# CHAPTER ONE: INVESTIGATIVE SKILLS AND TECHNIQUES

## SCIENTIFIC INVESTIGATION

This refers to activities that scientist carry out when they want to discover more about something they are curious

## PLAN

It is a written account of what one intends to do.

## THE AIM OF THE EXPERIMENT

This refers to the reason why a person wants to carry out an investigation

## HYPOTHESIS

- It is a suggested possible explanation of the observation. It can be improved to be true or false by the results obtained after carrying out the investigation.
- In other words, a hypothesis is a "tentative explanation" for what we observe.
- A good hypothesis must be testable. It could be proved true or false.
- Examples of hypotheses include

a. Chlorophyll, located in plant cells, causes grass to be green.
b. A virus which infects white blood cells, causes AIDS.
c. Collagen, a connective tissue protein, weakens with age causing the skin to wrinkle.
d. The more sunlight a tomato plant receives, the bigger it will grow.

## THE EXPERIMENT

- The biologist must set up an experiment to test the hypothesis.

## VARIABLES

Variables are differences that will test hypothesis. These could be things that can be changed or controlled in an an experiment.

## TYPES OF VARIABLES

### a. INDEPENDENT VARIABLE (INPUT VARIABLE)

This is the variable that is altered or changed during the investigation

### b. DEPENDENT VARIABLE(OUTCOME VARIABLE)

This is the variable that changes due to changes in the other variable. Therefore it depends on another variable for it to change.

**c. CONTROL VARIABLE**

- This is the variable that is kept constant or the variable that is not allowed to change.

**DESIGNING AN EXPERIMENT**

- This is the process that involves listing activities to be carried out in order to get results from the investigations.
- A design includes what to do, how to do it, what to observe and how the observation will be handled

**DESCRIPTION**

It is the statement the shows what was observed. It may be presented in form of words

**EXPLANATION**

This shows why a given observation was made.

**FACTUAL STATEMENTS**

This refers to the statement that contains information which is clear and true.

**OPINION STATEMENTS**

This refers to personal statements explaining an event or situation

**AN ASSERTION**

This is a positive statement usually made without an attempt at furnishing evidence.

**CONCLUSION**

This involves making deductions from explanations on the observations made. It is used to show whether the aim of the experiment was met or not.

**WRITING A SCIENTIFIC REPORT**

- It is a written record on all that was done during the investigation
- The report should have the following information
  1. A title- this is derived from the aim of the experiment

2. Statement of the aim of the experiment
3. Statement of hypothesis.
4. Description of the procedure used.
5. Results obtained.
6. Presentation of the results in form of tables and graphs.
7. Conclusions from the data.

**HOW TO REPRESENT ANALYSED DATA**

Analyzed can be represented using tables, graphs, charts, bar graph .

**MODIFIED LEAVES AND THEIR FUNCTIONS**

1. **Leaf tendril**

Some leaves have parts of their leaves modified into slender, twining tendrils.

The figure below shows leaf tendril-

2. **Spines-**

Some plants such as cacti have leaves modified into slender, sharp spines or hooks for defence against grazing animals and reduce water loss.

The figure below shows Cactus which has leaves modified into sharp spines for defence.

## Adaptations : The Prickly Pear Cactus

- Conserves water by not having leaves
- Fleshy stems store water and swell during rain.
- Has spikes to deter grazers
- Toxic calcium oxalate under the skin. Only woodrats and javalinas can metabolise this chemical without harm to kidneys..

_ Engelmann's Prickly Pear

### 3. Pitcher

A pitcher is a leaf modified into a hollow jug structure. Such leaves serve as traps of insects or small animals which decay and provide nutrients to the plant. The figure below shows a leaf of saracenia (pitcher plant) modified to a pitcher to trap insects.

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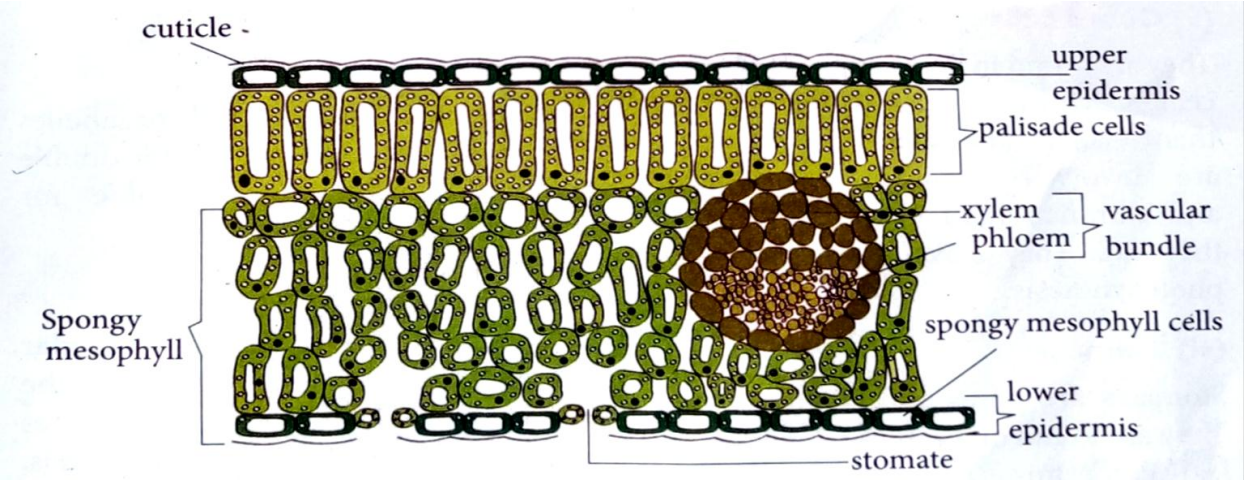
## CHAPTER 2 : PLANT STRUCTURES AND FUNCTIONS

The diagram below shows the external structure of a leaf. The leaf has a leaf blade and a stalk or petiole as shown below


Petiole joins the leaf to the stem

## THE INTERNTAL STRUCTURE OF THE LEAF

The internal structure of the leaf is composed of the following




### CUTICLE

- It is a thin waxy layer found on both the upper and lower surface of the leaf.
- Cuticle is adapted for photosynthesis process because it is transparent to allow light into the leaf

### FUNCTIONS OF THE CUTICLE

- It prevents excessive loss of water through evaporation from the leaf
- It also protects the leaf from attack by pests

### UPPER AND LOWER EPIDERMIS

They are adapted for photosynthesis process because they do not have chloroplasts. This allows light to pass through to the palisade mesophyll and spongy mesophyll cells where photosynthesis process takes place.

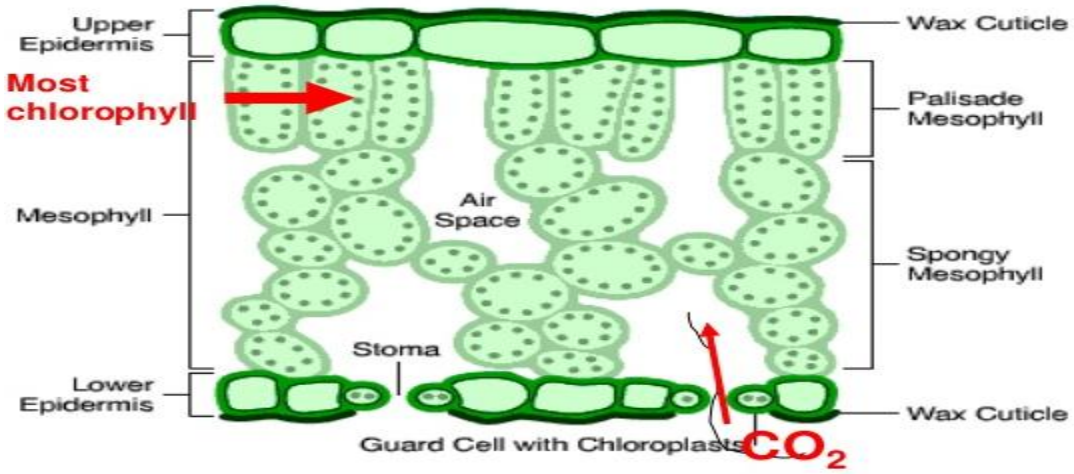
### FUNCTIONS OF THE UPPER AND LOWER EPIDERMAL CELLS.

**T**hey cover the surface of the leaf for protection

### PALISADE MESOPHYLL CELLS

Palisade mesophyll cells are adapted for photosynthesis process in the following ways**:**

a. It contains numerous chloroplasts that are involved in photosynthesis.
b. They are closely packed together to increase the surface area for photosynthesis process




**FUNCTION OF THE PALISADE MESOPHYLL CELLS:**

It is a site for photosynthesis process

**SPONGY MESOPHYLL CELLS**

Spongy mesophyll cells are adapted for photosynthesis in the following ways

- They contain few chloroplasts for photosynthesis process.
- They have big air spaces for gas exchange or aeration.

**FUNCTION OF SPONGY MESOPHYLL CELLS**

It is the site for photosynthesis process

**GUARD CELLS**

Guard cells **are** cells surrounding each stoma. They help to regulate the rate of transpiration by opening and closing the stomata. They help to regulate the rate of transpiration by opening and closing the stomata

Plants obtain the gases they need through their leaves. They require oxygen for respiration and carbon dioxide for photosynthesis. The gases diffuse into the intercellular spaces of the leaf through pores which are normally on the underside of the leaf-stomata

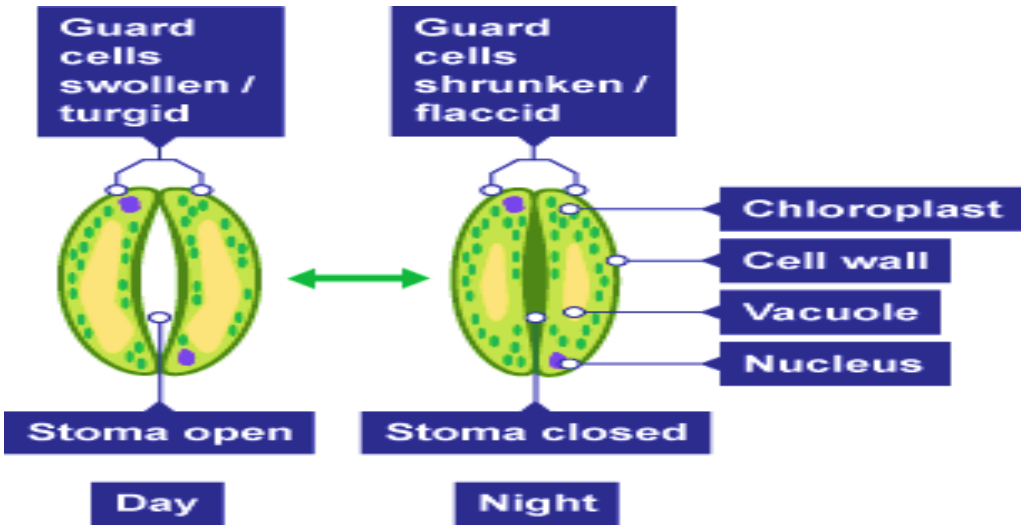
The stomata consist of the minute pores called stoma surrounded by a pair of guard cells.

The function of the guard cells is to control the opening and closing of the stoma. The guard cells tough, flexible and thinner.

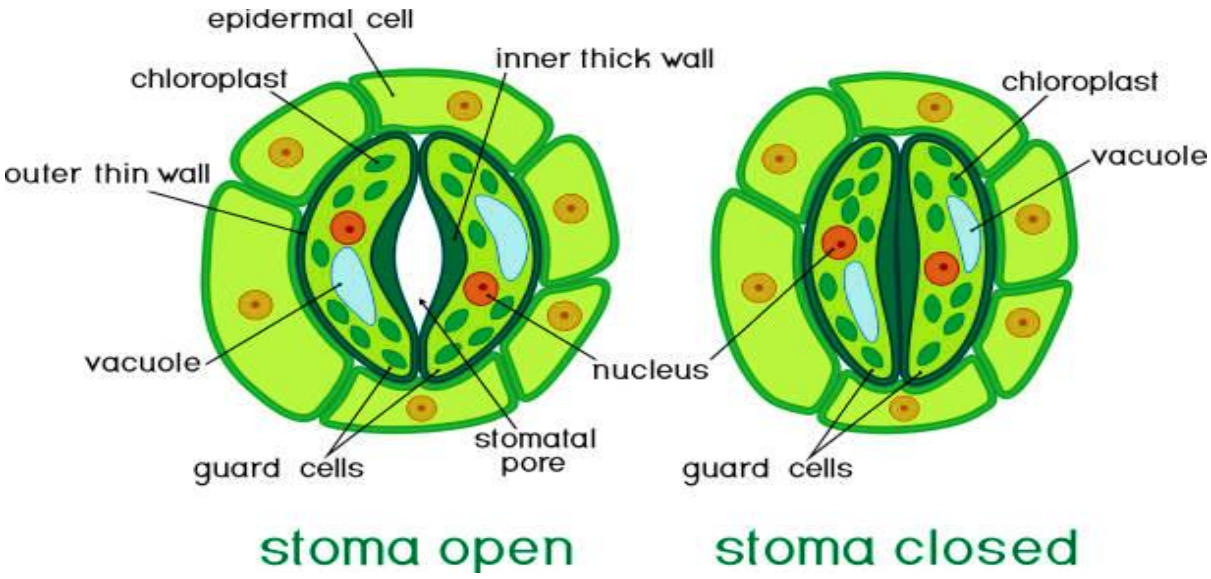
**DIFFERENCES BETWEEN THE GUARD CELLS AND EPIDERMAL CELLS**

| Guard cells | Epidermal cells |
|---|---|
| They are bean-shaped cells surrounding the stomata | They are not bean-shaped |
| They contain chloroplasts | They do not contain chloroplasts |

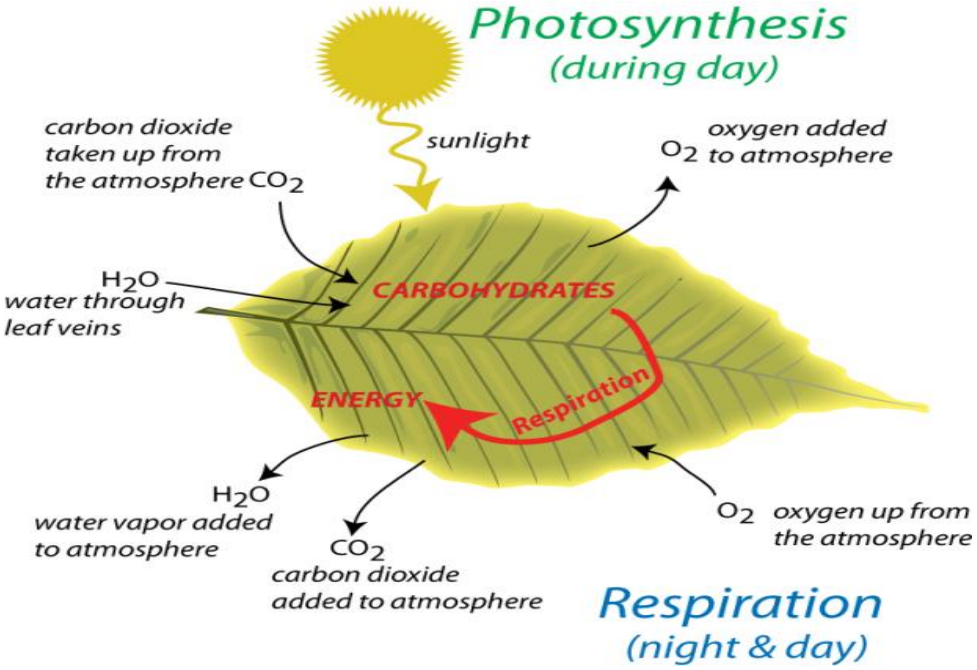
The opening and closing of the stoma depend against the turgor pressure caused by the osmotic flow of water in the guard cells. When the guard cells are expanded, the stomata open and close, when the guard cells lose water. Stomata normally open when the light strikes the leaf and close during the night.




**THE STOMATAE**



**GAS EXHANGE IN THE LEAF**




During the day time oxygen gas diffuses into the leaf and carbon dioxide diffuses into the leaf through the stomata.

During the day time, carbon dioxide diffuses from the atmosphere into the leaf to be used up in the photosynthesis process. A diffusion gradient for carbon dioxide exists between the atmosphere and the intercellular spaces of the mesophyll cells because the concentration of carbon dioxide in the atmosphere remains approximately constant, while the concentration in the intercellular spaces of the leaf cells falls as carbon dioxide is used up during photosynthesis.

Photosynthesis process produces oxygen. This oxygen diffuses out of the leaf into the atmosphere. However not all oxygen diffuses out of the leaf through the stomata, some oxygen is used up by the respiration process in the leaf.

The four conditions which are needed for photosynthesis process to occur to produce oxygen are sunlight, chlorophyll, water and carbon dioxide.

**ADAPTATION OF THE LEAF PHOTOSYNTHESIS**

1. **The leaf has Air spaces**

- They have spaces which allow free circulation of gases in the leaf

2. **Has chloroplasts**

They contain chlorophyll which absorbs light energy from sunlight.

3. **Has stomata**

They are used for gas exchange. Carbon dioxide diffuses into the leaf and oxygen diffuses out of the leaf through the stomata during the day time.

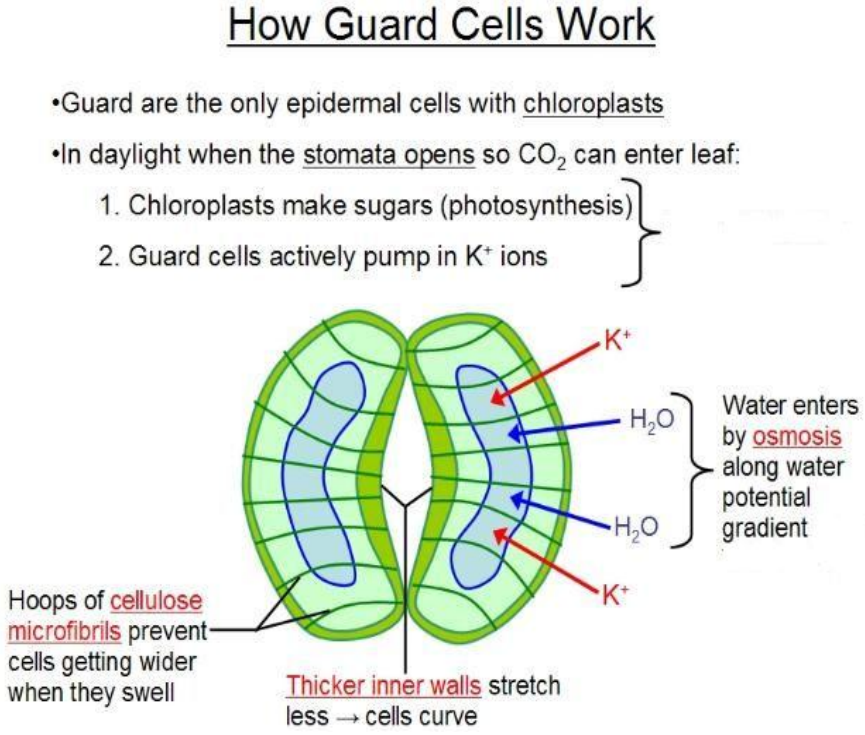
The stomata are surrounded by the guard cells.

The function of the guard cells is to control the **opening and closing the stomatal pore** .They swell when water flows into them, causing the stomatal pore to open .Similarly the pore closes if the guard cells shrink. They also help to **regulate transpiration**

**STOMATA AND THE GUARD CELLS**

They are tiny pores within the guard cells and are found on both upper and lower leaf epidermis.

In most plants growing on land, the number of stomata on lower leaf surface is always higher than the number of stomata on the upper leaf surface. This is important because it ensures that the plant loses less water through the upper side that directly faces sunlight.



**FUNCTIONS OF THE STOMATA**

a. Helps in the exchange of gases by opening and closing the pores in the leaves
b. It helps to expel the excess water out from the leaves in the form of water vapor.
c. It allows the uptake of carbon dioxide and give out oxygen during the process of photosynthesis.
d. Based on the weather conditions, it closes or opens its pores to maintain the moisture balance
e. Stomata remain open during the day and closed at night. This closure prevents water from escaping through open pores.

**THERE ARE USUALLY FEWER STOMATA FOUND ON THE UPPER SURFACE OF A LEAF. SUGGEST WHY THIS IS BENEFICIAL TO A PLANT**

This is to reduce the evaporation of water from the plant. Plants have more stomata on the lower epidermis as compared to the upper

**4. The presence of veins in the leaf**

They contain phloem and xylem tissues which are involved in the transport of substances to and from the leaves

**FUNCTIONS**

- They are conducting water and minerals salts or food substances.
- The phloem contained in the veins transports food substances away from the leaves while xylem tissues -transports water to the leaves

**THE DISTRIBUTION OF THE STOMATA ON THE UPPER & LOWER SURFACE OF THE LEAF**

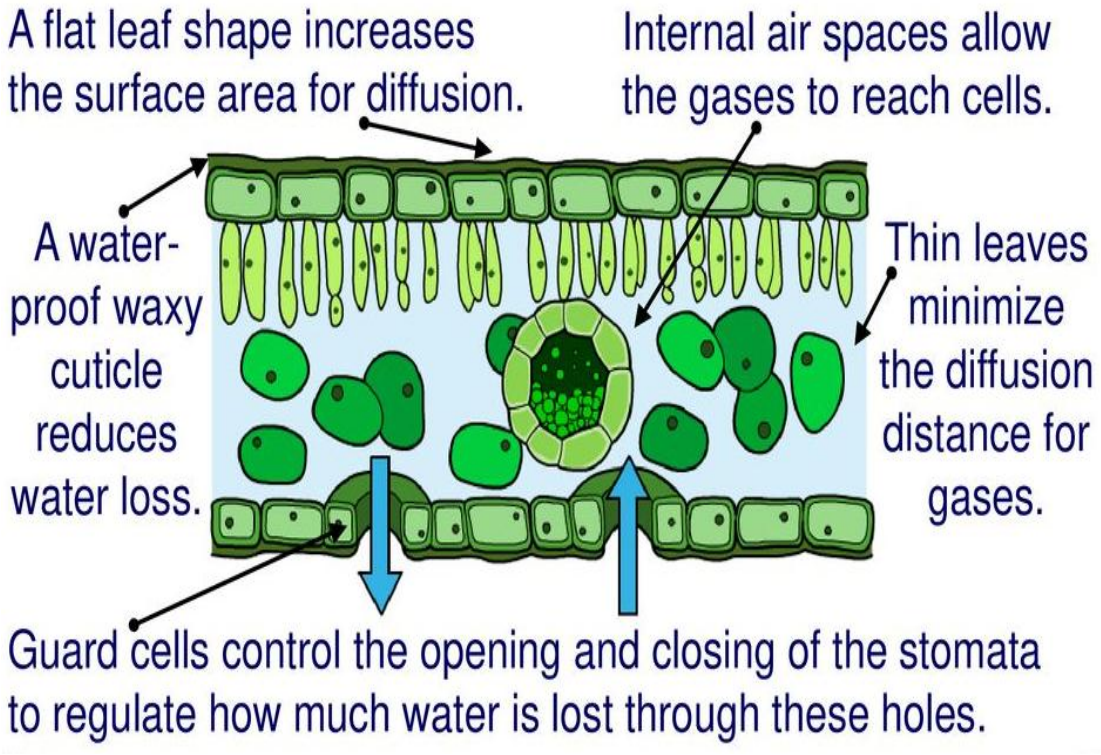
- There are more stomata on the lower surface than on the upper surface of the leaf.
- Plants growing on land always have more stomata on the lower surface. This is important because it enables them to minimise loss of water by exposing only few stomata on the side that faces the sun directly. The side that is hidden from the sun has more stomata.

- In plants growing in water such as water lily, they have very many stomata on the upper surface and few stomata or none lower leaf to eliminate excess water absorbed.
- Number of stomata in a leaf also indicates where a plant is grown. Plants grown in areas with adequate water have leaves with many stomata while plants in dry areas have few stomata.

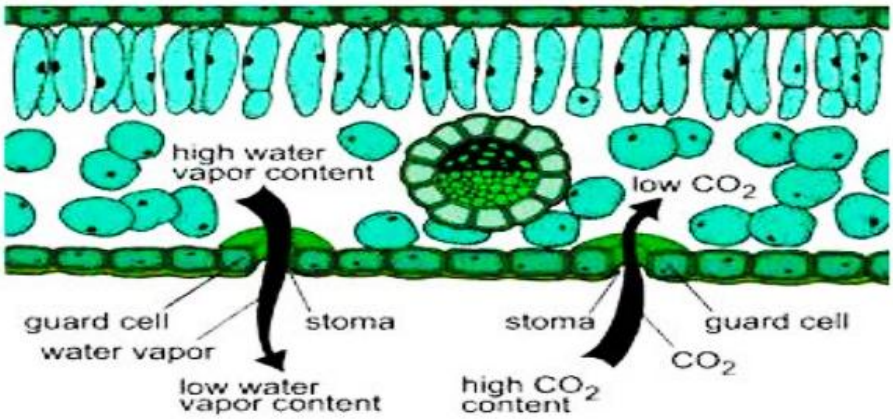
**GAS EXCHANGE IN PLANTS**

- Carbon dioxide and oxygen diffuses in and out of the leaves through the stomata.
- Carbon dioxide is used in **photosynthesis** process and produced by **respiration**
- The diagram below shows gas exchange through the stomata found on the surface of the leaf.

