesophyll.
Use the doiagram to answer Questions 31 and 32



31. The plant is likely to be found in a
A. rain forest
B. savannah
C. sesert
D. pond

32. The main functions of the air spaces is
A. cooling
B. transpiration
C. buoyancy
D. photosynthesis

33. The major problem experienced by organisms in freshwater bodies is
A. osmotic balance
B. temperature regulation
C. drying up
D. wave action

34. The major problem experienced by organisms in small water bodies is.
A. osmotic balance
B. temperature regulation
C. drying up
D. wave action

35. The major problem experienced by organisms in terrestrial habitat is.
A. osmotic balance
B. temperature regulation
C. desiccation
D. wave action

36. The major problem experienced by organisms in intertidal zone is.
A. osmotic balance
B. fluctuations
C. desiccation
D. wave action

37. Which of the following physical factors is likely to affect the distribution of plants in a pond?
A. Light
B. Humidity
C. Wind
D. Temperature

38. Pond weeds normally lack thick layers of cuticle because
A. their system of photosynthesis is not efficient
B. thre is no danger of becoming desiccated
C. their leaves are either dissected or ribbon-shaped
D. there are numerous stomata on their upper epidermis

39. The speed of the flow of water in a river is faster in the middle than along the banks due to
A. differences in turbidity at different parts of the river
B. the abundance of fishes and other organisms along the bank
C. reduced force of gravity in the middle portion of the river
D. resistance offered by the wall of the banks

40. The adaptations for water conservation in organisms include the following **except**
A. scales in fishes
B. scales on leaves
C. thick leaves

D. spine in cactus

41. The distribution of organisms in a freshwater habitat like a stream or pond is determined by the following except
A. rainfall
B. temperature
C. pH of soil
D. light penetration

42. Which of the following is the characteristic of a swamp?
A. Vegetation with stratified arrangement (Hint: Forest)
B. Mesophytes with broad leaves (Hint: Forest)
C. The ground is flooded most of the time
D. Predominance of climbing plants (Hint: Forest)

43. Very low annual rainfall, sparse vegetation, high day temperatures and cold nights are characteristics of the biome known as
A. a swamp
B. tropical forest
C. desert
D. Guinea savannah

44. The following structures are adaptation for water conservation **except**
A. sunken stomata
B. scales in animals
C. pines on plants
D. thick leaves

45. Which of the following is not an adaptation of plants or animals to desert environment?
A. Well developed tap root system
B. Broad leaves for storage
C. Stems with spike-like leaves
D. Metabolic waste in the form of uric acid in some animals

46. The large intercellular air spaces which penetrate the tissues of most hydrophytes is a pathway through which
A. carbon dioxide absorbed by the leaves can diffuse to the roots
B. oxygen produced in the leaves can diffuse to the submerged parts
C. salts absorbed by roots can reach other parts of the plant
D. manufactutured food is translocated

47. Desert plants are normally called
A. hydrophytes
B. mesophytes
C. halophytes
D. xerophytes

ANSWERS TO OBJECTIVE TEST

1A 2A 3A 4A 5A 6C 7B 8A 9C
10B 11A 12A 13D 14B 15B 16D 17C
18D 19C 20B 21D 22B 23C 24C 25A
26D 27B 28B 29C 30B 31D 32C 33A
34C 35C 36B 37A 38B 39D 40A 41B 42C
43C 44D 45B 46B 47D

ESSAY

1. State **five** structural features which adapt each of animals and plants to a named habitat

Hint:
Adaptations of Animals to Freshwater habitat: Ref to notes and write on Gills, swim bladder, streamlined shape, lateral line, fins, slimy body surface, suckers and air bubbles.

Adaptation of Hydrophytes to Freshwater Habitats
i. Large air spaces (lacunae) and roots for buoyancy
ii. Stomata on upper surface of floating leaves for effective gaseous exchange.
iii. Waxy cuticle to repel water
iv. Leaves with large surface area for maximum absorption of water and sunlight.
v. Thin cuticle in submerged plants for absorption of water and mineral salts.
vi. Flexible stems and leaves in submerged plants in order to withstand wave action.
vii. Flowers are raised above water to enable pollination.