**Leaves are adapted to increase the rate of diffusion of gases and to reduce the rate of water by evaporation in the following ways:**

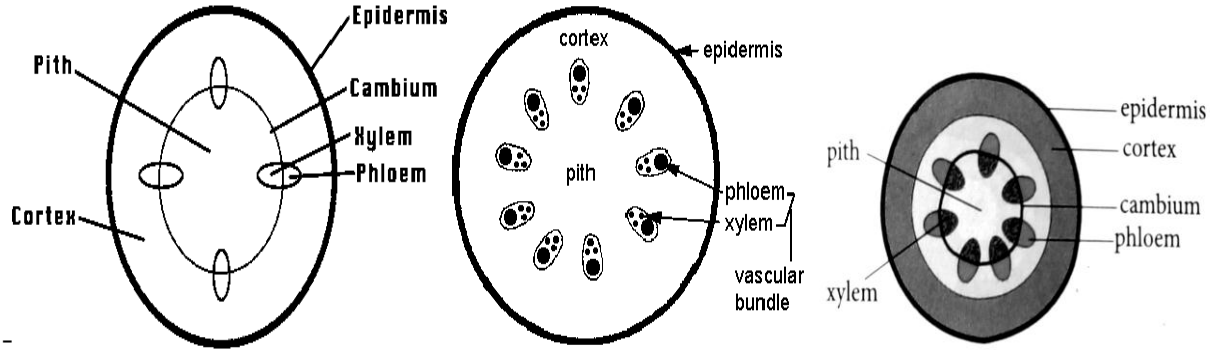


## THE GAS EXCHANGE IN THE GREEN LEAF



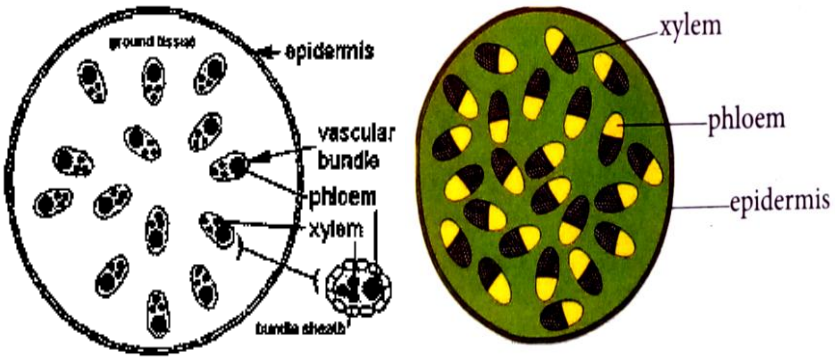

## THE INTERNAL STRUCTURE OF A DICOTYLEDONONUS STEM

In dicotyledonous stem, the veins or vascular bundles are arranged to form a ring. The diagram below shows the cross-section of a dicot stem



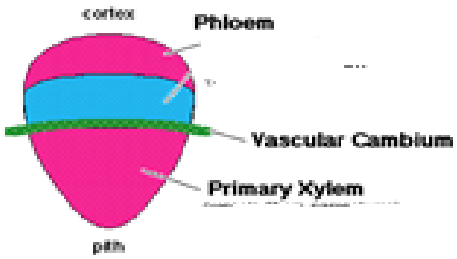

## TRANSVERSE SECTION OF THE MONOCOT STEM

The veins or vascular bundles in the monocotyledonous stem are just scattered anyhow. The diagram below shows transverse section of the monocot stem



The vascular bundles in monocots are arranged in scattered bundles throughout the cortex.

**THE FUNCTIONS OF THE PARTS OF THE DICOT STEM**

| PART | FUNCTION |
|---|---|
| **Phloem** | It is used for translocation i.e. Transports sugars from photosynthetic leaf cells to sink tissues. |
| **Xylem** | It transports water and mineral s from the roots upward and throughout the plant |
| **Vascular cambium** |  <br>Produces new phloem tissues and xylem tissues |
| **Pith** | Storage of water and food. It stores and transport nutrients throughout the plant |
| **Epidermis** | It protects the stem against water loss, it regulates gas exchange, secretes metabolic compounds. |
| **Pericycle** | Provides support, structure and protection for the plant. The Pericycle cells surround the xylem and phloem in the stem and help to hold the plant upright allowing it to growth. |
| **Vascular bundles** | • Transport critical substances to various parts of the plant.<br>• Vascular bundles are made up of xylem, phloem and cambium.<br>• Xylem transports water and nutrients<br>• Phloem transports organic molecules or |

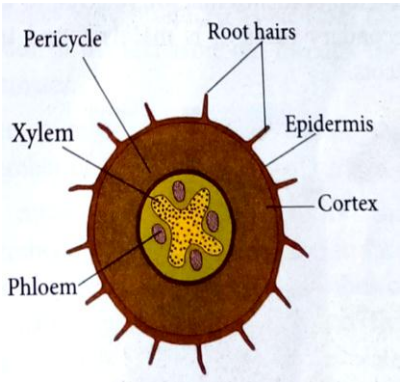
| | |
|---|---|
| | manufactured food to the storage organs or where it is used.<br>• Vascular cambium is involved in plant growth. |

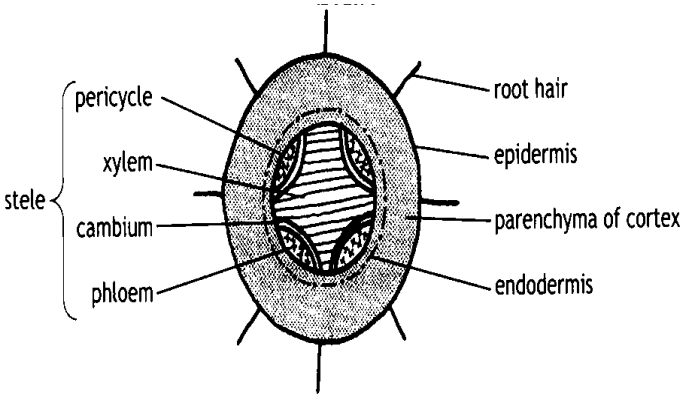
**FUNCTIONS OF THE STEMS**

1. They support the leaves enabling them to be exposed to light for efficient photosynthesis.
2. They store food substances in their cortex in form of starch and sucrose.
3. They transport substances from the roots to the leaves and from the roots to the leaves to all other parts of the plant.
4. They hold and support flowers and fruits exposing them to agents of dispersal respectively.
5. Some stems have thorns that protect the plant from grazing animals.

**DICOTYLEDONOUS ROOT**

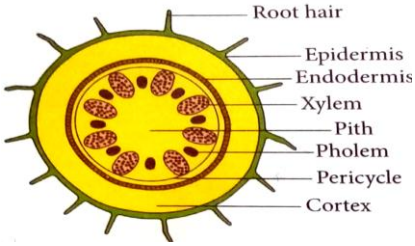
In the dicotyledonous root, the phloem alternates between the radiating arch of the xylem




**MONOCOTYLEDONOUS ROOT**

In monocotyledonous root, the phloem and xylem are arranged to form a ring in which xylem tissue alternates with a phloem tissue.



## TYPES OF THE ROOTS

There are two types of roots which include tap root system and fibrous root system

1. **THE TAP ROOT SYSTEM**

   In this system, one primary root develops from the stem and grows straight - downwards. The root can then develop branches that are referred to as secondary roots. It is mainly found in dicots. The diagram below shows tap root system

2. **THE FIBROUS ROOT SYSTEM**

   In this system, many primary roots develop from the base of the stem. The stems are almost of the same length. They form a mass of roots and each can form branches. The diagram below shows the fibrous root system

## MODIFIED ROOTS

The following are the modified roots

1. **Prop roots** are adventitious roots which grow from the stem down into the soil. They provide additional anchorage to plants.
2. **The buttress roots** also provide additional anchorage to the plant.
3. **Climbing roots** are adventitious roots that hold the plant to a solid support.
4. **Aerial roots** absorb moisture from the air.

5. **Pneumatophores** are the breathing roots of mangrove plants.

**FUNCTIONS OF THE ROOTS**

1. They anchor or hold the plant firmly into the soil.
2. They absorb water and mineral salts from the soil for use by the plant.
3. Some roots store food substances for the plant

**PHOTOSYNTHESIS PROCESS**

Photosynthesis process is defined

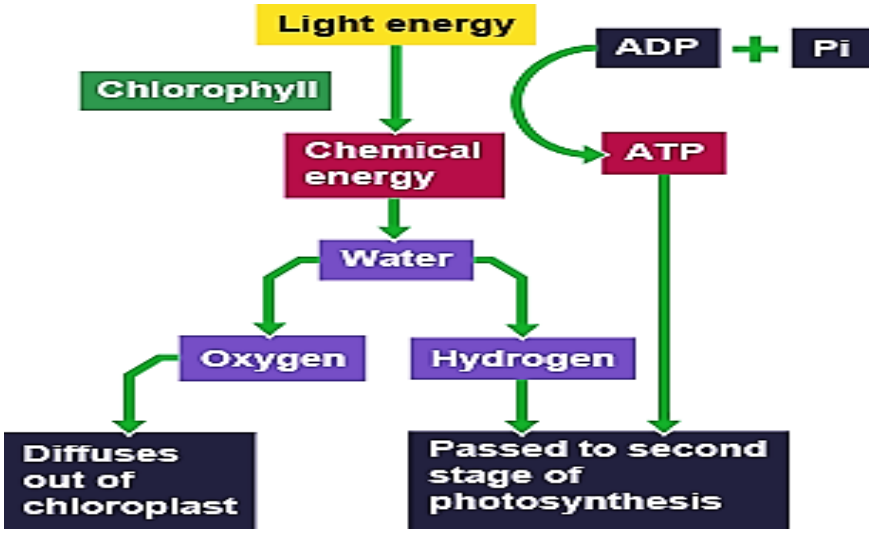
- as the process by which green plants make glucose from water and carbon dioxide using light energy.
- as the process by which green plants make glucose as its main product and oxygen as it's by product from water and carbon dioxide using light energy in the green leaves and stems.
- Oxygen is usually released as a by-product.
- The following is the word equation for photosynthesis process

$$\text{Carbon dioxide} + \text{Water} \xrightarrow[\text{Chlorophyll}]{\text{Light}} \text{Glucose} + \text{Oxygen}$$

- The raw materials for photosynthesis are carbon dioxide and water. **Glucose** is the **first and main product** of the photosynthesis process. The glucose made is converted to starch and stored in the leaves. **Oxygen** is produced and is released to the atmosphere as the **by-product** of photosynthesis.
- **Chlorophyll** is used to absorb light energy from sunlight while light energy is used to split water to hydrogen and oxygen atoms.
- **Oxygen** is released to the atmosphere as the **by-product** of photosynthesis process while **hydrogen is used to combine with carbon dioxide to produce glucose**.

**STAGES OF PHOTOSYNTHESIS PROCESS**

1. **Light stage or light dependent stage**

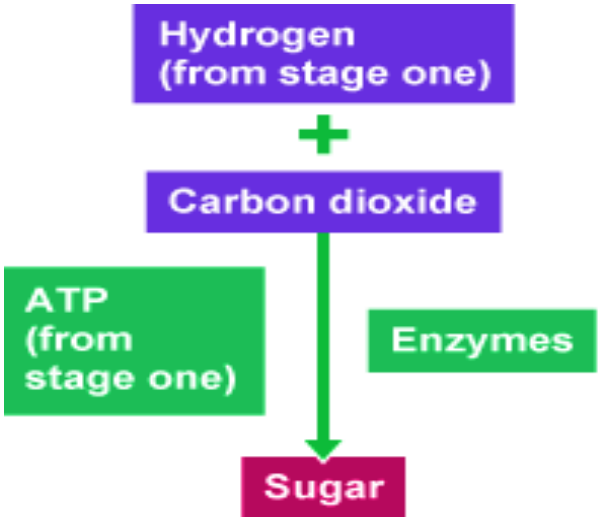



During this stage, light energy absorbed by chlorophyll from sunlight splits water into oxygen gas and hydrogen atoms in the process known as photolysis and light energy is converted to form ATP **(Adenosine Trisphosphate). ATP** is used in the dark stage of photosynthesis**.** Therefore, **photolysis** is the splitting of water molecules by sunlight energy to form oxygen gas and hydrogen atoms.

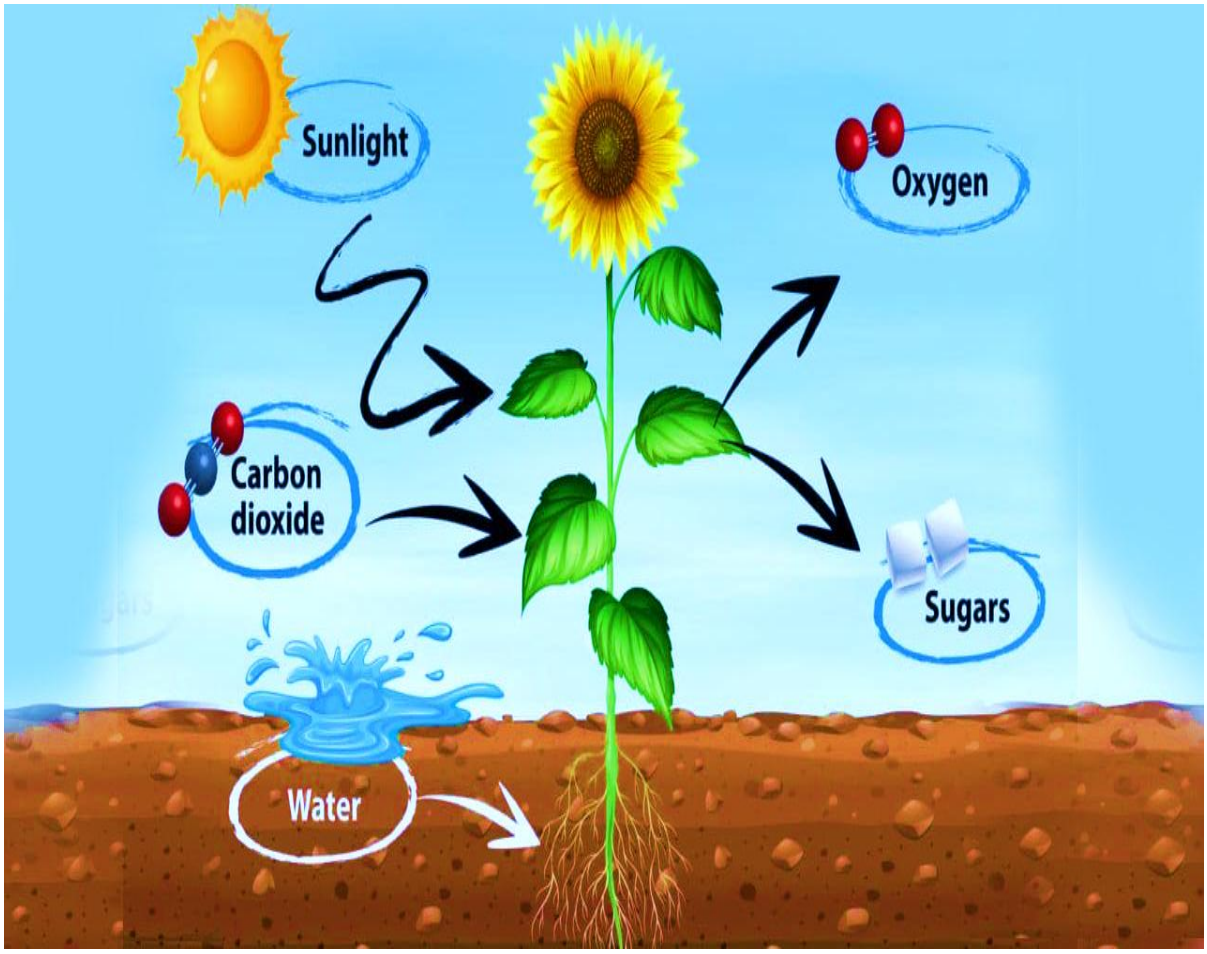
The **oxygen** produced during light stage is ***released as a by- product*** and some is used by the same plant ***for respiration.***

The hydrogen produced in the light stage is used in the dark stage of photosynthesis. This stage occurs in the grana of the chloroplast during the day.

2. **Dark stage/light independent stage**



During this stage, **hydrogen** produced in the light stage **reacts** with **carbon dioxide i**n the presence of **ATP molecules** to form **glucose.** The end product of the dark stage is **glucose.** Dark stage occurs in the **stroma** of the chloroplast **during the night**

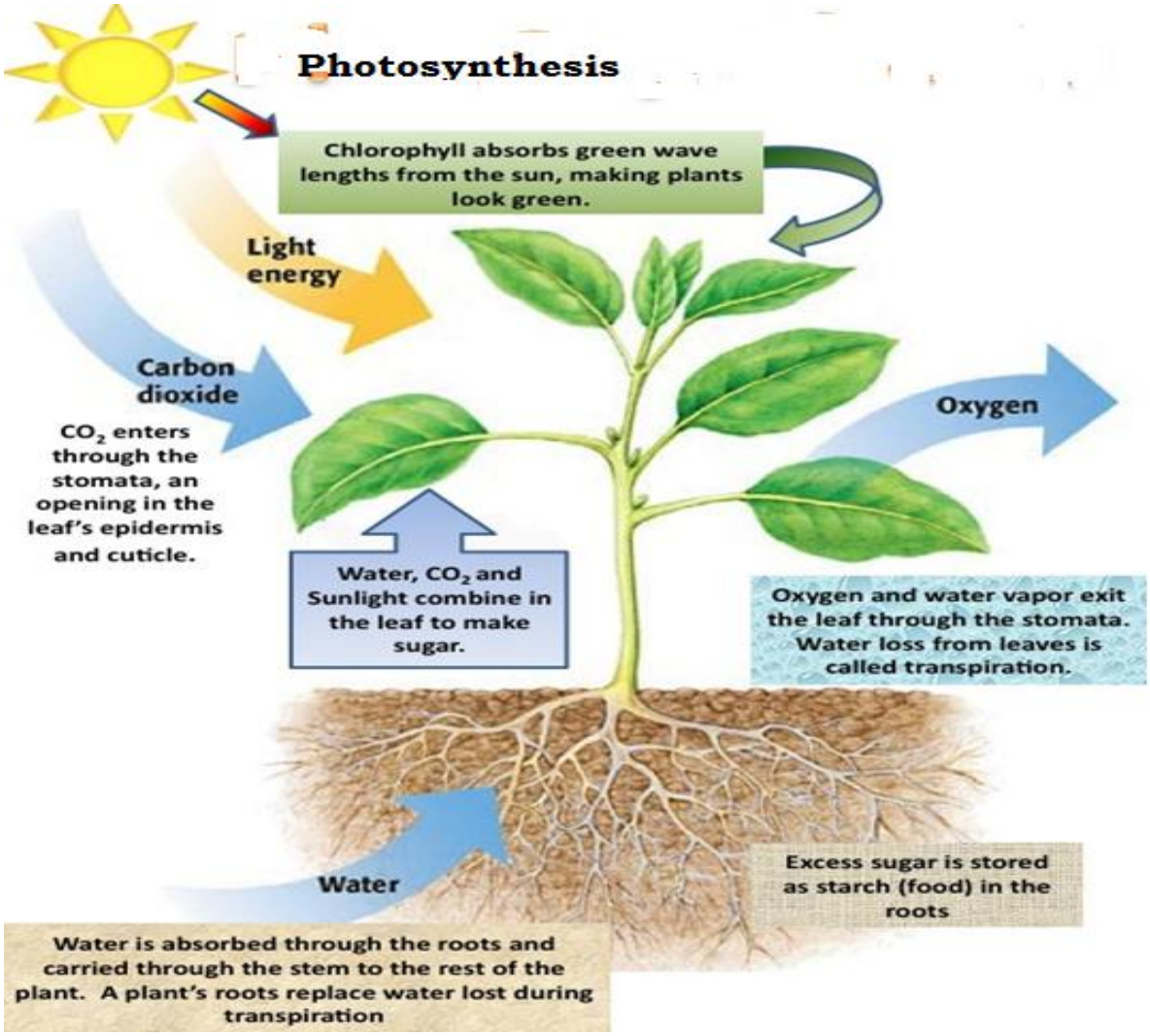



**During photosynthesis process, green plants which are producers**

- Obtains light energy from sunlight using chlorophyll. The role of Chlorophyll (green pigment)absorbs light energy from the sunlight.
- Green plants obtain carbon dioxide from the atmosphere through the stomata found on the surface of the leaves.
- Green plants obtain water from the soil through the roots.
- Water and carbon dioxide are used in the green plants as raw materials which combine to make sugar, the main and the immediate product of

photosynthesis. Excess sugar is stored in the plants in form of starch. Oxygen is also produced as it's by product.

- Water vapour and oxygen diffuses out of the leaves to the atmosphere through the stomata. See the diagram below.



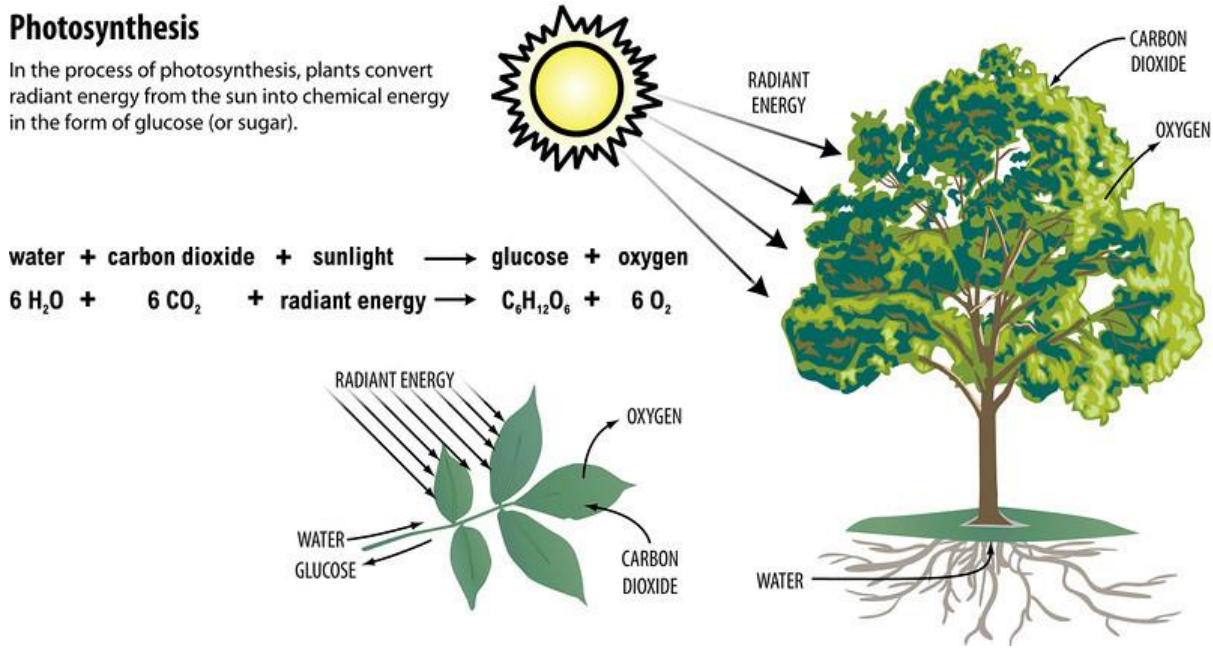

**WORD EQUATION OF PHOTOSYNTHESIS PROCESS**

The word equation of photosynthesis process is shown below**:**

$$\text{carbon dioxide + water} \xrightarrow[\text{chlorophyll in leaves}]{\text{energy from light}} \text{glucose + oxygen}$$

**CHEMICAL EQUATION OF PHOTOSYNTHESIS PROCESS**

**The following is the chemical equation of photosynthesis process:**




**IMPORTANCE OF PHOTOSYNTHESIS**

It is important for the following reasons

1. **It is a source of energy**

   Plants make their own food through the process of photosynthesis. Animals depend directly or indirectly on plants for their food. The food in plants contains energy from the sun stored as chemical energy. This energy is transferred to animals when they feed on plants. This energy is necessary for normal life processes to take place.

2. **It provides oxygen in air**

   Oxygen is a by-product of the process of photosynthesis. This oxygen replaces oxygen in air which is continuously used up by all living things during respiration.

3. **It makes carbon dioxide available to plants and animals**.

   During photosynthesis, the carbon part of carbon dioide from the air is incorporated into the synthesized food. This way, the carbon is made available to living things.

4. **It prevents accumulation of carbon dioxide in the air.**

Some of the carbon dioxide in the air is used up during photosynthesis. A reduced level of carbon dioxide in the atmosphere prevents global warming. Global warming is the increase in global temperature caused by increasing levels of carbon dioxide in the atmosphere among other factors.

## STOMATES

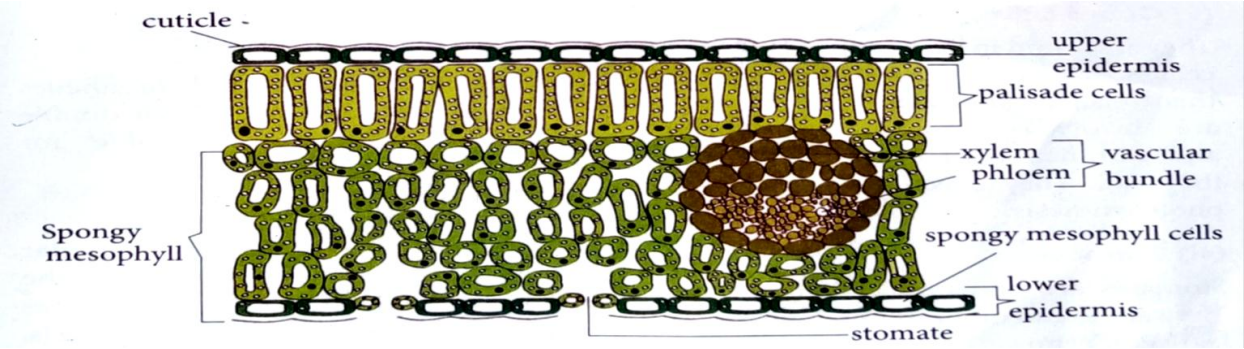
### THE DISTRIBUTION OF THE STOMATA ON THE UPPER AND LOWER SURFACE OF THE LEAVES

- There are more stomata on the lower surface than on the upper surface of the leaf.
- Plants growing on land always have more stomata on the lower surface. This is important because it enables them to minimise loss of water by exposing only few stomata on the side that faces the sun directly. The side that is hidden from the sun has more stomata.
- In plants growing in water such as water lily, they have very many stomata on the upper surface and few stomata or none lower leaf to eliminate excess water absorbed.

  Number of stomata in a leaf also indicates where a plant is grown. Plants grown in areas with adequate water have leaves with many stomata.

### THE INTERNTAL STRUCTURE OF THE LEAF

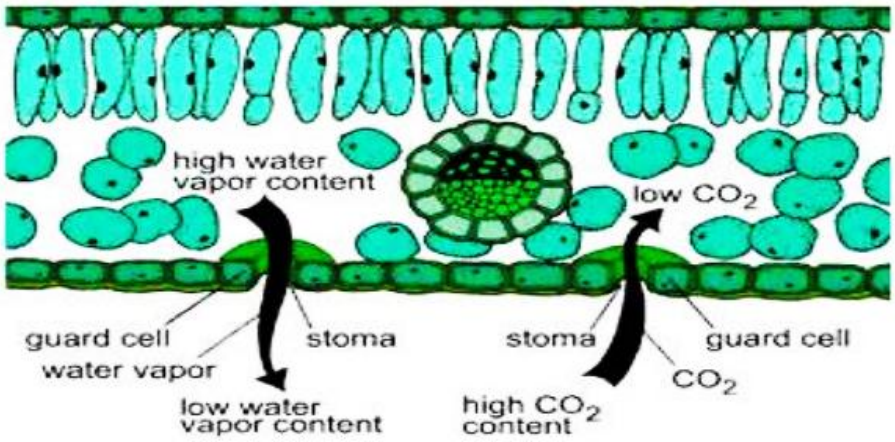
The internal structure of the leaf is composed of the following



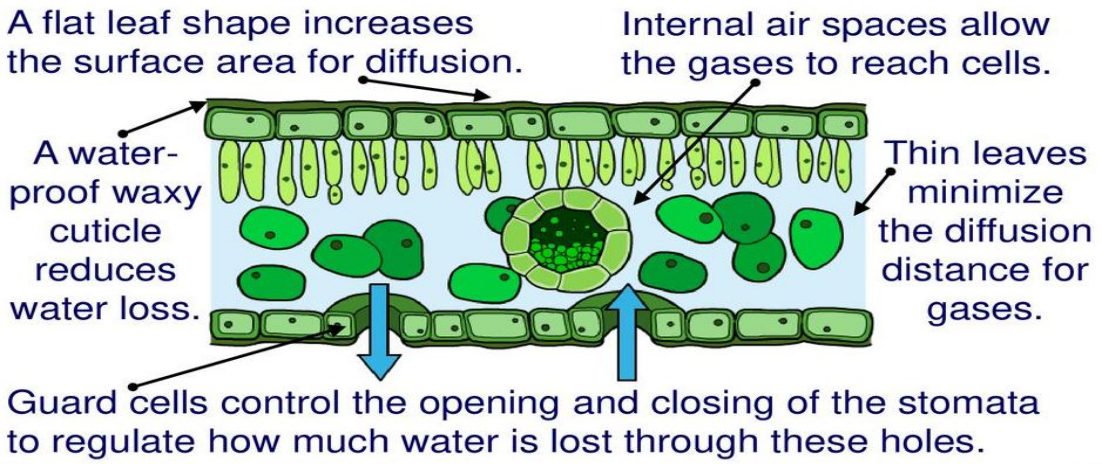

### GAS EXCHANGE IN PLANTS

- Carbon dioxide and oxygen diffuses in and out of the leaves through the stomata.

- Carbon dioxide is used in **photosynthesis** process and produced by **respiration**
- The diagram below shows gas exchange through the stomata found on the surface of the leaf.



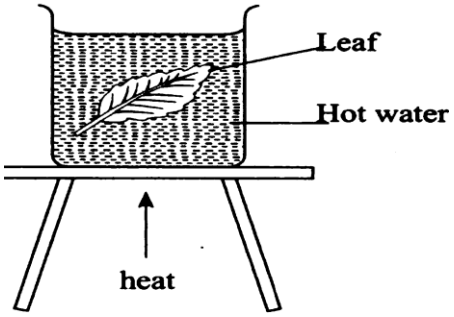

**Leaves are adapted to increase the rate of diffusion of gases and to reduce the rate of water by evaporation in the following ways:**



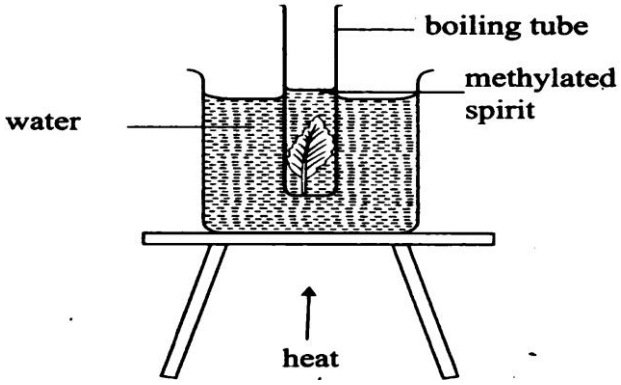

**THE STEPS FOLLOWED WHEN TESTING FOR STARCH IN THE LEAF**

**These include**

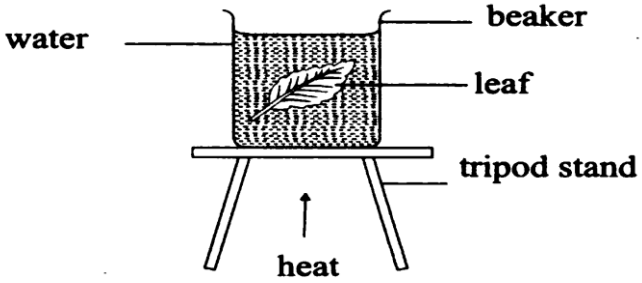
1. The potted plant is kept in the dark for three days or 72hours so that the leaves are destarched
2. The destarched leaf is placed in boiling water to for 30 seconds in order to kill leaf cells and denature enzymes so as to stop further chemical reactions within it.



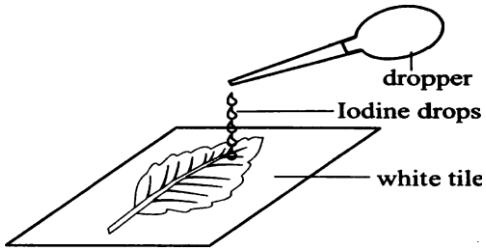

3. It is boiled in methylated spirit or alcohol to remove chlorophyll from the leaf and becomes white.IT is easier to observe colour changes on such a leaf. However, alcohol makes the leaf stiff and brittle.



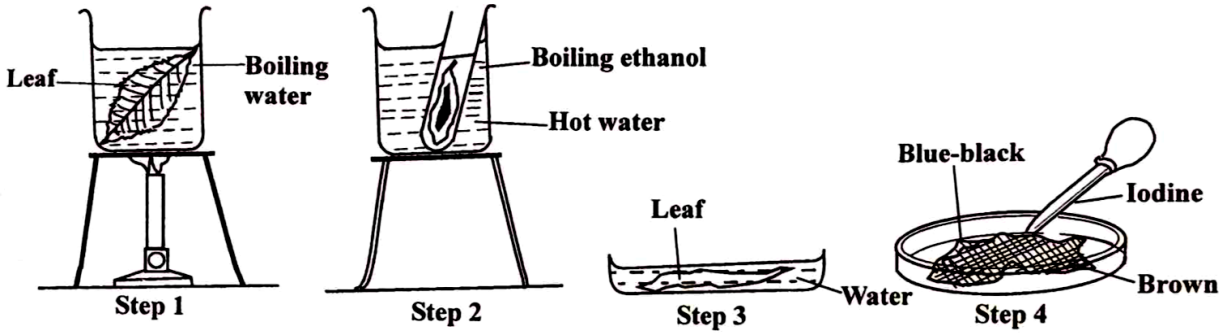

4. The leaf is placed in boiling water in order to soften it so that it can be spread out on the tile for testing with iodine solution.




5. It is placed on a flat white tile and placed iodine solution on it in order to test for starch.



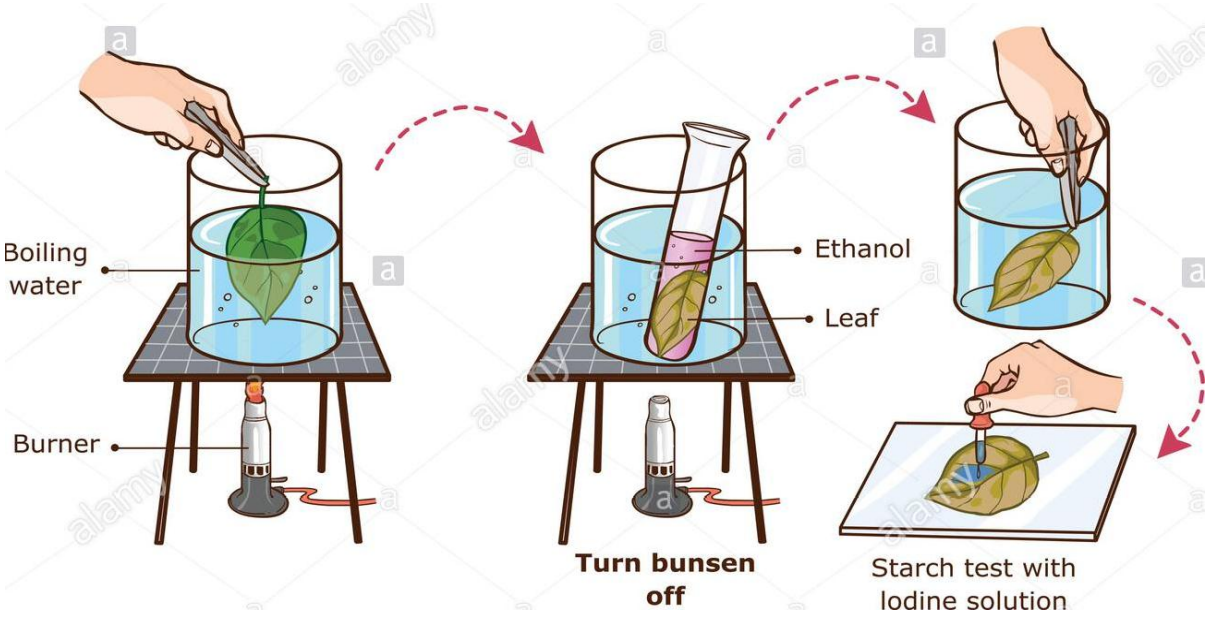
If the iodine solution changes colour from brown to blue-black, then that part of the leaf has starch and therefore photosynthesis must have taken place in that part.




**SUMMARY OF THE FOUR STEPS OF STARCH TEST IN THE LEAF**

The four steps of starch test in the leaf can be summarized in the diagrams below:

**Explain the purpose of each of the following steps of starch test in the leaf.**



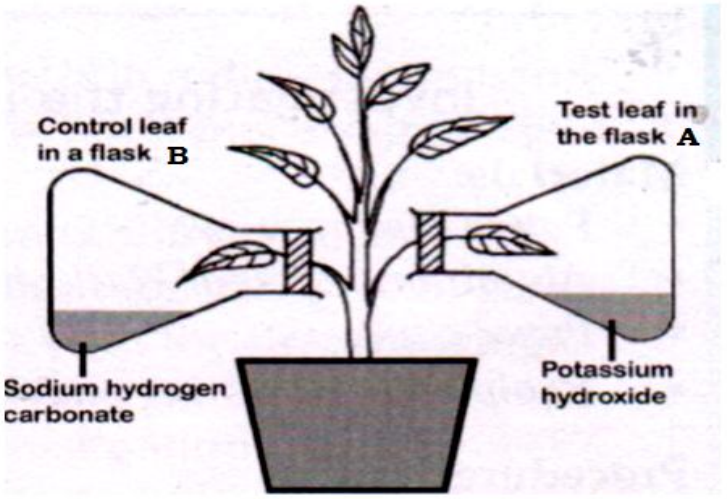

- Step 1 is carried out to kill the cells and stop chemical reactions in the leaf.
- Step 2 is carried out to declourise or removes chlorophyll from the leaf.
- Step 3 is carried out to soften the leaf
- Step 4 is carried out to test for starch presence in the leaf. If starch is present, the leaf turns blue-black but if it is absent, the leaf remains brown.

**REQUIREMENTS FOR PHOTOSYTHESIS PROCESS IN GREEN PLANTS-**

**EXPERIMENT 1**

**AIM: TO SHOW THAT CARBON DIOXIDE IS NECESSARY FOR PHOTOSYNTHESIS PROCESS**

**PROCEDURE**




**CONTROL EXPERIMENT**

Control experiment is the experiment with of factors available for the process to take place. In respect with this experiment, Flask B is the control experiment.

**PROCEDURES**

1. Keep the potted plants in dark for three days or 72hours so that the leaves are destarched.
2. Place the leaves of the potted plants A in a conical flask containing potassium hydroxide or soda lime. The purpose of potassium is to absorb carbon dioxide from the air.
3. Place the leaves of the other potted plant B in a conical flask that contains sodium bicarbonate which produces extra carbon dioxide.
4. L-eave the plant in sunlight to allow the leaves to photosynthesize.
5. After a few hours, test the particular leaf and some other leaf of the same plant for the presence of starch.

**OBSERVATION**

The leaf which was inserted in the conical flask that contains potassium hydroxide turns brown and the other leaf contained in a conical flask containing sodium bicarbonate turns blue-black.

**CONCLUSION**

Potassium hydroxide in the conical flask absorbs carbon dioxide; thus, due to the absence of carbon dioxide, the leaf fails to produce starch which proves that carbon dioxide is necessary for photosynthesis.

**OR**

**AN EXPERIMENT TO SHOW THAT CARBON DIOXIDE IS NECESSARY FOR PHOTOSYNTHESIS PROCESS**

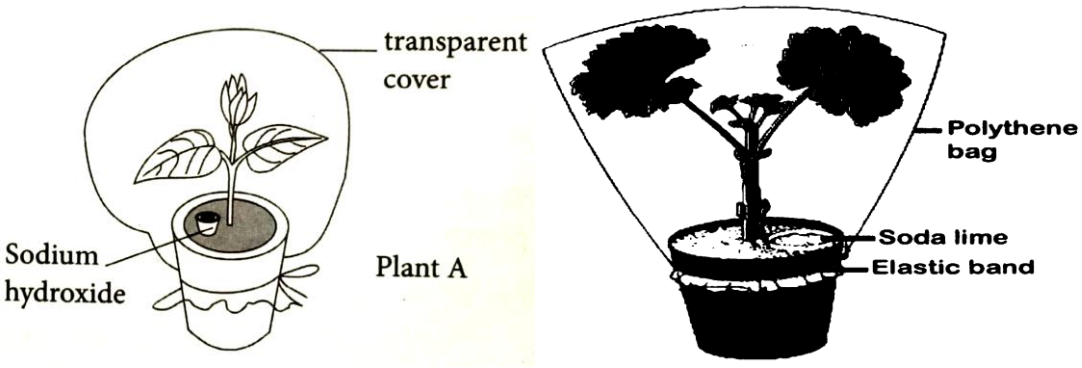
**Materials**

1. **Two potted plants** kept in the dark for 24 hours. The purpose of keeping the potted plant in the dark for 24 hours in order to destarch the plant 9to remove the starch from the leaves)
2. **-Transparent plastic bags** to allow light to pass through.
3. **Sodium hydroxide or potassium hydroxide solution** to remove or absorb carbon dioxide from the bag. This would make the leaves to deprived of carbon dioxide.

**PROCEDURE**

**1. PLANT A**

Put some sodium hydroxide or potassium hydroxide into the small plastic container and the plant should be covered with transparent polythene bag as shown below.

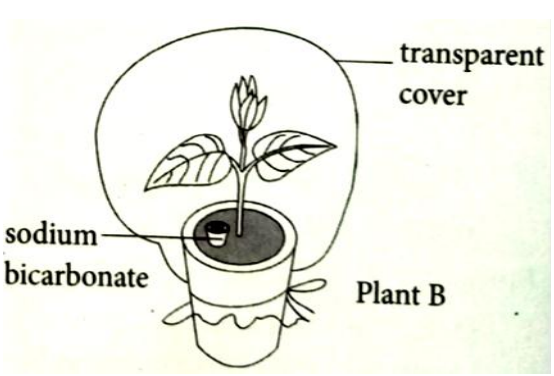


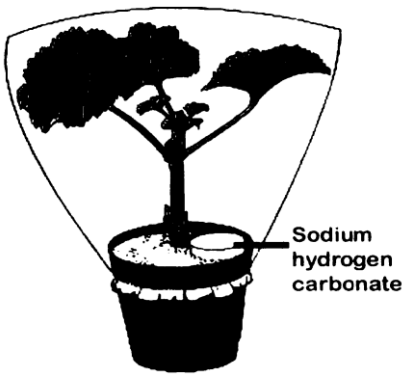
**THE PURPOSE OF SODIUM HYDROXIDE SOLUTION**

It absorbs carbon dioxide from the bag. This would deprive the plant of carbon dioxide. The leaf would not photosynthesize and hence it could not contain starch.

**2. PLANT B**

Repeat the procedure but place sodium bicarbonate solution/limewater in the soil holding the plant.




**PURPOSE OF SODIUM BICARBONATE SOLUTION**

It produces extra carbon dioxide for the plant.

**PURPOSE OF PLACING THE PLANTS IN SNLIGHT FOR 5-7 HOURS**

The two plants must be left in sunlight for 5-7 hours to allow photosynthesis to take place. Then one leaf from plant A and one leaf from plant B must be plucked and test for starch.

**RESULTS OF THE EXPERIMENT**

**SET UP PLANT A**

Sodium hydroxide absorbs carbon dioxide from air in the bag. Photosynthesis will not take place without carbon dioxide.

As a result, no starch is formed in the leaves of **plant A**. When the leaves from plant a are tested for starch they give a brown colour**.**

**SET UP PLANT B**

On the other hand, **set-up plant B** has a container with sodium bicarbonate. This chemical produces extra carbon dioxide into the air in the polythene bag. This

allows photosynthesis to take place in the leaves of plant B. When the leaves from plant A are tested for starch they change to **blue-black colour indicating presence of starch**. This activity shows that carbon dioxide is needed for photosynthesis to take place.

Set-up B acts as the control experiment

**DISCUSSION**

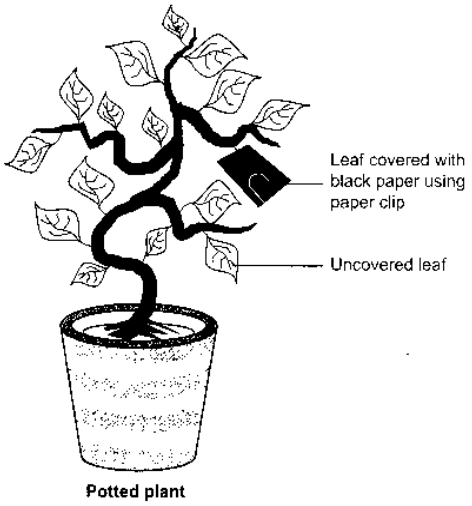
Sodium hydroxide or potassium hydroxide absorbs carbon dioxide from the air. The air in the bag in set-up A becomes free of carbon dioxide after some time. Photosynthesis will not take place without carbon dioxide. As a result, no starch is formed and the starch test is negative.

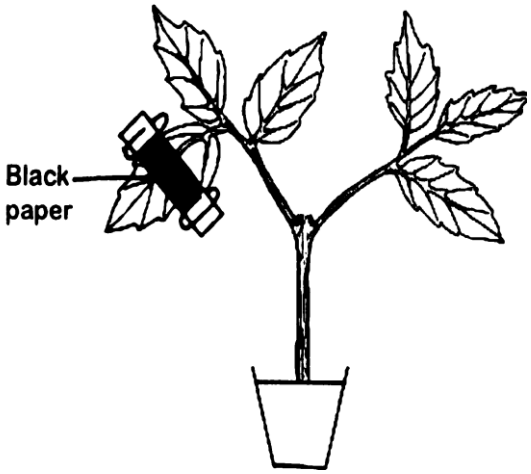
On the other hand

**AIM: TO SHOW THAT LIGHT IS NECESSARY FOR PHOTOSYNTHESIS**

**Apparatus and materials required**

A healthy potted plant , a petri dish , beaker containing water, forceps, a water bath, a burner, a piece of wire gauze, a tripod , a box of matches, alcohol , a strip of black paper, iodine solution and clips.

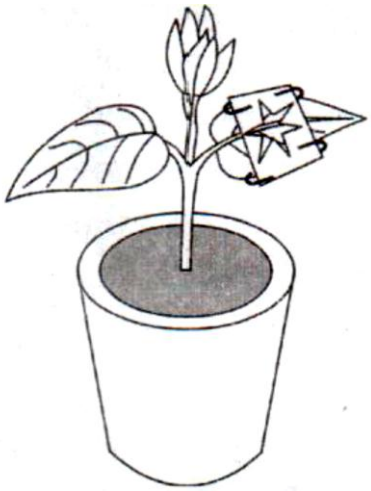


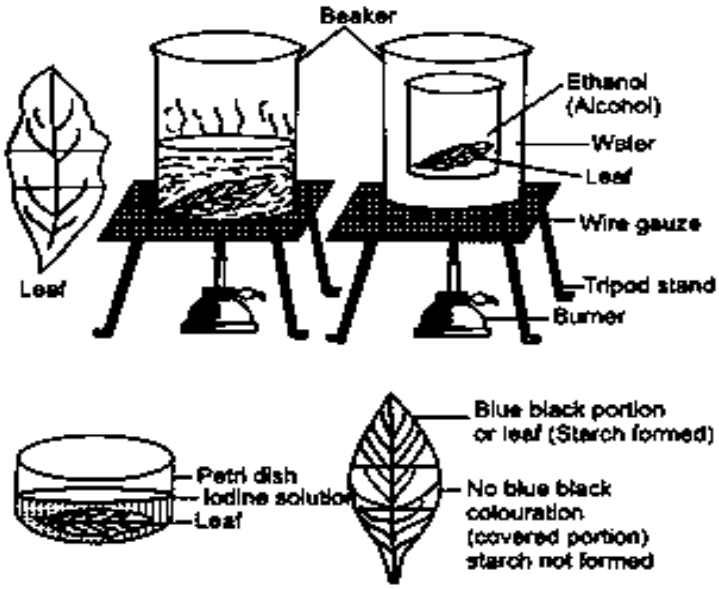

**PROCEDURE**

1. Take the potted plant and keep it in a dark place for 2-3 days so that the leaves get destarched.

2. Cover a part of one of the leaves with the strip of black paper. Make sure that you cover both the sides of the leaf

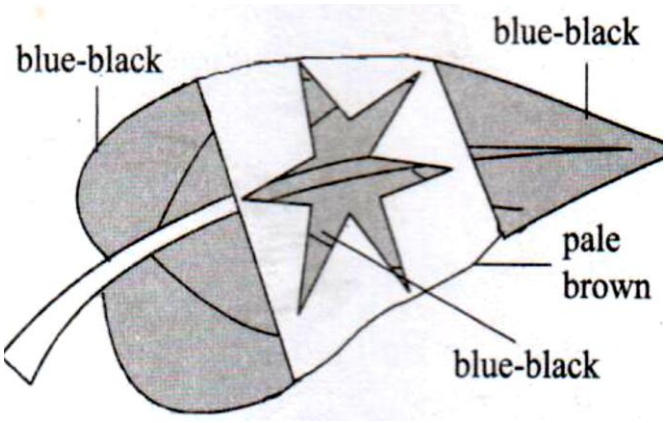


3. Now place this plant in sunlight for 3-4 hours.
4. Pluck the selected covered leaf and remove the black paper covering it. This prevents the entry-y of light.
5. Place this leaf in the beaker and boil it for about 10 minutes.
6. Take out the leaf and wash it under running water.
7. Take out the leaf in the petri dish and put a few drops of iodine solution on it. Now observe the change in colour. These steps are summarized below.