2. Tabulate **five** differences between savanna and forest plants

3. Describe **five** adaptations of animals in the tropical rainforest with examples

4. State five morphological features in

a. forest plants (mesophytes)
b. savanna plants (xerophytes)
c. freshwater plants

5. a. Name five examples of animals found on the rocky shore.
   b. Give five adaptive features of animals on the rocky shore

6. a. State five adaptive features of algae
   b. Give five economic importance of algae

7. a. What is brackish water?
   b. Name two examples of brackish water
   c. Give any four problems encountered by living organisms in a named brackish water

8. State four advantages and four disadvantages of aquatic habitat.

9. Name five examples of hydrophytes and state three adaptations each of any three of the named hydrophytes

10. Give the adaptations of freshwater
    a. animals
    b. plants

11. Match each of the following morphological features to the appropriate plants /habitat
    b) Possession of salt gland
    c) Development of drip tip
    d) Possession of sunken stomata
    e) Development of thick bark
    f) Numerous lacunae
    g) Possession of haustoria

    Hint:
    a) Halophytes
    b) Mesophytes
    c) Xerophytes
    d) Xerophytes
    e) Savannah
    f) Hydrophyte
    g) Parasitic plant

12. a) Name the major problem facing terrestrial organisms
    b) Give the adaptations of organisms to overcome this problem

    Hint:
    a) The tendency of losing water/desiccation

    b) Adaptive Features of some organisms to reduce water loss
    Plants – cuticle
    Mammals- hair/fur
    Birds – feathers
    Reptiles – scales
    Insects – chitinous exoskeleton
    Mucilage in Spirogyra
    Organisms which lack such devices are restricted to humid environment
    Examples are the moss plants, earthworms and termites.

13. Name the organisms in each of the following habitats
    Forest
    Savannah
    Desert
    Splash zone
    Intertidal zone
    Rocky sea shore
    Rock pool
    Subtidal zone
    Bathyal zone
    Abssal zone
    Estuary
    Lagoon

Hint:
For the forest, savannah and desert refer to notes and
Name the animals and plants in each

14. a) What are seaweeds?
    b) Name three main groups of seaweeds with examples
    c) Name the habitat of each group
    d) Give five general charcteristics of seaweeds

    Hint:
    a) Seaweeds are larger multicellular form of algae.
    Found on a rocky intertidal shore.

    b) Green algae e.g. *Ulva* (sea lettuce)
    Brown algae e.g. Sargassum, Fucus, Laminaria

Red algae e.g. Palmaria

(Refer to pages 312 and 313)

c) Green algae: Near the high tide mark/upper part of the rocky intertidal zone

Brown algae: In the middle part of the rocky intertidal zone

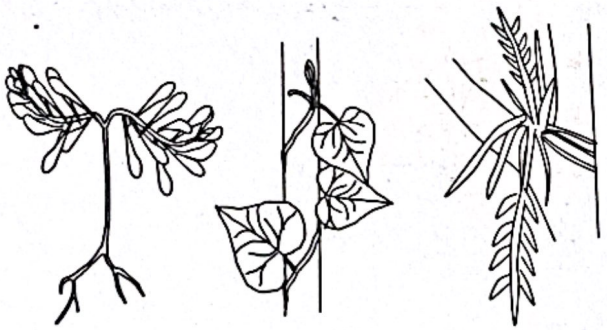
Red algae: Near the low tide mark/lower part of the rocky intertidal zone

15. Name two gaseous exchange structures in the aquatic habitat

Hint:

Gills - Tilapia, Tadpole
Siphon – Mosquito larva

16. *Use the diagam below to answer questions that follow*



a) Classify the plants in specimens A, B and C respectively

Hint:

A – Xerophyte
B – Climber
C - Epiphyte

b) Name the habitat of each of specimens A, B and C with reasons

Hint:

Habitat:
A – Savanna
B – Tropical rain forest
C – Tropical rain forest

Reasons:

A – Succulent leaves store water

B – Climbing stem to reach sunlight in competition for light
Broad leaves to enhance transpiration in a highly humid community

C – Epiphyte (small plant growing on tall trees to receive maximum sunlight in the mist of competition for light in a community of heavily crowned trees that does not allow maximum sunlight to reach the forest floor for smaller plants to thrive well)