**OBSERVATION**

On testing with iodine, the area covered with the paper clip or foil turned brown since this covered region did not receive light, hence photosynthesis did not occur. Hence no starch was formed there. The part of the plant not covered with the foil(the uncovered region) received light and starch was formed there due to photosynthesis. Therefore, on testing with iodine, it appeared blue-black. This is because starch was present. This part of the leaf acted as a control set-up since it had all conditions needed for photosynthesis.




**CONCLUSION**

Light is necessary for photosynthesis.

**VARIEGASTED LEAF**

A variegated leaf is one whose surface shows two colours, for instance, green on some parts and white on others. The green part has cells with chlorophyll so they can carry out photosynthesis and form starch. This part will turn blue-black to show presence of starch when iodine is applied. The white part has cells that do not have have chlorophyll. These cells will not carry out photosynthesis, so no starch will be formed. The starch test will be negative.

The green part of the leaf acts as a control experiment because it has all the conditions required for photosynthesis.

The figure below shows variegated leaf before testing with iodine and after testing with iodine.


*Leaf before testing with iodine*

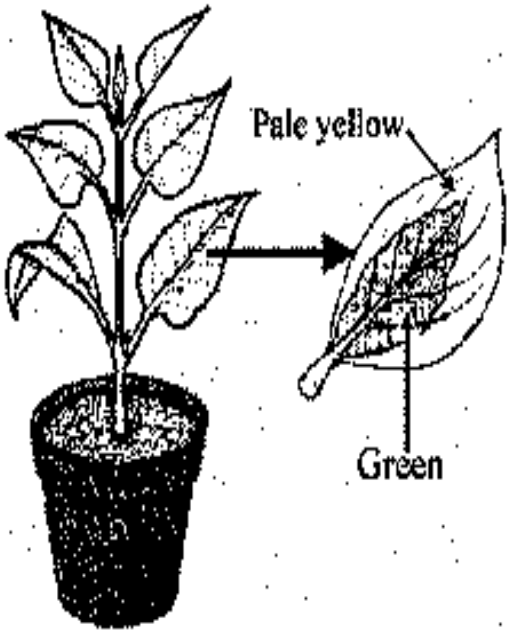

*After testing with iodine*

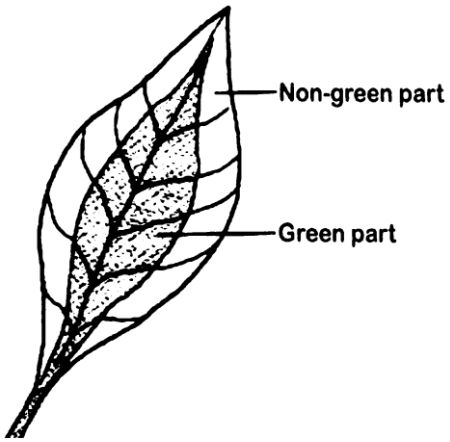
**EXPERIEMENT ON THE ROLE OF CHLOROPHYLL IN PHOTYOSYNTHESIS**

**Aim: To show that chlorophyll is essential for photosynthesis**

**Procedure:**

1. Take a potted plant with variegated leaves (whose leaves are partly green and partly white). The green part of the leaf has chlorophyll but the white part of the leaves does not have- chlorophyll.

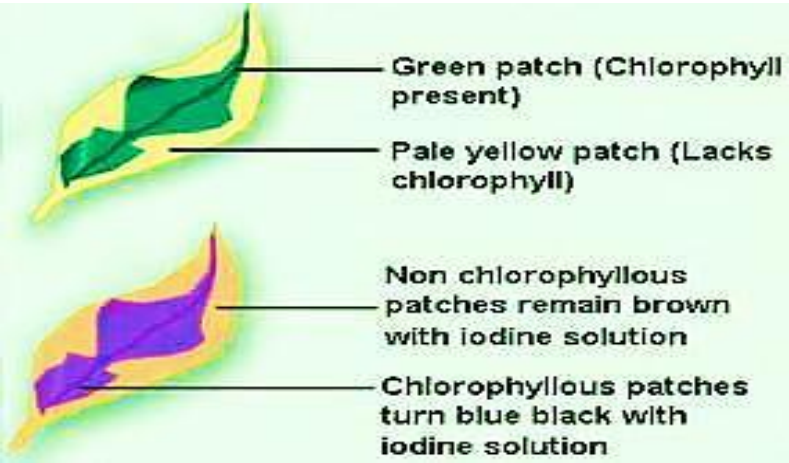


2. Place this plant in a completely dark place for about three days or 48 hours to destarch its leaves.
3. Take out the potted plant and keep it in bright sunshine for three to four days.
4. Pluck the variegated leaf from the plant and then remove its green colour "chlorophyll" by boiling it in alcohol. The green parts of the leaf get decolourised. So, we get decolourised leaf.
5. Wash the decolourised leaf with hot water to soften it and remove any chlorophyll which may b-e sticking to it.
6. Test the leaf for starch by pouring iodine solution over the colourles leaf and observe the change in colour of the leaf.

**Observations**

7. The outer part of leaf that was originally pale yellow (without chlorophyll) does not turn blue-black on adding iodine solution showing no starch is present in this outer part of the leaf.




**Conclusion**

- From this observation, we conclude that the photosynthesis to make starch does not take place without chlorophyll.

**Observation**

8. The inner part of leaf which was originally green (contained chlorophyll) turns blue-black on adding iodine solution showing that starch is present in this inner part of the leaf.

**Conclusion**

From this observation, we conclude that photosynthesis to make starch takes place in the presence of chlorophyll. In other words, chlorophyll is necessary for the process of photosynthesis.

**AN EXPERIMENT TO SHOW THAT CHLOROPHYLL IS NECESSARY FOR PHOTOSYNTHESIS PROCESS,**

Variegated leaf is used to investigate the importance of chlorophyll in the process of photosynthesis. Variegated is one whose surface shows green and non-green colours.

The **green part** has **cells with chlorophyll** so they **carry out photosynthesis** and **form starch**. This part will **turn blue-black** to show **presence of starch** when iodine is applied.

The **non-green part** has cells that do not have chlorophyll. These **cells will not carry out photosynthesis**, so **no starch will be formed**. Starch test will give a **brown colour**.

**EXPERIMENT**

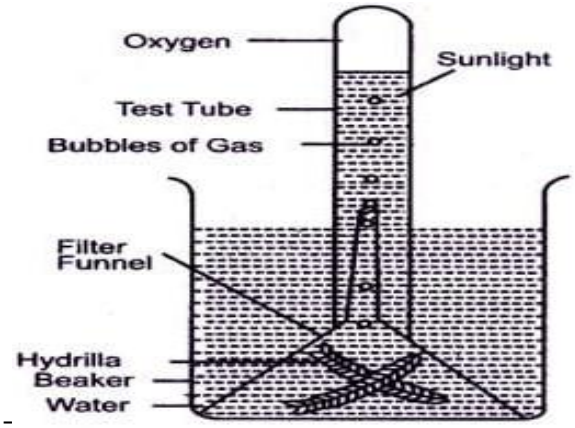
**AIM: TO DEMONSTRATE THAT OXYGEN IS PRODUCED DURING PHOTOSYNTHESIS**

**Materials required**

Beaker, water, test-tube, funnel, hydrilla plant

**PROCEDURE:**

1. Take a beaker to fill it with water and put Hydrilla plant in the beaker.
2. Add 1g of sodium bicarbonate to the water and stir until dissolved. The purpose of sodium bicarbonate in the experiment is to produce extra carbon dioxide.
3. Cut the base of the plants, tie them with a thread and cover them with an inverted funnel in such a manner that the cut end of the plant is towards the neck of the funnel.
4. Keep the whole apparatus in sunlight for some time and observe




**OBSERVATION**

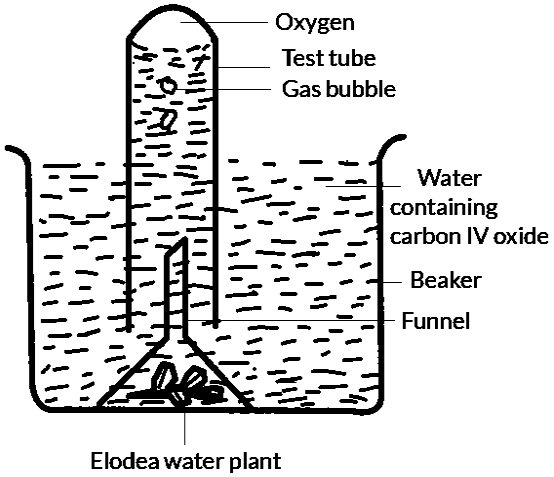
It is observed that some bubbles are coming out continuously from the cut ends of the plant and bubbles are collected at the top of the test tube by displacing the water.

**RESULTS**

On testing, it is confirmed that the gas is oxygen. The liberated gas is evolved due to the breakdown of water in presence of water.

**AN EXPERIMENT TO SHOW THAT OXYGEN IS PRODUCED DURING THE PHOTOSYNTHESIS PROCESS**

The plant was placed in bright sunshine. The aim of placing one set-up in the bright light was to allow the water weed to photosynthesis as it receives sunlight .Sodium bicarbonate was added in the water in the beaker in order to enrich or to produce extra carbon dioxide in the water**.**



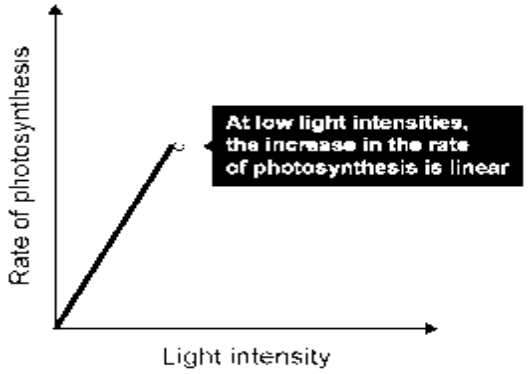
**RESULTS**

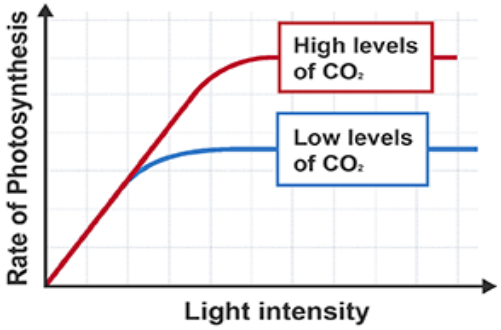
1. It was observed that there were bubbles of gas rising in the funnel in the set-up that was placed in the bright sunshine and nothing was observed in the set-up that was placed in the cup-board.
2. When the glowing splint was exposed to the gas collected in the test-tube B, it relit. This showed that oxygen that oxygen gas was being produced.

**THE MAIN FACTORS AFFECTING RATE OF PHOTOSYNTHESIS**

The main factors affecting rate of photosynthesis are light intensity, carbon dioxide concentration and temperature.

**1. Light intensity**

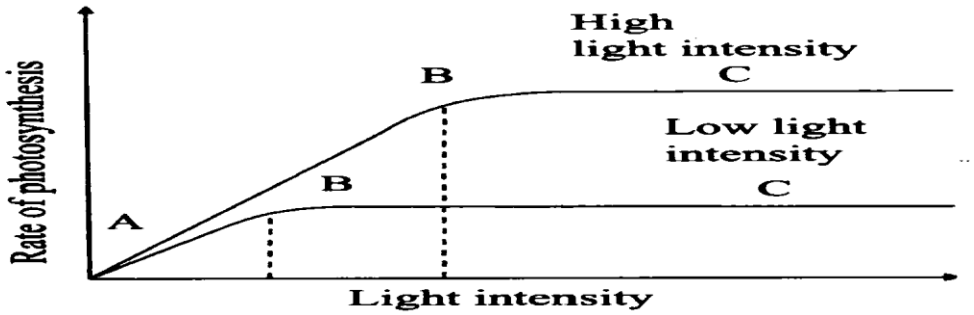



Without enough light intensity, a plant cannot photosynthesize very quickly even if there is plenty of water and carbon dioxide and a suitable temperature.

Increasing the light intensity increases the rate of photosynthesis until some other factors becomes in short supply. At very high light intensities, photosynthesis is slowed and then inhibited but these light intensities do not occur in nature.

The graph below shows the effect of light intensity on the rate of photosynthesis.



From the graph:

**A** and **B**- An increase in light intensity leads to an increase in the rate of photosynthesis.

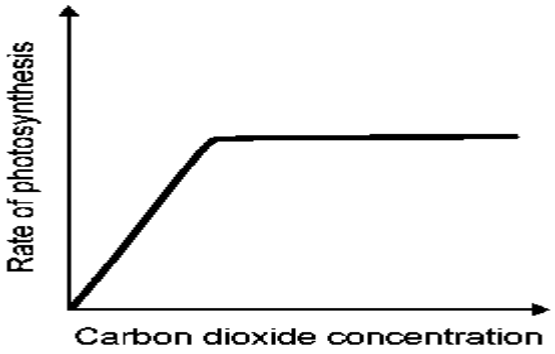
B and C- Any further increase in light intensity does not lead to an increase in the rate of photosynthesis. Instead, other factors limit the rate of photosynthesis at this point for instance carbon dioxide may be used up and therefore even with more light no more glucose can be made.

The light intensity varies with time of day, season and position of the plants on the earth's surface, Presence of water vapour, clouds, dust and air pollutants in the atmosphere reduces light intensity.

Photosynthesis takes place more rapidly on bright days than on dull days. However, very high light intensities destroy chlorophyll and slows down the rate of photosynthesis.

Plants in environments that receive a lot of sunlight have thick cuticles or hairy leaves for protection against very strong light.

**2. Carbon dioxide concentration**

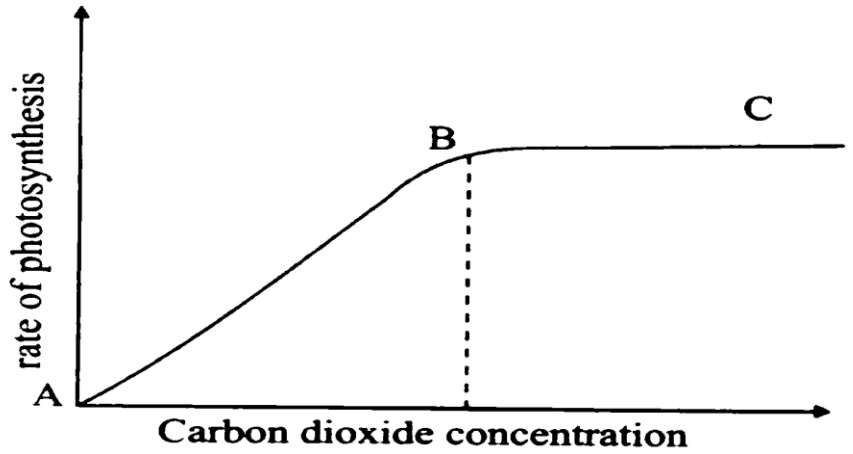



Carbon dioxide with water is one of the reactants in photosynthesis. As carbon dioxide concentrations increase, so too does the rate of photosynthesis until a certain point where the graph levels off. In other words, if the concentration of carbon dioxide is increased, the rate of photosynthesis will therefore increase.

At lower carbon dioxide concentrations, carbon dioxide is the limiting factor because an increase in carbon dioxide causes an increase in photosynthesis.

At higher carbon dioxide concentrations (plateau of graphs), further increasing the carbon dioxide concentration does not increase the rate of photosynthesis meaning another factor is limiting photosynthesis. In other words, at some point, a different factor may become limiting. Beyond this concentration, further increases in the concentrations in the concentration of carbon dioxide will not result in a faster rate of photosynthesis, and would appear on a graph as a horizontal line.

The graph below shows the effect of carbon dioxide concentration on the rate of photosynthesis.




**From the graph**

**Point A-B:** Increase in concentration of carbon dioxide causes a rise in the rate of photosynthesis**.**

**Point B-C:** Limiting factors set in and a further rise in carbon dioxide concentration does not cause a corresponding increase in the rate of photosynthesis.

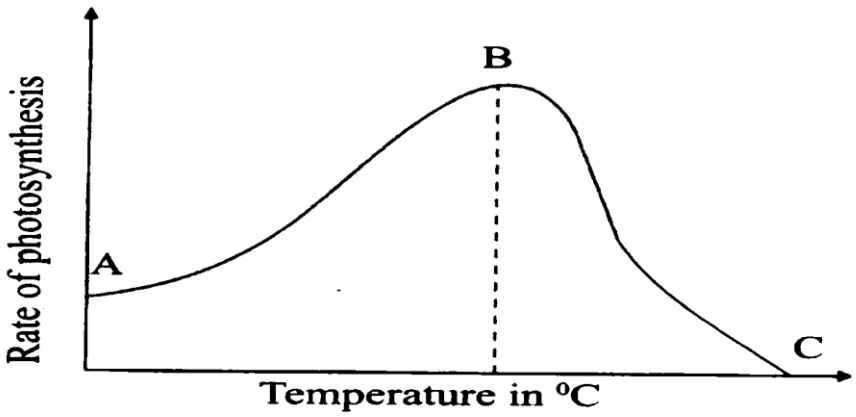
**3. Temperature**

The chemical reactions that combine carbon dioxide and water to produce glucose which are controlled by enzymes.

Temperature affects the rate of photosynthesis.

At low temperatures, the rate of photosynthesis is limited by the number of molecular collisions between enzymes and substrates. If the temperature is very

low, for example $0^oC$, then the enzymes are inactive and little photosynthesis takes place. At high temperatures, enzymes are denatured. If the temperature is higher than$40^oC$, enzymes are denatured. This means than an increase in temperature increases the rate of photosynthesis up to a certain point. Any further increase in temperature denatures the enzymes and the rate of photosynthesis falls rapidly as shown in the following figure, point **B-C**.




**From the graph:**

**Point A-B-** Increase in temperature causes a corresponding increase in the rate of photosynthesis. The rate of photosynthesis is highest at point B.

**Point B-C** – Any further increase in temperature causes denaturing of enzymes, so the rate of photosynthesis declines.

## CHAPTER 3- BLOOD DONATION

**What is blood transfusion?**

It is a process whereby a patient is given blood that has been donated by another person

**State five reasons why blood transfusion is necessary**.

1. Due- to excessive loss of blood by mothers at child birth.
2. Excessive loss of blood due to an accident or an injury.
3. Patients undergoing surgery that leads to excessive blood loss.
4. Children suffering from acute anaemia.
5. Patients undergoing surgery that leads to excessive blood loss.

**What is blood donation?**

It is a process whereby a healthy individual gives some amount of blood for use in blood transfusion to a patient.

During blood donation, the blood is collected by qualified medical staff under the Ministry of Health, the Red Cross and the officers of the blood transfusion services

**What are blood banks?**

These are where the blood is stored in hospitals which are kept at cool temperatures and chemicals are added to it to ensure it does not clot.

**Explain two types of blood donors.**

1. **Family replacement donors**

These are family members of a patient who are requested to donate blood to replace the one t-he patient used from the blood bank. This is done to make sure that another patient visiting the hospital with a need of blood will also be assisted.

2. **Voluntary non-remunerated donors**

These are individuals who freely donate blood at any time with a motive to save lives. This is done to ensure the blood banks will always have sufficient blood.

**Voluntary** means that the giving is done out of one's will without being forced or enticed.

**Non- remunerated** means that the person does not ask for payment. The act is done for free.

**Types of blood donations**

1. **An alllogeneic (homologous) donation**

   This is when a donor gives blood for storage at a blood bank for transfusion to an unknown recipient.

2. **Directed donation**

   This is when a person, often a family member, donates blood for transfusion to a specific individual**.**

3. **Replacement blood donating**

This is a hybrid of the two and is common in developing countries such as Malawi. In this case, a friend or family member of the recipient donates blood to replace the stored blood used in a transfusion ensuring i consistent supply of the blood.

4. Antilogous blood donation

   When a person has blood stored that will be transfused back to the donor at a later date, usually after surgery, that is called an **autologous donation.**

**Explain the steps that are involved in the blood donation process.**

- **Pre-donation counselling**
- Before donation of blood, the volunteers are taken through a session where they are taught about the importance of blood donation and the requirements for blood donation.
- At this session the donors are allowed to ask questions about their fears and the things they may not be sure of about blood donation.
- It is als-o used to teach the donors on who should donate blood and who should not. At the same time the donors are informed that after the donation, their blood would be screened and they would be given results of the tests. The results are confidential and can only be revealed to the donor after the tests. The results include t**he blood group, presence of any disease pathogens, and the health status of the donor**
- **Venipuncture**
- This is where the blood transfusion services help the donors in determining whether they are suitable to donate blood.
- The following criteria is used
- The age of the donor- not too young and not too old. The donor should be between 16 and 65 years old.
- Donor must be healthy at the time of donation to ensure there are no disease causing pathogens in his/her blood.

- Donor must not be suffering from diseases such as HIV and AIDS, syphilis and hepatitis B and C. These are diseases that are easily transmitted through blood.-
- After answering the questions, a brief medical examination is done on the donor. The blood pressure is first checked to make sure it's at normal level. Then a drop of blood is taken from the donor and then tested by the technicians for haemoglobin content. The tests will show whether the donor is eligible to donate the blood or not depending on his/her haemoglobin content.
- Venipuncture is a procedure where a needle is inserted into a vein to obtain blood.
- A person donating the blood is made to be very comfortable by reclining on blood donor chair. The chair is designed to ensure a comfortable position during blood donation.

- The technician identifies a vein on the arm to carry out venipuncture. A needle is inserted direct into the vein. An elastic band may be used to elevate the blood pressure in the veins of the arm. It is tied on the upper part of the arm in order to ease and speed up the process. Sometimes the donor is given an object -to squeeze repeatedly in order to increase blood flow to the targeted vein.

**c. Post-donation counseling**

- This done after blood donation where blood is taken to the blood transfusion laboratories where each individual blood is screened.
- Blood screening means carrying out tests on the donated blood to determine its suitability for transfusion.
- The tests in the blood transfusion laboratories include
  a. The -blood groups
  b. HIV tests
  c. Hepatitis B and C
  d. Tests for pathogens
  e. Rhesus factor tests
- The results of the tests are confidential and are then communicated to the donor.
- In case the blood is free of any problem, the donor is counseled on how to maintain health.

In case there is a problem such as the blood testing positive for HIV virus or Hepatitis B and C viruses, the patient is counseled on steps to take to live positively and to seek appropriate medication. All this information is always held confidentially.

## MALAWI BLOOD TRANSFUSION SERVICES

### THE OBJECTIVES OF THE MALAWI BLOOD TRANSFUSION SERVICES

It was established by Malawi government with the help of the European Union in 2003 to achieve the following objectives.

1. To reduce the incidence of HIV and AIDS and other diseases transmissible by blood and blood products.
2. Provide a safe and adequate blood supply to all health care facilities.
3. To provide adequate supplies of safe blood and blood products to meet the needs of all patients in all hospitals in Malawi.

### THE ACTIVITIES OF THE MALAWI BLOOD TRANSFUSION SERVICES

The following are the activities of the Malawi Blood Transfusion Services

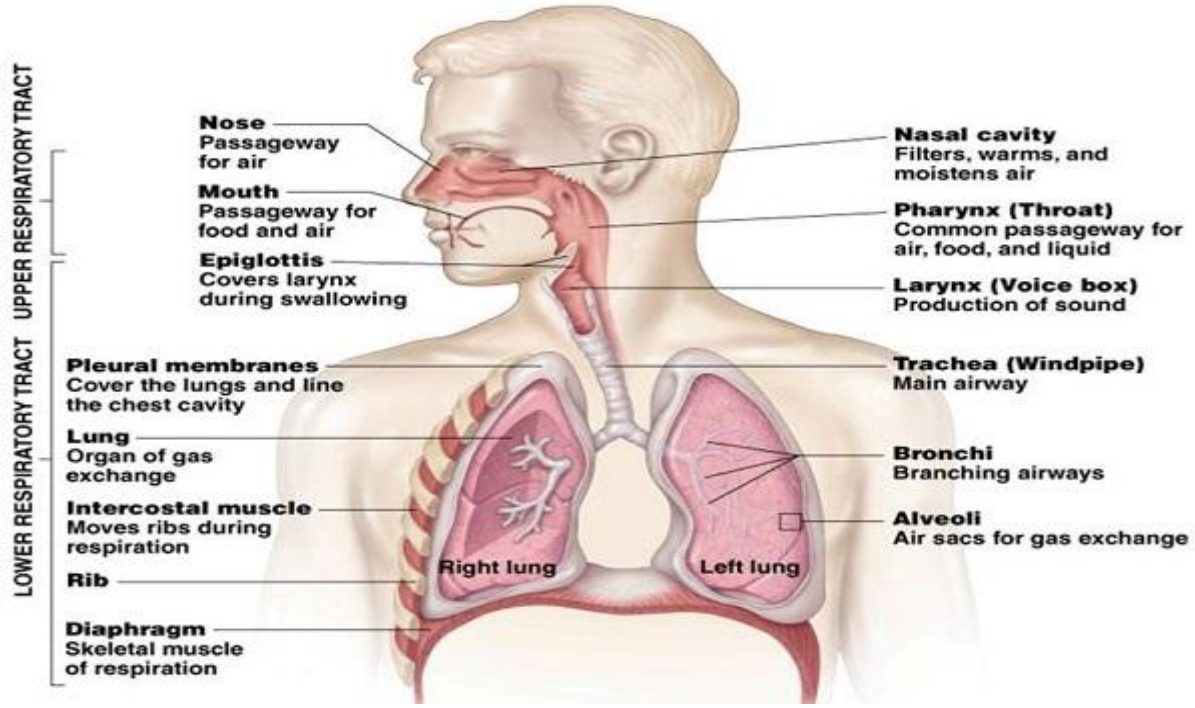
1. To collect blood from donors
2. To process the collected blood
3. To test an-d screen the collected blood
4. To supply safe and adequate blood products to all authorised hospitals in Malawi.
5. To encourage blood donation amongst school students, university students, youth groups and communities etc.
6. To encourage establishment of club 25 whose members assist the national blood transfusion services in encouraging others to do donate blood.
   The club has elected national and provisional administrative committees to organize activities.
7. The MBTS assists the 'Malawi Club 25 in supporting and facilitating regular meetings, providing secretarial services and promotional activities.

**FACTORS TO CONSIDER BEFORE BLOOD TRANSFUSION**

1. **Blood groups-** to avoid sticking together of red blood cells called agglutination.
2. **Rhesus factor-** to avoid miscarriage to pregnancies**.**
3. **HIV/AIDS** - to prevent transmission**.**
4. **Presence of hepatitis B - to avoid infection.**
5. **Syphilis- to avoid infection**
6. **Test for haemoglobin- To avoid oxygen short supply which may lead to death.**
7. **Blood pressure -test-** To avoid deaths that may occur due **to lower blood pressure.**
8. **Age of the donor us-** the blood donor too young
9. **Hepatitis**- Blood from individuals suffering from hepatitis should not be used for transfusion because virus can be transmitted through blood**.**

## CHAPTER 4- THE HUMAN RESPIRATORY SYSTEM

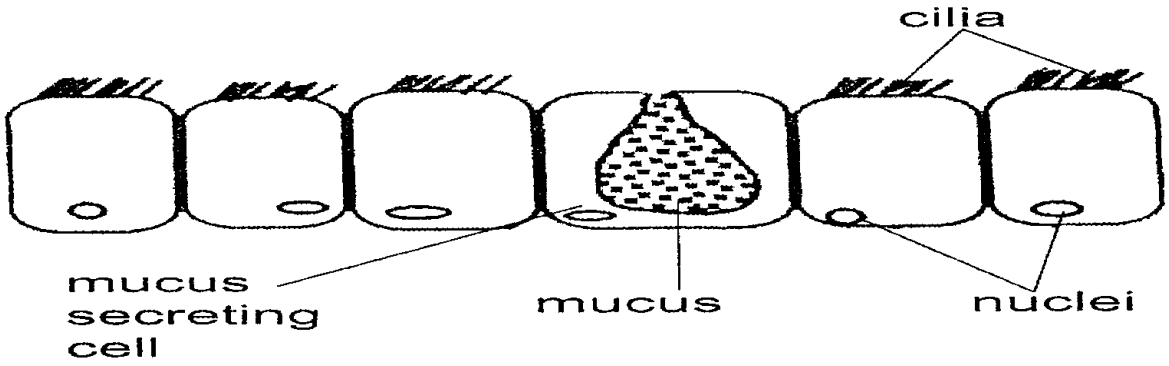
The human respiratory system is also called the breathing system because it involves the taking of air in and out of the lungs through the nose and mouth.




### IMPORTANCE OF BREATHING THROUGH THE NOSE

It is safe to take air into the lungs through the nose because it protects the delicate lining of the lungs in the following ways:

1. **Cilia** and **mucus** present in the nose trap dust particles and microbes that may be inhaled with the air. Cilia move the mucus with trapped dust out of the nasal cavity as shown in the diagram below.



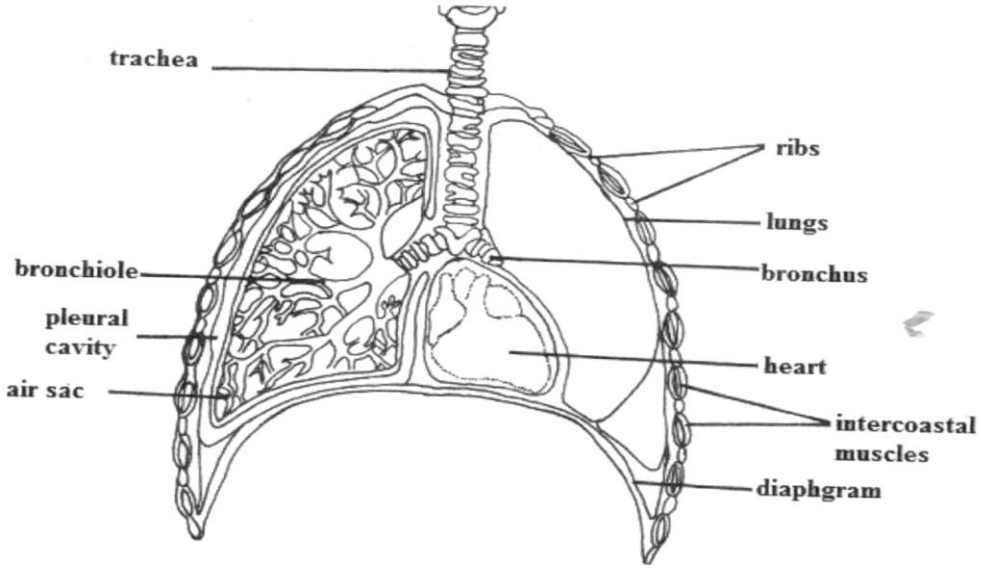

2. **Water vapour** from the mucous moistens the air once it is inhaled.

3. **Warms** the air using heat from the blood vessels in the nasal cavity.

**FUNCTIONS OF THE LARYNX AND EPIGLOTTIS**

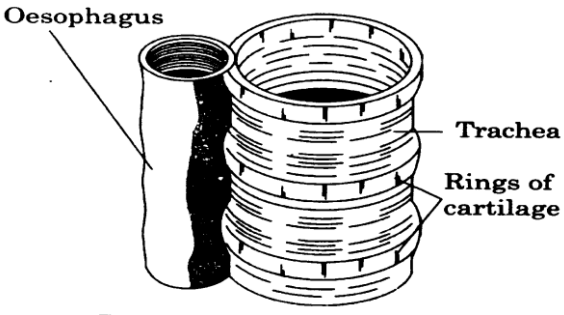
- **Larynx** is the passage of air into the trachea.
- **Epiglottis** prevents food and liquid from entering the trachea when swallowing.

**HUMAN RESPIRATORY SYSTEM**




**THE TRACHEA**

- It is the air tube leading to the lungs. It takes air of the air passages into the lungs.
- The trachea has rings of cartilage to keep it open and prevent it from collapsing. The diagram below shows the rings of cartilage of the trachea.

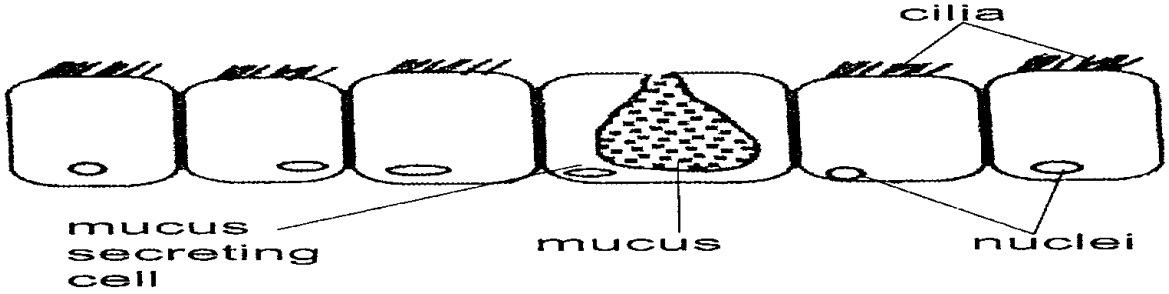



The function of the rings of cartilage is that it keeps **the trachea open and prevents it from collapsing.**

- The trachea has cilia and mucus that trap dust.

**BRONCHUUS**

One of the function of the bronchus is to filter the air goes to the air sacs. The bronchus contains the epithelial cells shown below to carry out this function.




The is adapted to the function of filtering the air in the following ways

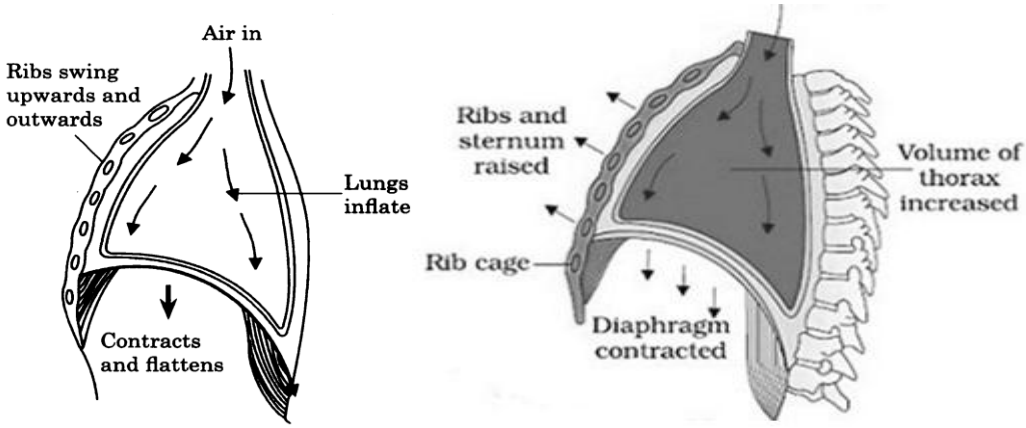
a. Mucus trap dust particles and bacteria
b. Cilia move the mucus and the trapped the trapped particles to the back of the throat where it is swallowed.

The bronchus is kept open to allow the air to enter and leave the lungs by rings of cartilage which hold the bronchus open.

**INHALATION (BEATHING IN)**

Inhalation is the active phase of breathing which draws air into the lungs.

During inhalation, the diaphragm muscles contract causing it to flatten as shown in the diagram below.




In the ribs region, the external intercostal muscles contract and the intercostal muscles relax. This causes the ribcage to move upwards and outwards.

The contraction of the diaphragm and the external intercostal muscles increases the volume in the chest cavity but causes a decrease in the pressure of air compared to atmospheric air.

Air rushes through the air passages into the lungs, forcing them to expand.

**DESCRIBE THE MAJOR STEPS THAT OCCUR DURING "BREATHING IN" IN HUMAN BEINGS.**

During inhalation, the external intercostal muscle contract pulling the rib cage upwards and outwards while the diaphragm muscle contract and becomes flat moving away from the chest cavity. The movements of the rib cage and diaphragm create space/volume inside and reduce air pressure as compared to the air pressure outside the lungs. Then air enters the lungs thereby inflating them.

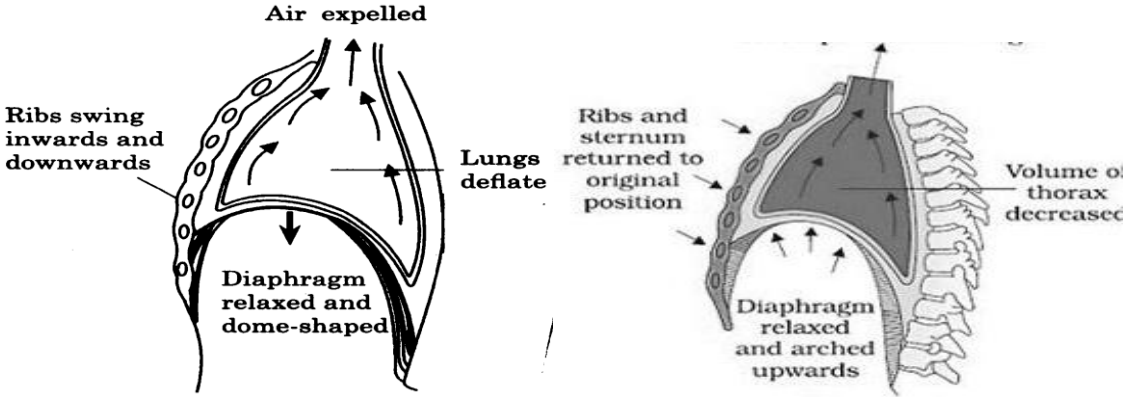
**THE EXHALATION (BREATHING OUT)**

Exhalation is the phase of breathing which expels air out of the lungs.

During exhalation, the diaphragm muscle relaxes making it to move upwards to become domed shaped.

The external intercostal muscles relax and the internal intercostal muscles contract. This cause the ribcage to move downwards and inwards. The volume of the chest cavity decreases and the pressure increases compared to the atmospheric air. Increased pressure forces air out of the lungs which becomes deflated.

The diagram below shows what happens during exhalation.



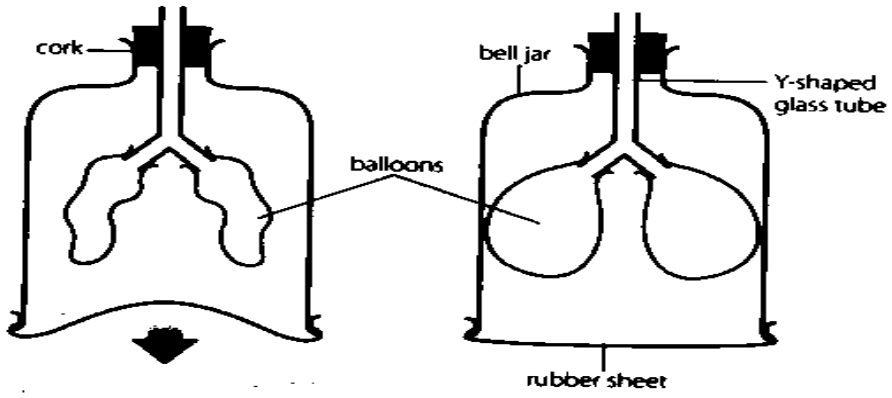
**DESCRIBE THE MAJOR STEPS THAT OCCUR DURING "BREATHING OUT" IN HUMAN BEINGS.**

During exhalation, the diaphragm muscles relax and domes upwards, internal intercostal muscles contract making the chest wall/ribs to move downwards and inwards. This results into decreased volume of chest cavity and in turn increases pressure in lungs hence air is forced out of the lungs into the atmosphere where the pressure is lower than in the lungs.

**DIFFERENCES BETWEEN INHALATION AND EXHALATION**

| **INHALATIONM** | **EXHALATION** |
|---|---|
| • External intercostal muscles contract<br>• Internal intercostal muscles relax | • External intercostal muscles relax<br>• Internal intercostal muscles contract |
| • Ribcage moves upwards and downwards | • Ribcage moves downwards and inwards |
| • Diaphragm muscles contract and diaphragm flattens | • Diaphragm muscles relax and diaphragm forms a dome shape. |
| • Volume of the thoracic cavity increases | • The volume of the thoracic cavity decreases |
| • Air pressure in the lungs and thoracic cavity decreases as compared to external atmospheric pressure. | • Air pressure in the lungs and thoracic cavity increases as compared to external atmospheric pressure |
| • External air is driven into the lungs due to the pressure difference between the inside and the outside | • Air in the lungs is compressed and forced out |
| • Lungs inflate | • Lungs deflate |

## THE LUNG MODEL OF THE HUMAN BREATHING SYSTEM

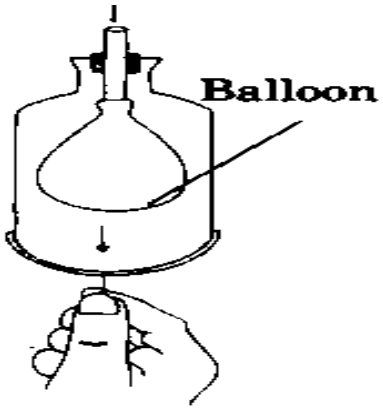



| Part of lung model | Part of respiratory system it represents |
|---|---|
| Balloons | Human lungs |
| Y-shaped glass Tube | Trachea |
| Rubber sheet/plastic bag | Diaphragm |
| Bell jar | Chest cavity |

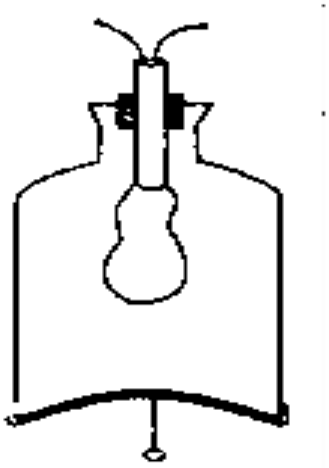
**What does the lung model illustrate or explain how the model is similar to the working of the thorax in humans during breathing.**

The model illustrates the role of the diaphragm during breathing. It shows how the lungs represented by the balloons filled with air as a result of the contraction of the diaphragm represented by the rubber sheet.

When the rubber sheet is pulled down (diaphragm contracts), it increases the volume of the bell jar and reduces pressure in it. Since the outside air pressure is higher than the pressure inside the bell jar, air rushes into the balloons and they swell. This is what happens during inhalation



When the rubber sheet is pushed up (diaphragm relaxes), it reduces the volume in the bell jar and increases the pressure inside it. This is what happens during exhalation.



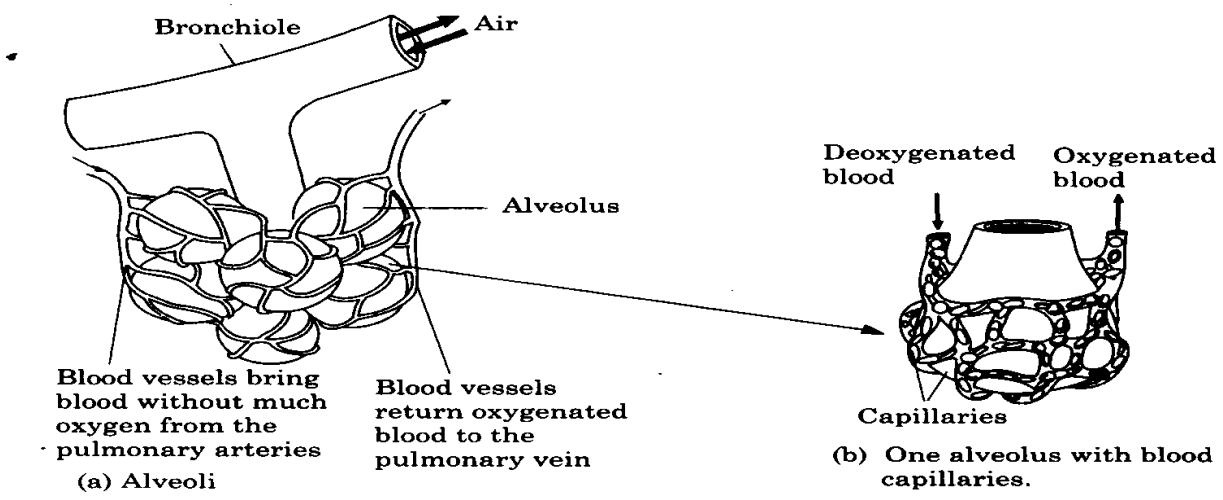
**THE LIMITATION OF A LUNG MODEL**

The bell jar is rigid it represents the rib cage but cannot move upwards or downwards or inward and outward to change the volume of the thoracic cavity.

**GASEOUS EXCHANGE ACROSS THE ALVEOLI IN HUMAN BEINGS**

Gaseous exchange at the alveolus takes place between the phases of inhalation and exhalation.

The diagram below shows alveoli which is a suitable place for gaseous exchange.

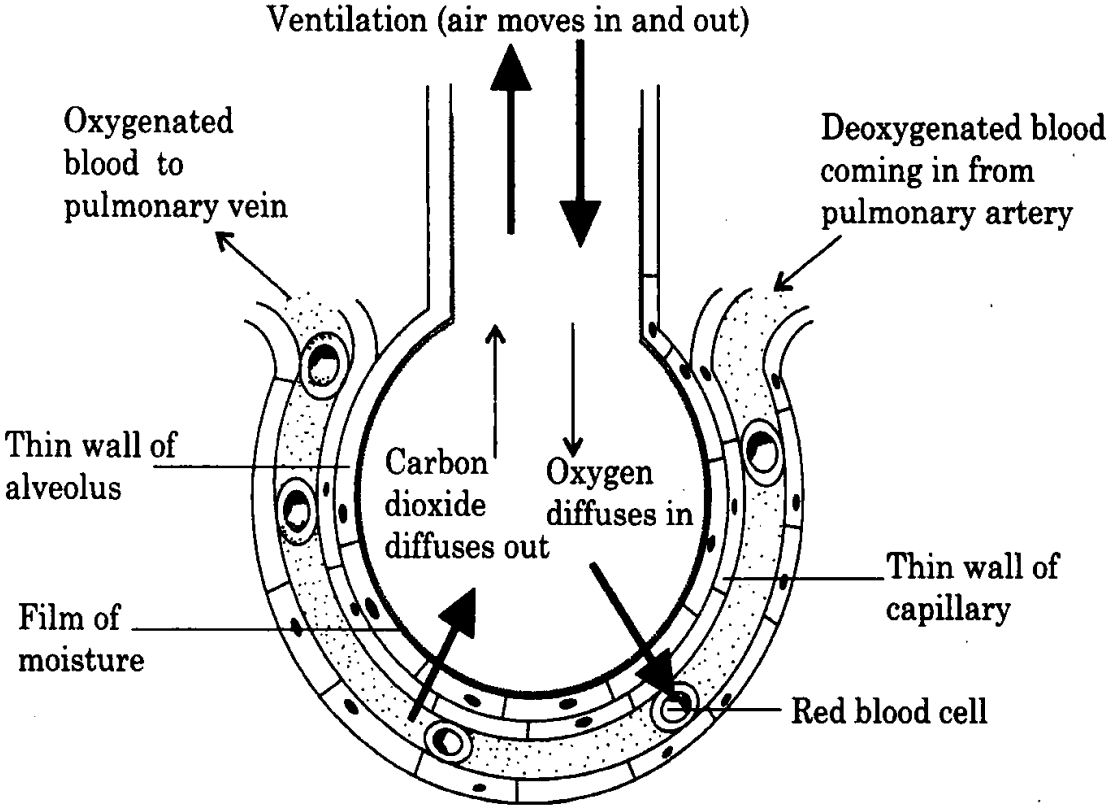


Alveoli are adapted for gaseous exchange in the following ways

1. It is supplied with blood which carries the gases being exchanged.
2. It has a very thin wall across which gases diffuse between it and the blood.
3. It is lined with a thin film of moisture to dissolve the diffusing gases.
4. A ventilation process brings in and takes away air containing the gases being exchanged.
5. It has a very large number of alveoli to increase the surface area for gaseous exchange.

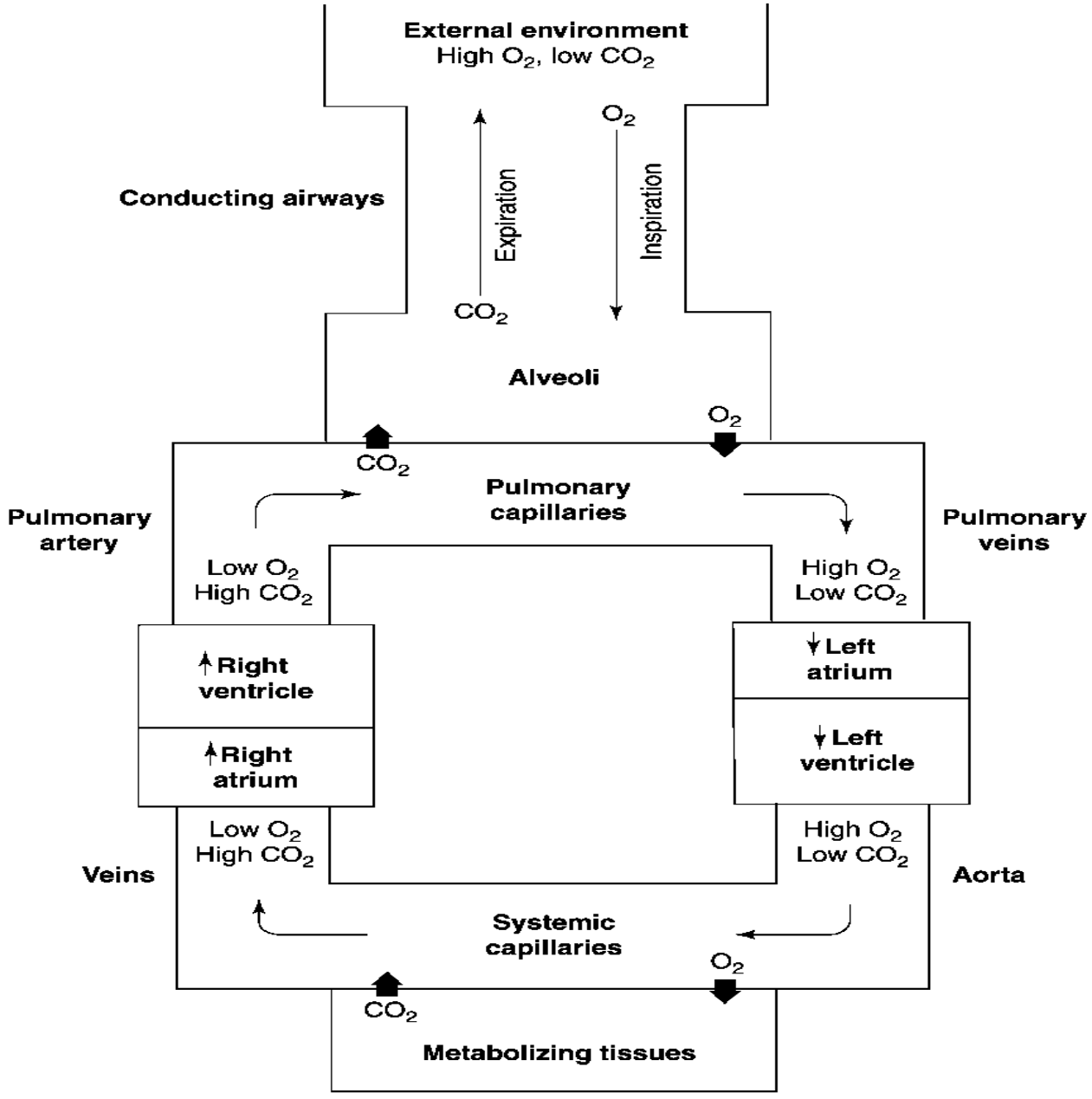
The diagram below shows the alveolus where gas exchange takes place.

**GASEOUS EXCHANGE IN THE ALVEOLI**




Oxygen in air in the alveolar space is at a higher concentration than that in the blood capillaries. Therefore it first dissolves in the water layer in the alveolar lining then diffuses across the alveolus, capillary walls into the red blood cells. This becomes oxygenated blood which is carried to the heart by the pulmonary vein.

Carbon dioxide in the blood diffuses across the capillary and alveolus walls into the alveolar space and is eventually expelled during exhalation as shown in the diagram below.




## ANALYSIS OF INHALED AND EXHALED AIR

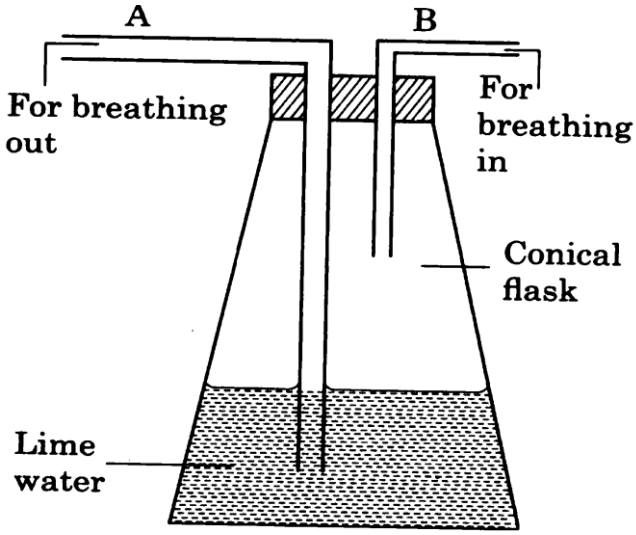
### Materials

- Conical flask

- Corks
- Glass tubes(L-shaped)
- Lime water
- Clock

**Procedure**

1. Take two tubes and put them in two holes of a cork making sure that they are airtight.
2. Put 50$cm^3$ of lime water into a conical flask and close it using the cork. Make sure the flask is airtight as shown in figure below. Make sure that one tube is dipped into the lime water while the second tube is above the lime water.




3. Breathe in and then breathe out into tube A to force your exhaled air into the flask. Continue this procedure and note the time that lime water will take to turn milky. Record the time.
4. Make another setup same as in step 2 above.
5. Suck in air from tube B and then close it. Breathe out the air to the atmosphere. Suck in air from the tube several times and note the time it will take for the lime water to turn milky.

**Observation**

From the experiment, you may have realized that when exhaled air is blown through tube A into the lime water, the lime water takes a very short time to turn milky.

**Conclusion**

The experiment shows that exhaled air contains a lot of carbon dioxide. Carbon dioxide makes clear lime water form a white suspension.

You may also have noted that as one sucked air through B, the air passed through tube A to the lime water. This is air from the atmosphere which is the same as the air that we inhale.

Passing the air through lime water took longer for the lime water to turn milky. This shows that inhaled air contains very little amounts of carbon dioxide.

**COMPARISON BETWEEN COMPOSITION OF GASES OF INHALED AIR AND EXHALED AIR**

**THE COMPOSITION OF INHALED AND EXHALED AIR**

| | | |
|---|---|---|
| **Gas** | **Inhaled air (%)** | **Exhaled air (%)** |
| Oxygen | 21 | 16 |
| Carbon dioxide | 0.03 | 4 |
| Nitrogen | 79.00 | 79.00 |
| Water vapour | Varied | saturated |

**In the above table:**

1. The percentage of oxygen in exhaled air is lower than in the inhaled air. The reason is that the body cells use oxygen for respiration.
2. The carbon dioxide content is greater in the expired air than inspired. This because the body cells produce carbon dioxide in respiration which diffuses from the blood into alveolar air.
3. The water vapour in the exhaled in the exhaled air is always high because the respiratory surfaces are always moist so some of the moisture evaporates and is lost as air is breathed out.

4. The nitrogen content of the two kinds of air is the same. This is because the body does not use it for anything, nor does the body makes any nitrogen so the rate of diffusion into and out of the blood is the same.

**DESCRIBE THE STEPS CARRIED OUT IN A MOUTH TO MOUTH RESUSCITATION IN ARTIFICIAL RESPIRATION.**

It is a First AID practice carried out on a person who is having difficulties in breathing due to an accident, fainting or health complications. Artificial ventilation is done by blowing air using one's mouth of the patient. The person carrying out the First Aid places his mouth onto the mouth and blows in air into the patient. This makes artificial ventilation to be referred to as the Kiss of life.

The figure below shows the kiss of life

**The following are the procedures for carrying out artificial respiration**

1. Let the patient lie on his/her back on a mat soft material
2. Close the patient's nose and pull the headache backwards
3. Cover the patient's mouth using a clean handkerchief or clean linen to prevent passage of fluids into his/her mouth.
4. Take a depth then place your mouth onto the mouth of the patient covering it completely
5. Breathe out heavily forcing the air into the lungs of the patient.
6. Remove your mouth and gently press the chest of the patient to force air out.
7. Repeat procedures 4 to 6 until the patients start to breathe without help.

Should the breathing fail after 2o trials, rush the person to the nearest healthy facility.

## CHAPTER 5: HUMAN NERVOUS SYSTEM

**Define Stimuli.**

It is the change in the environment that can lead to a change in activity of part or whole of an organism's body

**Explain two types of stimuli**

1. **External stimuli**

   These are changes in the external environment of an organism which are perceived by the organism.

   Examples include sound, light, temperature, touch and smell

2. **Internal stimuli**

These are changes within the body of an organism. For instance body temperature, salt concentration, carbon dioxide concentration and blood sugar that can lead to a change in activity of part or whole of an organism

**Define response**

It is a reaction of part or whole of an organism to a stimulus.

Examples of responses include

a. The rapid blinking of the eyes
b. The movements of the ants away from naphthalene.

### NERVOUS SYSTEM

It is the system of specialized cells known as nerve cells or neurones which are linked to each other and to different sensory cells and effectors in the body.

### THE COMPONENTS OF THE NERVOUS SYSTEM

The primary function of the nervous system is to receive information and to generate a response to a given stimulus.

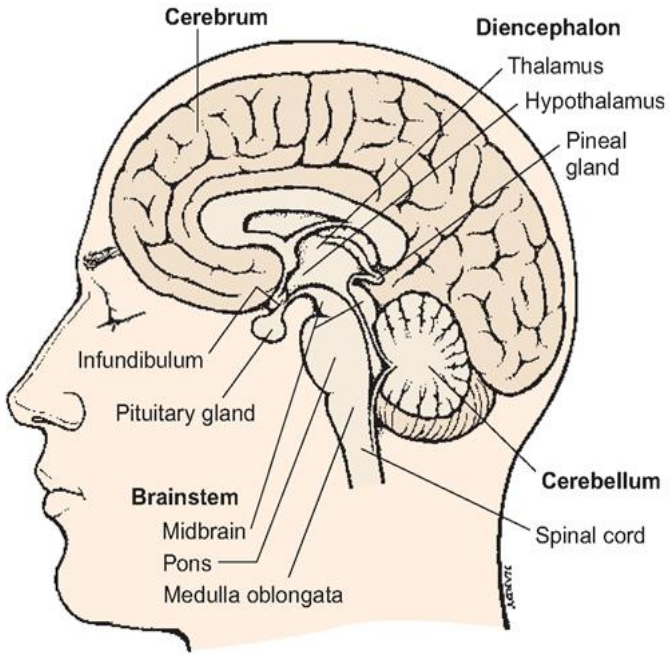
Nervous system has two main parts

a. **The central nervous system** which is made up of the brain and spinal cord.

b. **The peripheral nervous system -** This is made up of nerves that branch off from the spinal cord and extend to all parts of the body.

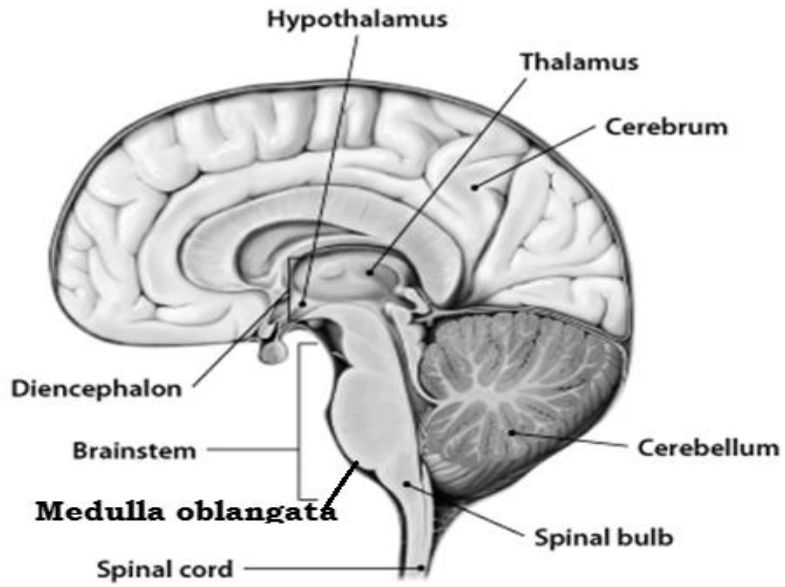
**THE BRAIN**

The diagram below shows the three main divisions of the human brain namely the cerebrum, cerebellum and medulla oblongata.




- The brain is made up of two halves known as hemispheres which are the right hemisphere and the left hemisphere.
- The two hemispheres are interconnected by a group of nerves called **corpus callosum**
- The function of the right hemisphere is that it controls activities of the left side of the body.
- The function of the left hemisphere is that it controls activities of the right side of the body.
- The outermost part of the brain is called the **grey matter.**
- The inner larger part of the brain is called the **white matter.**

**SECTION THROUGH THE HEAD TO SHOWING THE BRAIN**




- The cerebrum is the largest part
- The cerebellum below the rear part of the cerebrum
- The medulla oblongata is located beneath the cerebellum

**THE CEREBRUM**

- It is the largest part of the human brain

**THE FUNCTIONS OF CEREBRUM**

1. It is the thinking centre
2. It is involved in learning
3. It is involved in imagination and creativity
4. It is the memory centre
5. It is the intelligence centre
6. It is responsible for personality/character
7. It is responsible for emotions such as joy and sorrow
8. It is- involved in voluntary of body movements such as walking, dancing and jumping
9. It receives and interprets impulses from the sense receptors

**a. CEREBELLUM**

It performs the following functions**:**

- Coordination of body movements

- Maintaining body balance and posture
- Ensuring dexterity in fine movements like using hands and fingers to carry out skilful tasks such as playing a guitar, sewing and typing.

**b. MEDULLA OBLONGATA**

The function of the medulla oblongata is to control involuntary responses such as breathing, blood circulation, heart, digestion and swallowing

**c. HYPOTHALAMUS**

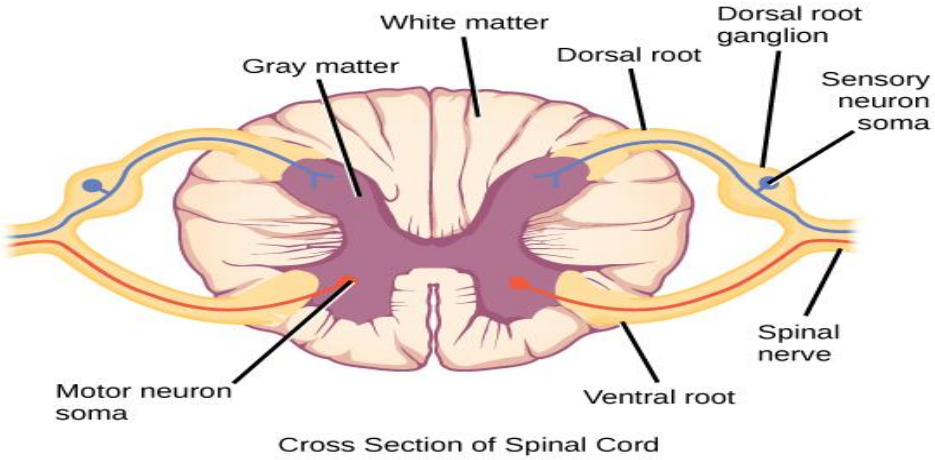
- It controls secretion of hormones by pituitary glands and so involved in homeostatic processes
- It also controls hunger, thirst and sleep

**SPINAL CORD**

- The spinal cord is the extension of the brain
- The outer parts of the spinal cord contain the **white matter** and the inner part contains **the grey matter**
- There is a narrow canal called **the central canal** which runs down the spinal cord.

  The spinal canal contains the fluid called **cerebro-spinal fluid**.

**TRANSVERSE SECTION OF A SPINAL CORD**




Cross Section of Spinal Cord

**DIFFERENCES BETWEEN THE BRAIN AND SPINAL CORD**

The difference between the brain and the spinal cord is that the grey matter is on the outer surface in the and the white matter is in the inner surface while in

the spinal cord the grey matter is in the inner surface while the white matter is on the outer surface.

**FUNCTIONS OF THE SPINAL CORD**

a. Linking the nerves of the peripheral nervous system with the brain
b. Co-coordinating certain automatic responses

**1. THE PERIPHERAL NERVOUS SYSTEM**

- The peripheral Nervous System- made up of the peripheral nerves.
- This is the system of nerves that connect the spinal cord and the brain to all other parts of the body.
- -The nerves that connect the brain to surrounding parts in the head such as the ear and eyes are known as **cranial nerves.**
- The nerves that connect the spinal cord to surrounding parts of the body such as hands, legs, ribs and abdomen are known as the **spinal nerves.**
- The peripheral nervous system connects the receptors to the central nervous system
- It also connects the central nervous system to the effectors.

**2. THE AUTOMATIC NERVOUS SYSTEM**

- It is part of the peripheral nervous system
- It constitutes part of the motor neurones.
- -It involves responses that you do not have any control
- It influences organs, glands and smooth muscles
- Some examples of response of the automatic nervous system include
  - ✓ Beating of the heart
  - ✓ Narrowing and dilating of the pupil
  - ✓ Swallowing
  - ✓ Vomiting
  - ✓ Sneezing
  - ✓ digestion

**THE EFFECTS OF ALCOHOL ON THE BRAIN**

1. It brings about depression. It does this by slowing down the speed of activity of the brain
2. it affects the cerebrum such that judgement is impaired
3. it affects the cerebellum so that balance of the body is lost

**THE EFFECTS OF THE INDIAN HEMP**

1. Cannabis makes one to have a false sense of well being. This makes the person fail to respond to the stimulus on time
2. An individual attains a sense of hopelessness and fear leading to depression
3. Smoking marijuana reduces the strength and speed of communication between the mind and the body, the brain takes time to send impulses for a given activity to be carried out
4. It makes someone to loses memory
5. Makes the person to feel drowsy with relaxing effect even in times when one is supposed to be active.

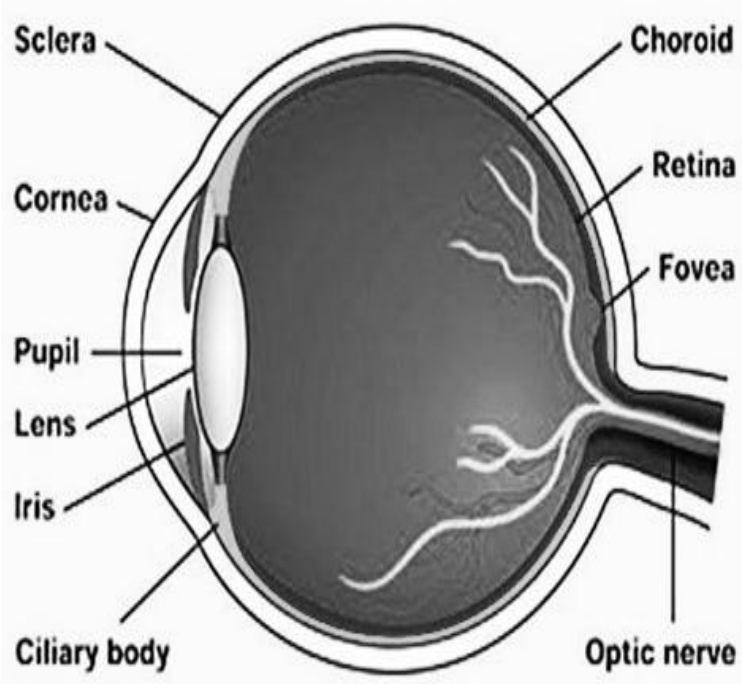
**THE EFFECTS OF DRUG ABUSE**

1. Some drugs cause a person to hallucinations which leads to depression. Hallucination is caused by drugs such as cocaine and heroine.
2. Some drugs affect the brain cells involved in sleep. This makes a person to lose sleep for example caffeine.
3. Some drugs like valium are sedatives. They affect the brain making a person to feel sleepy.
4. Smoking cigarettes introduces nicotine into the blood. Nicotine makes blood vessels to be narrow. In a narrow vessel, blood pressure increases hence rapid transmission.

## CHAPTER 6: SENSE ORGANS- THE EYE

Function of the eye- It enables us to see objects

**EXTERNAL PART OF AN EYE SHOWING MUSCLE ATTACHMENT ON THE EYEBALL**

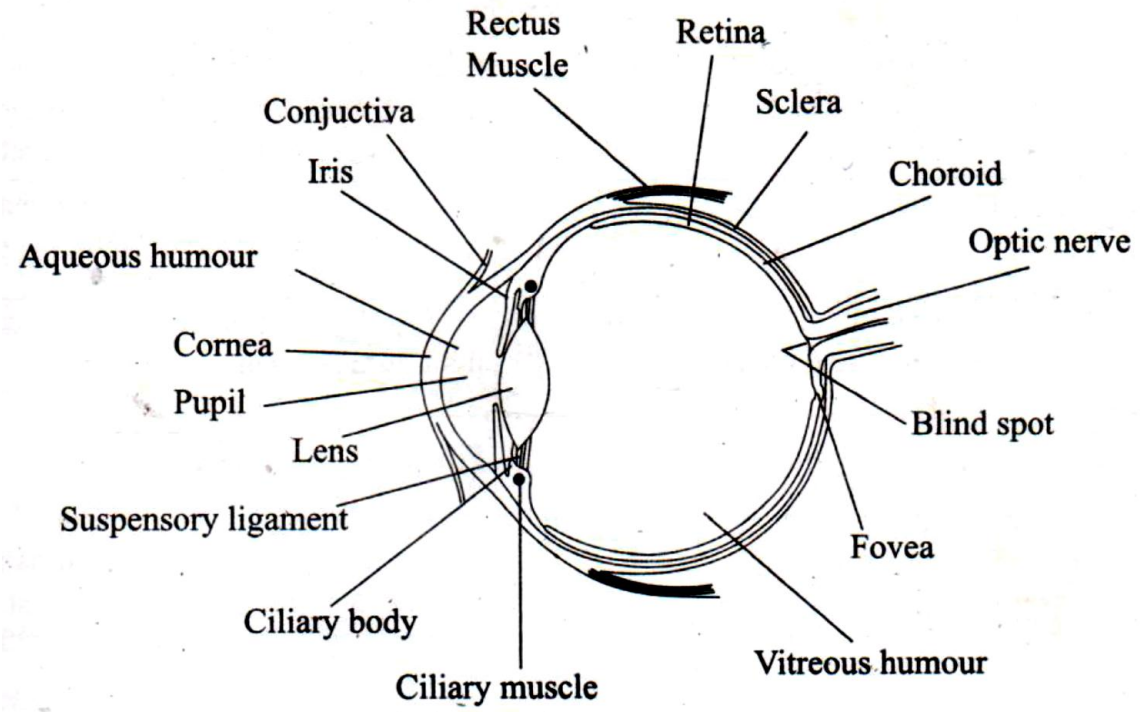



The following are the functions of the labeled parts in the diagram above.

- **Pupil-** Regulates the amount of light entering the eye, becomes smaller under bright light and enlarges under dim light
- **Sclera-** Protects the delicate parts of the eye
- **Cornea-** Allows light to pass to the inside of the eye
- **Choroid-** Supplies blood to the eye. Pigment prevents reflection of light within eyeball
- **Ciliary body** Produces aqueous homour that maintains the shape of eyeball ball, Ciliary muscle is involved in accommodation
- **Iris-** Regulates the size of pupil. Melanin gives the eye its colour
- **Lens-** Involved in accommodation by change in thickness. Refracts light onto the retina
- **Suspensory ligament -** Holds the lens in position
- **Aqueous humour-** Concerned with nutrition and metabolism of lens and cornea which have no blood supplies. It maintains the shape of the eyeball
- **Vitreous humour-** Fills eyeball and maintains its shape**.** Involved in refraction of light

- **Retina-** Rods sense dim light, cones sense

**INTERNAL PARTS OF THE EYE**



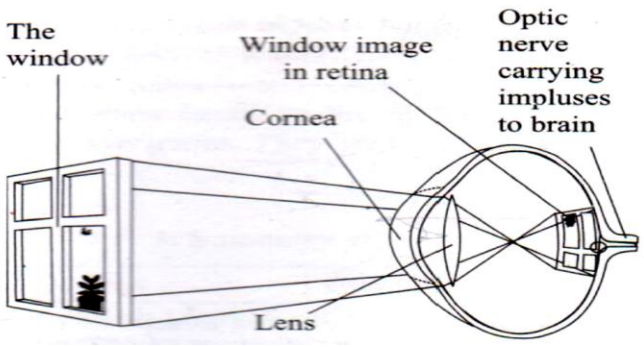

**PARTS OF THE EYE AND THEIR FUNCTIONS**

- **Eyebrows** - Prevents fluid from entering the eye
- **Eye lashes** - Trap dust particles preventing them from entering into the eyes
- **Tear glands** - They secrete tears that keep the eye moist. They wash away dust particles or irritating materials. They contain antiseptic properties that kill pathogens
- **Tear duct-** Drains away excess tears into the nasal activity
- **Eyelids-** They cover and protect the eye from physical damage
- **Muscle attachment to skull-** They control the movement of the eyeball in the orbit
- **Pupil-** Regulates the amount of light entering the eye, becomes smaller under bright light and enlarges under dim light
- **Sclera-** Protects the delicate parts of the eye
- **Cornea-** Allows light to pass to the inside of the eye

- **Choroid-** Supplies blood to the eye. Pigment prevents reflection of light within eyeball
- **Ciliary body** Produces aqueous homour that maintains the shape of eyeball ball, Ciliary muscle is involved in accommodation
- **Iris-** Regulates the size of pupil. Melanin gives the eye its colour
- **Lens-** Involved in accommodation by change in thickness. Refracts light onto the retina
- **Suspensory ligament -** Holds the lens in position
- **Aqueous humour-** Concerned with nutrition and metabolism of lens and cornea which have no blood supplies. It maintains the shape of the eyeball
- **Vitreous humour-** Fills eyeball and maintains its shape**.** Involved in refraction of light
- **Retina-** Rods sense dim light, cones sense colour and bright light
- **Conjunctiva-** Protection of the eyeball
- **The blind spot-** It is the point where the optic nerve leaves the eye. It is not sensitive to light because there are no photoreceptor cells, rods or cones located here. Any image falling on the blind spot is not seen because it does not cause generation of an impulse. The blind spot has only blood vessels

**HOW THE EYE WORKS**

- An object reflects light rays to the eye. Light rays enter the eye through the cornea. The cornea refracts light to the pupil.
- Iris regulates the amount of light entering the eye. The light rays then pass through the pupil into the aqueous houmour which refracts the rays towards the lens.
- The lens focuses the rays of light onto the retina through the vitreous homour.
- On the retina, an upside down image is formed. The cons and rods in the retina -are stimulated. An impulse is generated and sent to the brain through the optic nerve. The diagram below shows the formation of window image in the eye

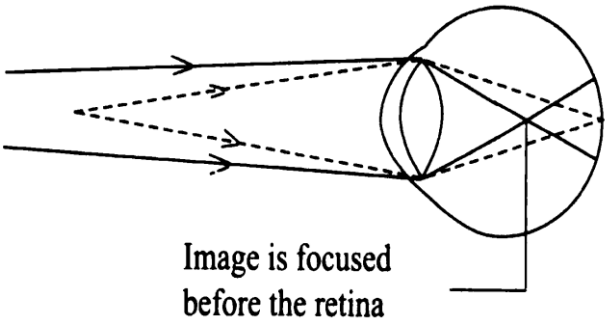



- The brain interprets the impulse to an actual image of what was observed.

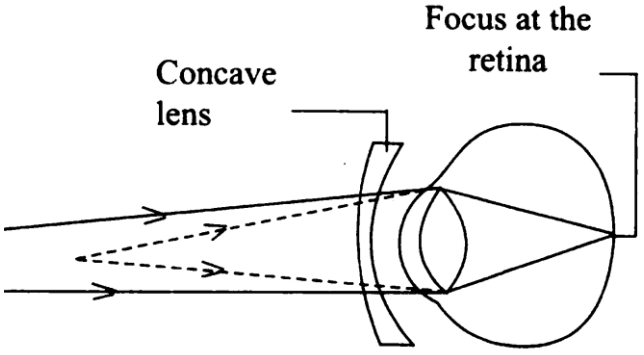
**THE DEFECTS OF THE EYE AND THEIR CORRECTIONS**

**1. Short-sightedness or myopia**

- It is caused by a long eye ball. People with such eye defect can only clearly see objects that are near. Short- sightedness causes light to focus in front of the retina instead of on the back of the eye causing distant objects to appear blurred. Close objects appear normal, headache and eye strain
- The person with this has eye defect has inability to see distant objects
- The diagram below shows short-sightedness.

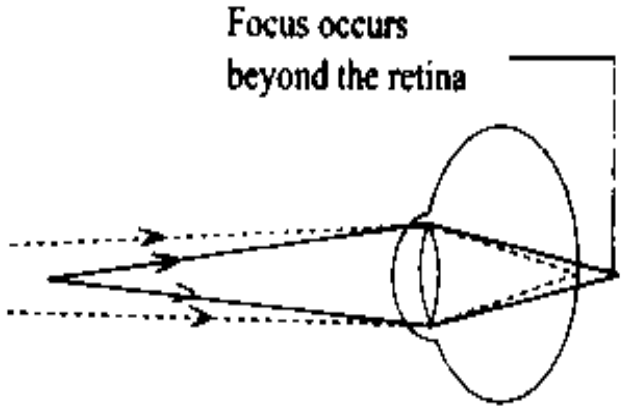



- It can be corrected by wearing concave or diverging lens in spectacles. The diagram below shows the correction of short-sightedness using concave lens.

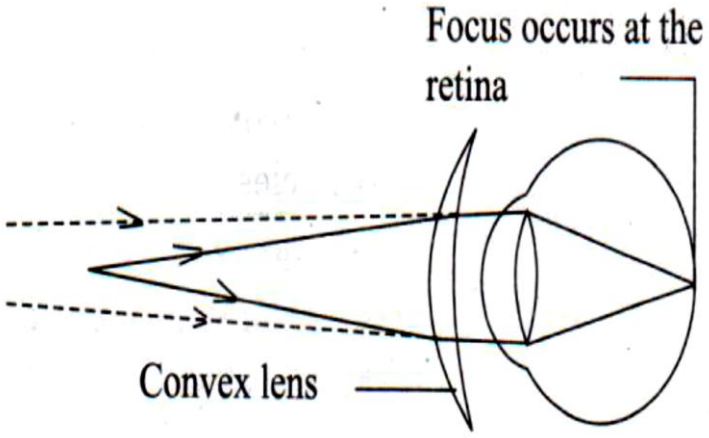


## 2. LONG-SIGHTEDNESS OR HYPERMETROPIA

- It is caused by a short eyeball. The person with this eye defect has inability to see near objects. People with this defect cannot clearly see the objects that are near.
- The diagram below shows long-sightedness

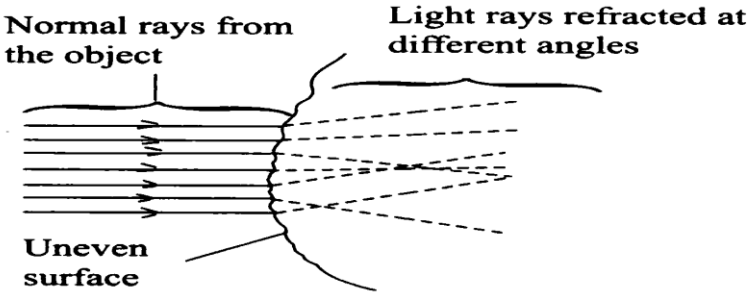



- It can be corrected by fitting spectacles with a convex lens in front of the eyes.
- Figure showing convex corrects long sightedness




## 3. ASTIGMATISM

- It is caused by uneven surface of lens or cornea. As the result of this, light passing through them are bent at different angles as shown in the diagram below and are scattered therefore not all of them are focused on the retina. This causes the image of the object that is formed to fall out of the retina and hence be distorted. This condition is known as **astigmatism.**




- The person with this eye defect has parts of the image is blurred.
- It can be corrected by using lens that had been ground unequally to compensate for the irregularities of the cornea.

**4. CATARACTS**

- It is caused by stiff opaque lens. The person with this defect has poor vision.
- It can be corrected by surgery to remove defective lens and replace it with an artificial lens

**5. OLD SIGHT OR PRESBYOPIA**

- It is caused by inelastic lens. The lens of the eye loses its elasticity with aging. As a result, the ability of the lens to change its thickness during accommodation in order to view the objects reduces. This means the defective lens cannot readily accommodate to near as well as far objects.
- The person with this eye defect has Short and long-sightedness
- It can be corrected by bi-focal lens in spectacles

**THINGS THAT SHOULD BE OBSERVED WHEN TAKING CARE OF THE EYES**

1. Always eat diet of fruits and vegetables that contain vitamin A for proper eye vision
2. Avoid looking at very bright light since strong rays of light damages the retina of the eye.
3. Avoid working or reading in dim light as dim light causes strain to the eye.
4. Have regular eye check up by optician
5. Always wash your eyes with clean warm water.
6. If an object enters into the eyes, do not rub the eye. Flush the object out of the eye- using clean slightly warm water.

7. When using a computer, take a break after every 40 minutes to take the eyes from the computer screen
8. Wear glasses only after recommendation by a doctor.

## THE EAR

### FUNCTION OF EARS

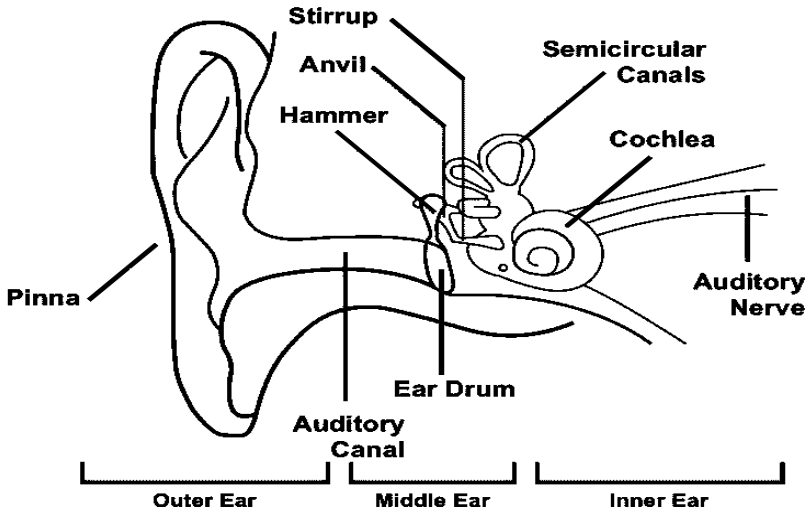
a. For hearing

b. For maintaining body balance or maintaining posture

The ear has sensory receptors that detect sound and others that detect movement and position.

### A LONGITUDINAL SECTION THROUGH THE EAR

The ear has three main chambers




### 1. THE OUTER EAR

- The outer ear is made up of the pinna (earlobe), auditory canal (ear tube) and the eardrum(tympanic membrane)
- The function of the pinna is that it receives or collects sound waves and directs them into the auditory canal
- The auditory canal or ear is the passage between the pinna and eardrum
- The ear tube or auditory canal is line with cells that secrete wax.

- The function of the wax found in the auditory canal is to keep the eardrum soft and traps dusts.
- The eardrum is a thin flexible sheet-like membrane. The function of the eardrum is that it passes sound vibrations from the outer ear to **ossicles** in the middle ear.

**2. THE MIDDLE EAR**

- The middle ear is separated from the outer ear by **eardrum** and from the inner ear by the **oval window** and **round window**.
- The middle ear contains three ossicles namely **hammer(malleus), anvil (incus) and stirrup(stapes)**
- The functions of the ossicles (tinny bones) are to receive vibrations from the eardrum and then amplify the vibrations and pass them to the oval window**.**
- The middle ear also opens to into throat through **Eustachian tube**.
- The function of the Eustachian tube is that it ensures equal air pressure on both sides of the eardrum in the middle ear and the external air pressure.
- The functions of the oval window and round window which are thin flexible membrane is that they are involved in the transmission of vibrations to the cochlea in the inner ear.

**3. THE INNER EAR**

- The inner ear is made up of the semicircular canal*vestibular apparatus) and the cochlea.
- The semicircular canal or vestibular apparatus is responsible for maintaining ba-lance and posture.
- The function of the cochlea is that it is responsible for hearing.

**HEARING PROCESS**

- Vibrations of sound cause hearing. These vibrations pass through air in the form of sound waves. On reaching the ear, the sound waves are directed by the pinna into the ear tube.

- On reaching the eardrum, sound waves cause it to vibrate. The vibration of the eardrum causes the hammer in contact with it to vibrate. The hammer in turn causes the anvil to vibrate which in turn causes the stirrup to vibrate. As these vibrations pass through the ossicles, they are amplified. The last ossicle, the stirrup causes the oval window to vibrate. The vibrating oval window causes the fluid inside the cochlea to vibrate accordingly.
- Vibration of fluids in the cochlea stimulate sensory cells in cochlea to generate nerve impulses which are transmitted to the brain via the auditory nerve. On reaching the brain, the impulses are interpreted into sound.

## THE EAR DEFECTS

**Define the term deafness.**

Deafness is a condition whereby an individual is unable to hear.

**Explain two types of deafness.**

**1. Absolute/nerve deafness**

This condition where the sound impulses are not able to reach the brain. This may due to

- Damaged auditory nerve
- Damaged cochlea
- Damaged brain cells that are involved in sound reception

**CAUSES OF ABSOLUTE/NERVE DEAFNESS**

- Hereditary- child is born with some parts of the inner ear either missing or functionless.
- Infections of the inner ear

**CORRECTION OF ABSOLUTE DEAFNESS**

Nerve deafness cannot be treated but affected individuals can be assisted to live normal lives by

- Use of visual signs during speech
- Learning skills of lip reading.

In this way, they can be able to communicate with other individuals.

**2. CONDUCTIVE DEAFNESS**

This is a condition whereby a person is partially unable to hear due to problems of relaying of sound waves to the inner ear. This may due to:

- Failure of the eardrum to vibrate
- Failure of ossicles to amplify and pass sound waves to inner ear

**CAUSES OF CONDUCTIVE DEAFNESS**

- Accumulation of wax in the ear canal
- Damage of the eardrum by objects, blows on the head and loud sounds.
- Ear infections leading to production of pus that reduces sound movement in the ear.
- Use of certain drugs such as chloroquine in some individuals

**CORRECTION OF CONDUCTIVE DEAFNESS**

It can be corrected by

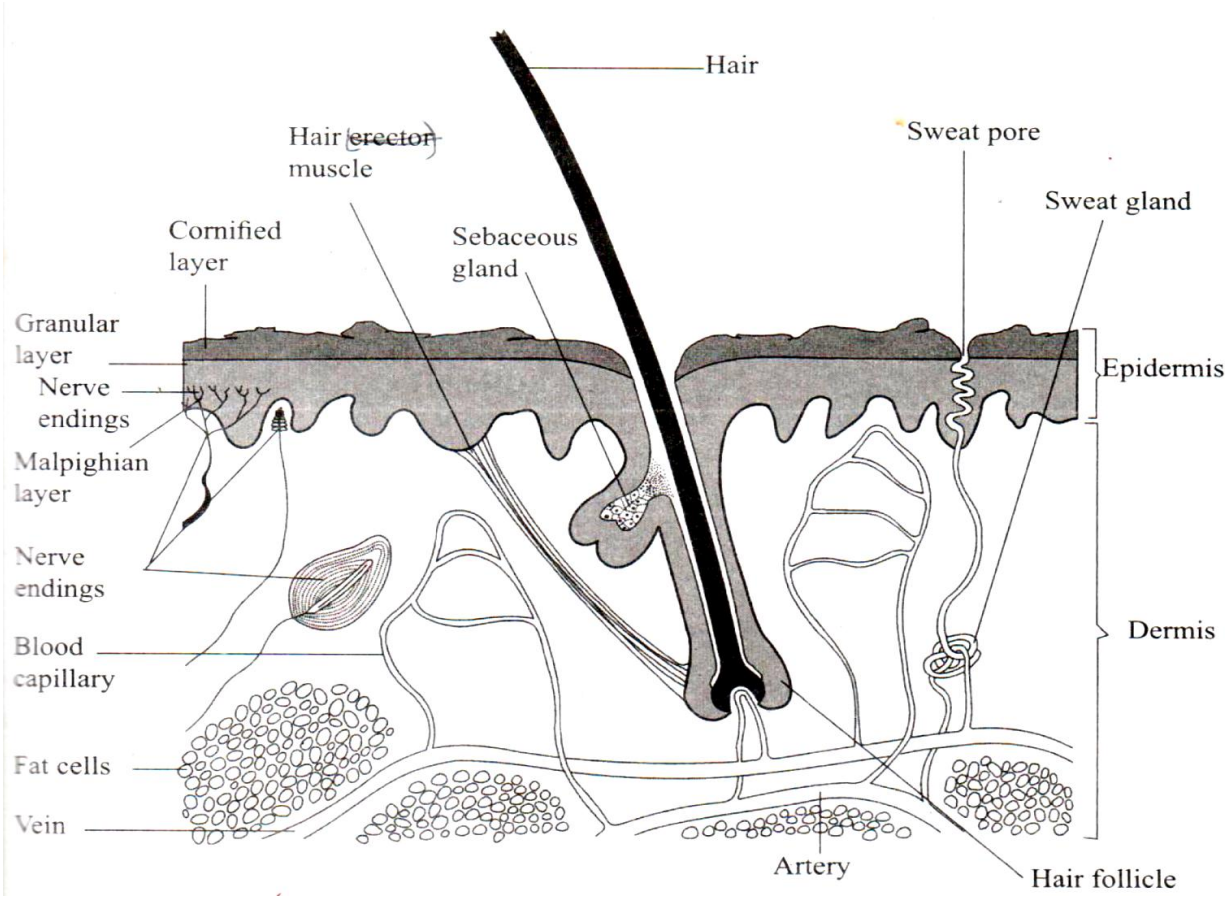
a. Treatment of ear infections by specialists (audiologist)
b. Use of hearing aids. These are devices that are fixed in the auditory canal to enhance sound transmission in the ear.
c. Learning lip reading skills and use of visual signs in speech.

**WAYS OF PROPER CARING THE HUMAN EAR.**

1. Clean the outer ear with a clean soft cloth with warm water and soap.
2. Do not insert swab or sticks or matchsticks into the ear. The ear produces wax that cleans the inner ear. If the wax clogs the ear canal see a medical doctor for treatment.
3. Protect your ears from loud sounds or noises. This is by lowering the volume fall sound equipment around you.
4. Avoid use of earphone with amplified sound. Continuous use of earphones damages the eardrum

**THE HUMAN SKIN**

The diagram below shows the cross-section of the human skin




The skin has two main layers: the epidermis and dermis.

**1. EPIDERMIS**

2. This is the upper layer of the skin.

It is made up of three layers of cells which are the **cornified layer**, the **granular** layer and the **malphighian l**ayer.

**a. THE CORNIFIED LAYER**

It is the outmost layer in the epidermis. It is made up of dead cells which form a tough protective outer layer

It performs the following functions:

a. It acts as a barrier against entry of micro-organisms
b. It reduces loss of water
c. It protects the inner cells from mechanical damage.
d. The cells in this layer produces large amount of tough waterproof protein called **keratin** which strengthen them

**b. THE GRANULAR LAYER**

- It is made of living cells which eventually form the cornified layer.
- It is the middle layer of cells in the epidermis**.**
- It is the site of the formation of cornified layer

**c. THE MALPIGHIAN LAYER**

- It is the innermost layer of cells of the epidermis.
- It is made up of actively dividing cells which are responsible for the renewal of the epidermis
- The cells in this layer contain melanin pigment which contributes to the skin colour
- Melanin protects against ultra violet light from the sun which can damage the skin cells beneath it.
- It performs the following functions

a. It produces cells that are responsible for the renewal of epidermis

b. It contains melanin pigment that protects against ultra violet light from the sun which can damage the skin cells beneath it.

**3. THE DERMIS**

- This is thicker than epidermis and is located below it
- It contains the following structures

**a. SWEAT GLANDS**

- These are tinny coiled tubes which secrete and release sweat through the pores on the surface of the skin.
- Sweats consist of **water** and **mineral salts** such as sodium chloride and traces of **urea** and **lactic acid**.
- The liquid that forms sweat is absorbed by sweat glands from the blood capillaries supplied to each gland. It reaches the surface of the skin through the pore and water in it evaporates into the air.
- The function of sweat glands is that they produce sweats that consist of water, mineral salts, urea and lactic acid.

**b. BLOOD CAPILLARIES**

- The function of the blood capillaries in the skin is that they supply the cells in the skin with oxygen and nutrients and take away carbon dioxide and waste substances.

**c. HAIR FOLLICLES**

- These are tiny pits in the dermis. Hair is made up of a protein called **Keratin.**
- The function of the hair follicle is that is the place where the hair grows inside the follicle due to addition of cells to it at the bottom of the pit.

**d. SEBACEOUS GLANDS**

- These are small glands which open into the hair follicle.
- Function of the sebaceous glands is that they produce an oily secretion called sebum which keeps the skin soft and has antiseptic properties to kill bacteria on the skin.

**e. HAIR ERECTOR**

- The erector muscle is attached between the bottom part of the hair and the epidermis.
- When the erector muscle contracts, the hair fibres stand upright and very small pimples or swellings appear on the skin. When it relaxes, the hair lies flat on the skin.

**f. SUBCUTANEOUS FAT LAYER**

It has two important functions which include:

- This is a layer of cells in which fat is stored.
- It acts as a heat insulator

**FUNCTIONS OF THE SKIN**

The following are the functions of the human skin

1. It regulates body temperature
2. It provides protection against external physical forces
3. It acts as water proof thereby preventing unnecessary water entering the skin.

4. It helps to regulate body temperature
5. It stores food in the form of fat
6. It prevents loss of water from the body
7. It gets rid of waste products.

**BRIEFLY EXPLAIN FOUR WAYS PROPER CARING OF THE SKIN.**

a. Clean your skin every day using clean water and soap. This helps to open the pores of the skin.
b. Protect your skin from direct sun by wearing protective clothing.
c. Take food rich in vitamin C to keep the skin soft and pliable.
d. If your skin is dry, apply moisturizer creams but if always oily wash regularly to remove the dirt that is attracted by the oil.

## CHAPTER 7: LOCOMOTION

**What is locomotion?**

- It is the movement of the whole organism from one place to another.
- In other words, locomotion is the change in position of the whole organism from one place to another.

### THE HUMAN SKELETON

**Name the two main regions of a human skeleton**

1. **Axial skeleton**

- It is arranged along the axis of the endoskeleton.
- It is made up of the bones of
  a. The skull - forming the bone of the head
  b. Ver-tebral column - bones of the backbone
  c. Rib cage

2. **Appendicular skeleton**

- This refers to parts of endoskeleton that join to the axial skeleton.
- It consists of the bones of the
  a. Pectoral girdle- bones at the shoulder region

b. Pelvic girdle - bones of the hip region

c. Paired limbs

**FUNCTIONS OF THE DIFFERENT PARTS OF THE SKELETON**

| PART | FUNCTION |
|---|---|
| Skull | It protects the brain, nasal organs, eyes, middle and inner ears |
| Vertebral column | It protects the spinal cord<br>Supports the head and provides points of attachment for the pelvis and the ribcage |
| Rib cage | It protects the lungs, heart, liver and other internal organs. |
| Girdle | It gives attachment to the forelimbs.<br>It absorbs stress from limbs |
| Pelvic girdle | It gives attachment to the hind limbs.<br>It absorbs stress from limbs. |
| Paired limbs | It enables locomotion to take place and provides an attachment for the muscle tissue. |

**State and explain the functions of the human skeleton.**

1. **Support**

   The bones offer support of tissues in the body

2. **Protect-ion**

   Bones provide protection for certain delicate internal organs like the brain, the heart, the lungs and the spinal cord from mechanical injury.

   They also protect parts of the ear (inner ear) and the eyes.

3. **Muscle attachment**

   Bones provide surfaces for attachment of muscles.

4. **Movement**

   Bones work together with muscles to produce movement. The movement of the whole body is known as locomotion.

5. **Shape-**

The skeleton gives the body its shape.

6. **Formation of blood cells**

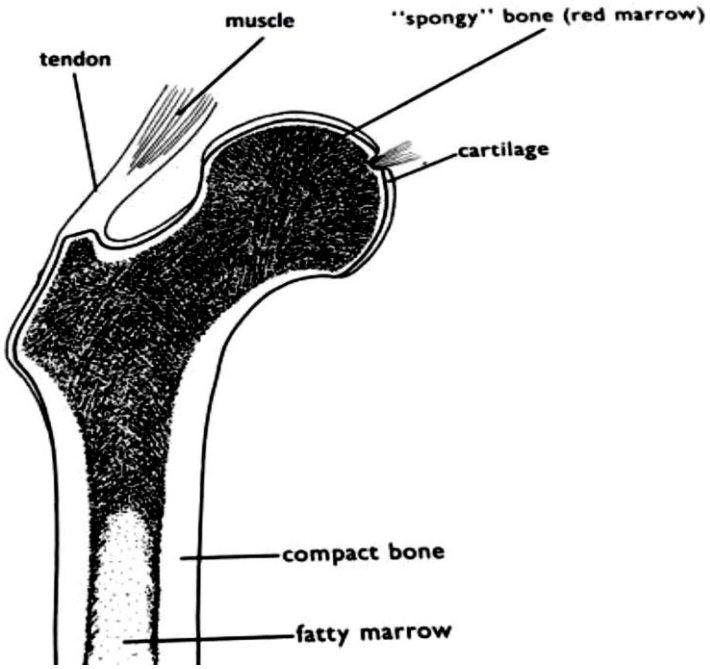
   Bones are important in the formation of blood cells. Red blood cells are formed in the bone marrow of short and long bones.

7. **Storage of minerals**

   Bones store calcium and phosphorous

**STRUCTURE OF THE BONE**

- The bones consist of a hard outer part of the **compact bone**. The inner part has spongy bone.
- **Compact bone** is dense and strong. It provides an attachment site for muscles.
- **Spongy bone** is light in weight, it is rich in blood vessels, it is very porous.
- Spongy bone has spaces called cavities, filled with a material called **bone marrow.**
- Bones are living tissues, made up of cells like any other body tissue.
- The figure below shows the cross-section of the bone



**A JOINT**

- A joint is a place where two or more bones meet.
- There are two main types of joints

**a. Movable(synovial) joints**

These are joints in the endoskeleton where movement occurs.

**b. Immovable joints**

These are joints where movements does not occur

**MOVABLE JOINTS**

These are joints that allow free movement of bones to occur. Examples of movable joints are

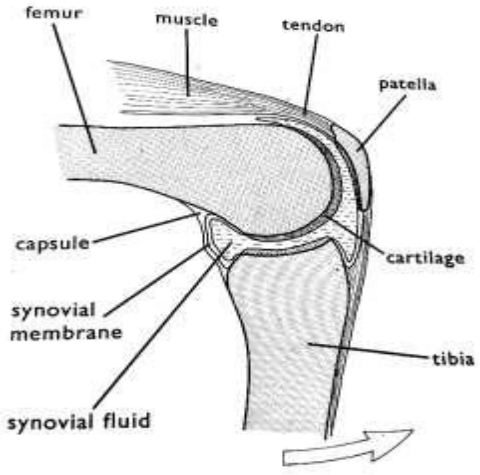
a. Hinge joint
b. Ball and socket joint
c. Gliding joint
d. Peg and socket joint

**HINGE JOINT**

- A hinge joint is movable joint which allows movement in one plane only just like a door allows movement in one plane only. In other words, hinge joint allows $180^o$ only
- **Examples of hinge joint**.

**a. Knee joint**

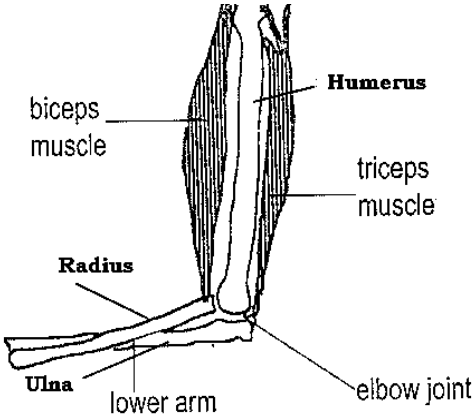
The diagram below the knee joint, an example of hinge joint.



| Structure | Function |
|---|---|
| Tendon | • It attaches muscles the bones |
| Synovial membrane | • It secretes synovial fluid |
| Ligaments | • It act as lubricants at the joints |

**a. Elbow joint**

The figure below shows a hinge joint at the elbow joint

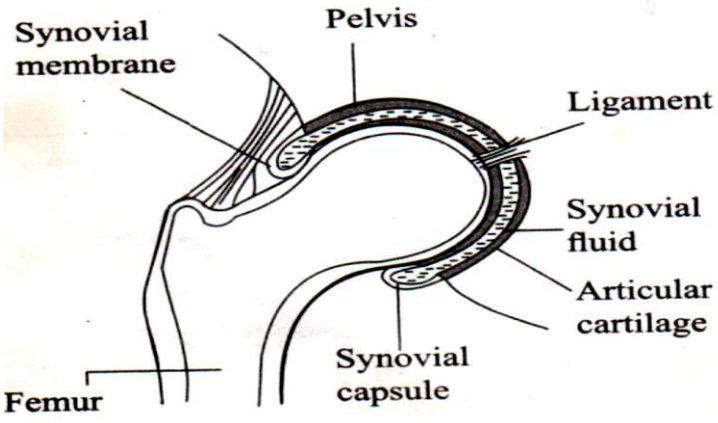



**BALL AND SOCKET JOINT**

These are joints that can move in all planes. They can rotate at their respective joints. Examples of ball and socket joints

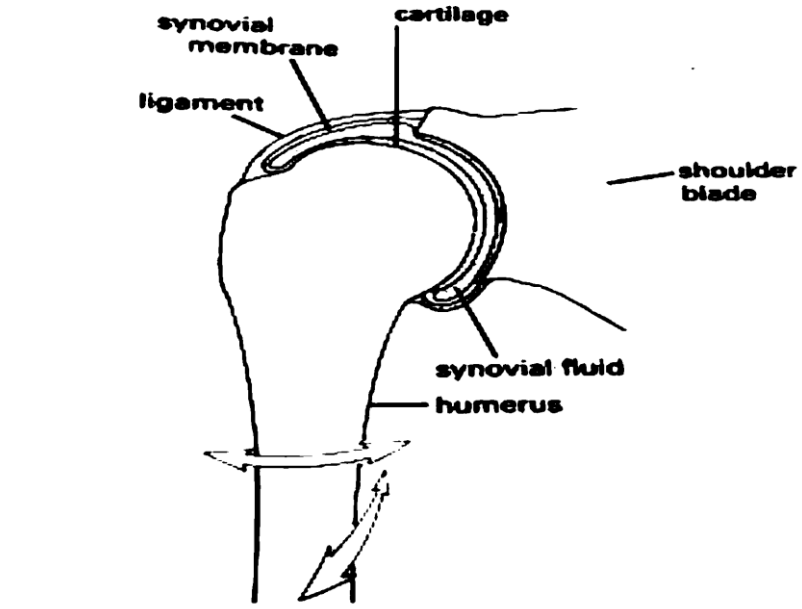
a. **Hip joints**

- Bones at the hinge joint and ball-and-socket joint are held in place by ligaments which joint are held in place by ligaments which joint them together.
- Figure below shows the hip joint which is an example of ball and socket joint.



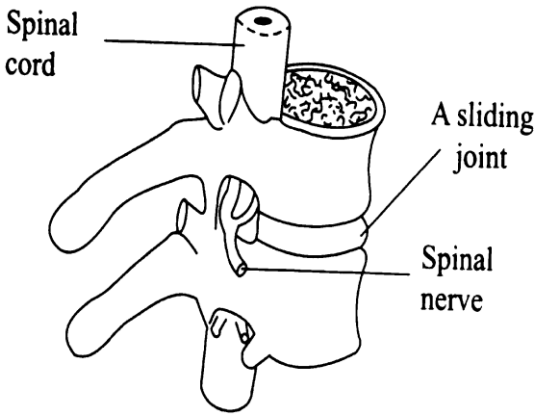
b. **Shoulder joint**

Figure below shows shoulder joint formed by humerous, shoulder blade and scapula bones at shoulder joint.



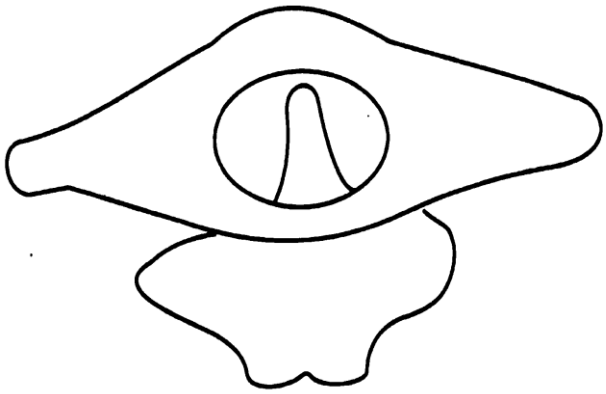

**GLIDING JOINT**

- These are joints that allow slight movements of the bones.
- They are found in between the vertebral bones.
- They allow slight bending of the backbone.
- They are also found in the carpals of the palm and the tarsals of the foot.
- The diagram below is a section of vertebra column showing the position of gliding joint.



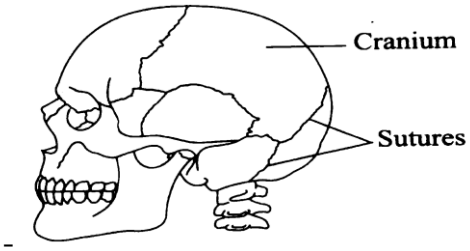
### PED AND SOCKET JOINT- PIVOT JOINT

- It is found between the first and the second vertebrae in the neck.
- It allows rotation of the bend.
- The diagram below shows illustration of peg and socket joint.

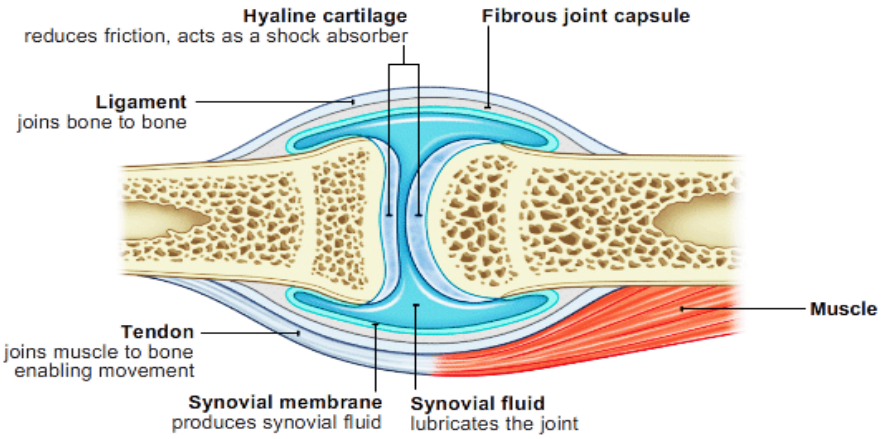


### IMMOVABLE JOINTS

These are joints that do not allow movement of bones to occur. They are also called **fixed joints.** They join bones that form the cranium. Figure below shows sutures in the human skull, an example of the immovable.




### PARTS OF THE JOINT



| Structure | Function |
|---|---|
| Ligaments | They hold bones together at the joint |
| Synovial membrane | They produce or secrete synovial fluid |
| Synovial fluid | They act as lubricant at the joints |
| Tendons | They attachment muscles to the bones |

## MUSCLES

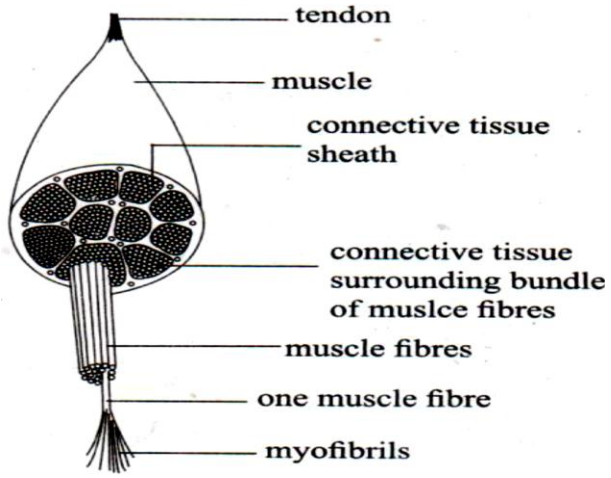
- Muscle tissue is an elastic tissue. It works by contracting.
- A muscle is made up of thousands of small fibres.

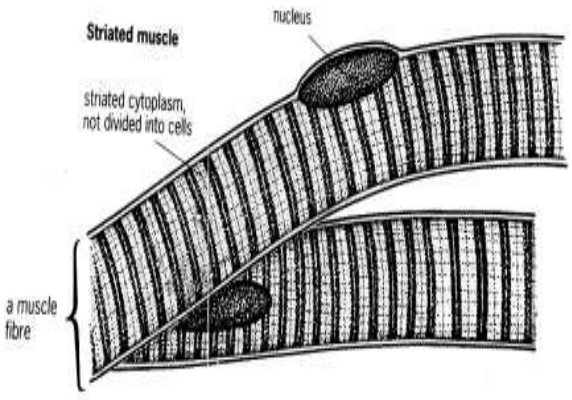
### THREE DIFFERENT TYPES OF MUSCLES

**Name three types of muscles in the human body.**

### 1. VOLUNTARY MUSCLES

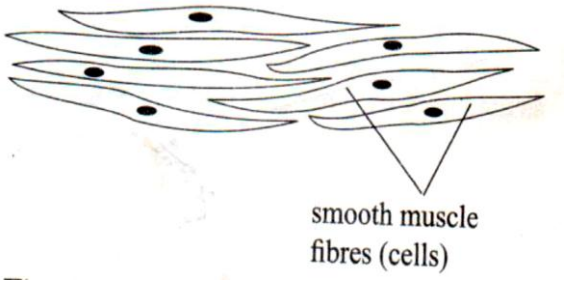
- These are muscles in the body that you can consciously control.
- These are muscles which are made to contract or tighten by the conscious control of the brain.
- They contract suddenly and powerfully, but they get tired quickly.
- The contraction of voluntary muscles will lead to the movement of the skeleton and therefore cause locomotion. Examples of such activities are running, jumping, walking among others
- Voluntary muscles are also called skeletal muscles since they are attached to the bones. The diagram below shows skeletal muscles.



## 2. INVOLUNTARY MUSCLES

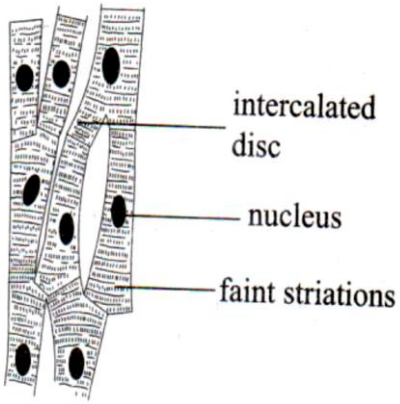
- These are muscles that are not under our will control. They are muscles that contract involuntarily to perform their function.




- Examples of involuntary muscles in the body are
  a. Muscles of the alimentary canal
  b. Muscles of the blood vessels
  c. Muscles of the bladder
  d. Muscles of the iris in the eyes

## 3. HEART MUSCLES

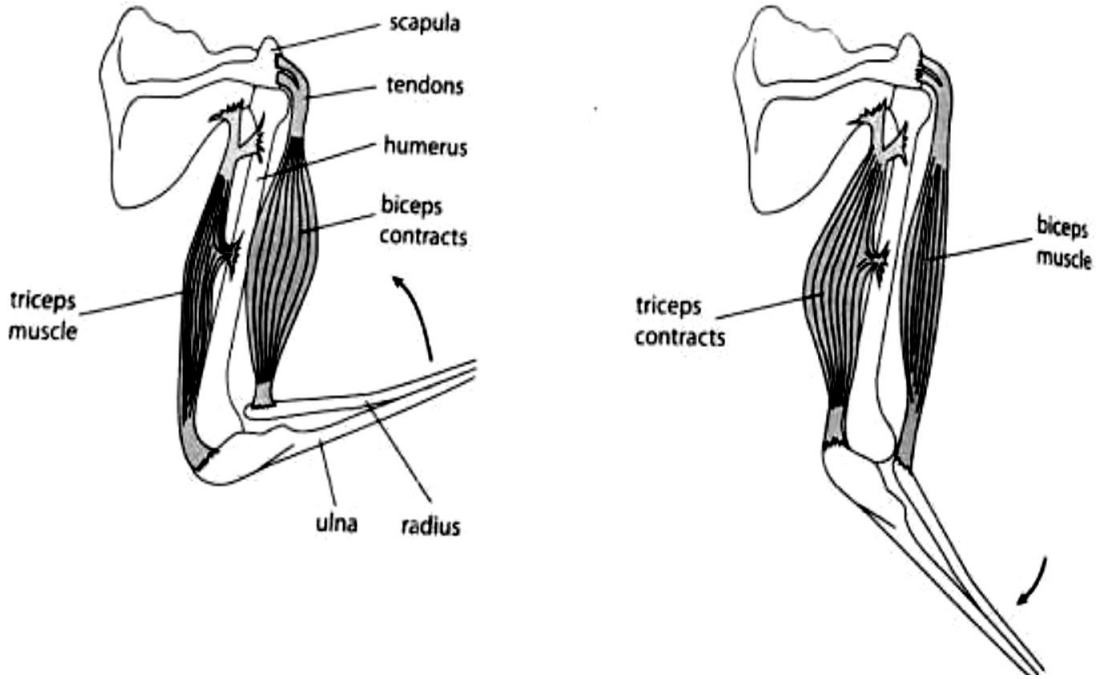
- This is type of the muscle that is found in the heart.
- It works by contracting and relaxing of the heart to pump the blood around the body. The heart or cardiac muscle is shown below.



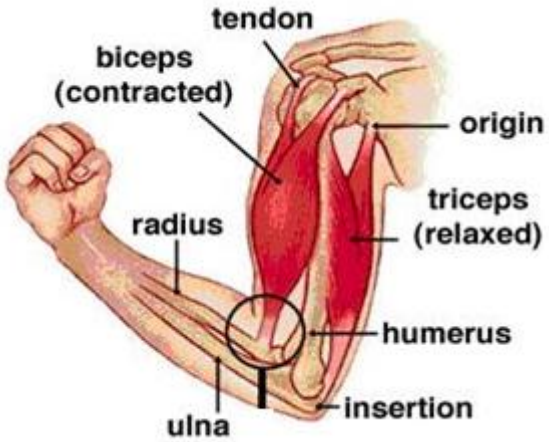

## ANTAGONISTIC MUSCLES

- These are voluntary muscles that work in pairs such that when one pair contracts, the other relax causing the movement of the limbs.

- The Diagram below shows antagonistic muscles (biceps and triceps)that work in pairs

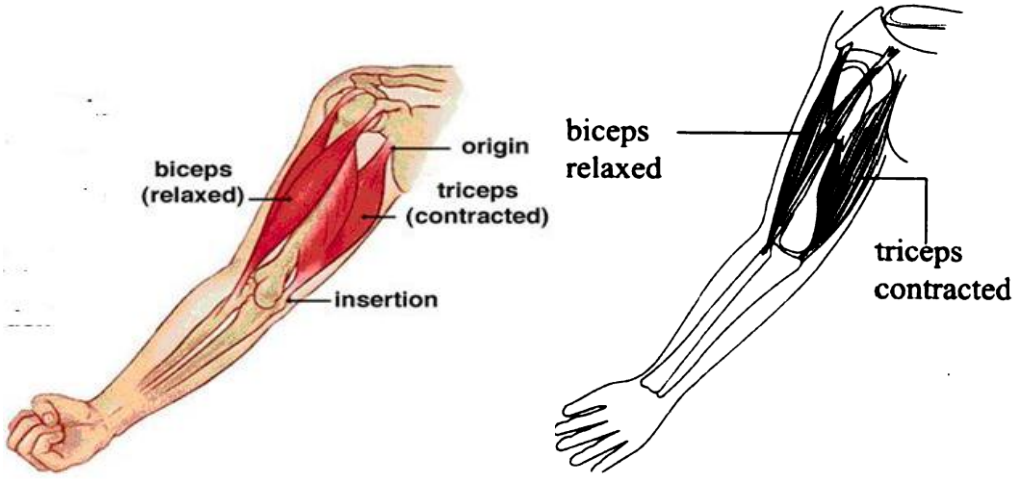



- There are two sets of muscles on each side of the humerous, some on the inner side and others on the other side. Those on the inner side of the upper arm are the **biceps**. The muscles on the outer or backslide of the arm are the **triceps**.
- Figure below shows the bent arm showing biceps and triceps

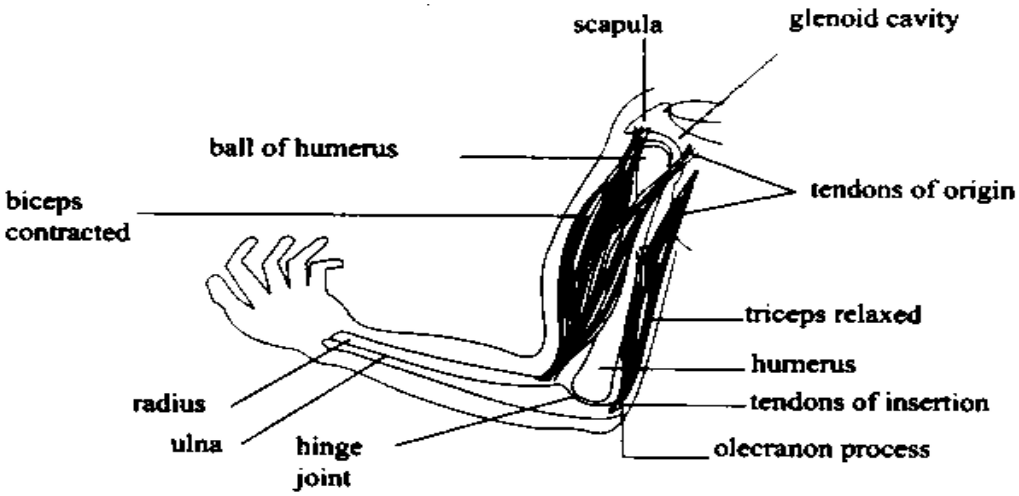



- The biceps and triceps are referred to as **antagonistic muscles**. This means that they never contract or relax at the same time. When one contracts, the

other is relaxed. When the lower arm is straightened at the elbow, we say that the arm is **extended**.




- When the arm is bent at the elbow, we say the arm is **flexed.**




- When the arm is **extended, the triceps muscles are in contracted state** and so they are tight and short in length. The biceps muscles on the other hand are **relaxed and therefore stretched.**
- In order for the arm to be flexed, the biceps muscles contract, therefore shortening. This causes them to pull against the radius. This action raises the lower part of the arm. The triceps must relax and stretch to allow the movement of the arm to take place.

## INJURIES TO BONES

**Define the term fracture.**

A fracture is a broken or cracked bone which occurs as a result of a heavy impact -against the body.

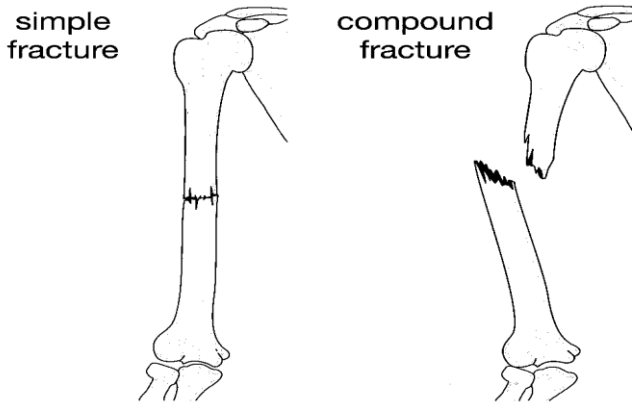
**EXPLAIN TWO TYPES OF FRACTURES.**

1. **SIMPLE FRACTURES OR CLOSED FRACTURE**

   -This fracture where the broken bone remains beneath and does not pierce through the skin.

2. **COMPOUND FRACTURES**

This is the type of fracture where the broken bones pierce through the skin. This causes the wound to bleed and swell.




**Describe how to perform the First Aid for fractures.**

- Before taking an injured person to hospital, a straight or smooth piece of wool called a splinter can be placed next to the injury and tied along to prevent further movement of the bones which can make the wound worse.
- Then support the injured part with a sling.

**INJURIES TO JOINTS**

**Explain two types of injuries which occur at joints.**

1. **Sprains**

**Describe how the sprain is brought about.**

- Sprains are injuries that occur at joints and they occur when a wrist or an ankle is suddenly twisted.

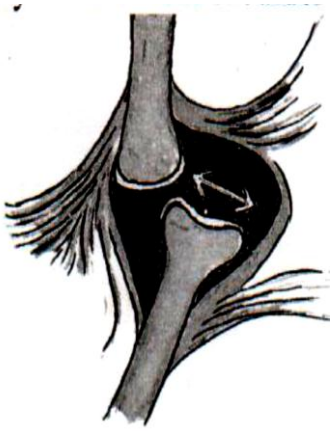
- The joint is suddenly pulled or twisted which causes a tear or injury to the ligaments that help keep the joint in place. They can be very painful

**Describe how to perform the First Aid for sprains.**

- Ice or cold water can be applied to a sprain to reduce pain, swelling or bleeding of tissue
- A sprain is taken care of by carefully applying a supporting bandage at the joint and giving it enough rest so that the damaged tissue can heal. The diagram below shows the First Aid for the sprain.

**2. Dislocations**

- This is the type of injury that occurs when a bone moves out of its position at a joint. It usually occurs at the shoulder or knee joint.
- The diagram below shows bone dislocation.



**Describe how to perform the First Aid for dislocations.**

A dislocated joint is usually managed by carefully and skilfully pushing the dislocated bone back into position. It is best done by a qualified First Aider. A sling can also be tied along the area to support the weight away from the joint.

## CHAPTER 8 DIARRHOEAL DISEASES

**What is diarrhoea?**

- Diarrhoea is condition whereby an individual passes out loose watery stool frequently due to an infection of the alimentary canal.
- It can also be defined as the continued passing out of watery faeces more than four times in a day which causes severe loss of water from the body (dehydration) and loss of important food substances needed by the body.
- Diarrhoea is a symptom of diseases that affect the alimentary canal.

**GENERAL CAUSES OF DIARRHOEAL DSEAESES**

5. Problems of intestinal disease or abdominal disorders caused by damaged wall of the bowel
6. Drinking and ingesting contaminated water and food by some microorganisms
7. Exposure to toxins
8. Small yellow tumor in lungs and the digestive tract especially appendix
9. Ingestion of non absorbable solutes which causes water to move from body tissues and blood vessels into the bowel
10. Problems to transport solutes from bowel into the blood vessels
11. Increased bowel mobility and no time for food and water to be absorbed
12. Small area for digestion and absorption.

**GENERAL SIGNS AND SYMPTOMS OF DIARRHOEAL DSEAESES**

1. Passing watery faeces more than four times per day.
2. Feeling thirsty and drinking eagerly
3. Unwilling or unable to drink any fluid.

4. Restlessness
5. General body weaknesses
6. Sunken eyes
7. Coma

**THE MAIN DIARRHOEAL DISEASES**

**CHOLERA**

- It is an acute infection of the intestinal tract caused by bacterium called Vibro cholera.
- Vibio cholera has the flagellum of one cell pore for movement

**Transmission of cholera**

a. Drinking untreated water contaminated by faeces
b. Transmitted by houseflies from faeces to food
c. -Eating uncooked food, fruits and vegetables if they are washed in contaminated water.

**Effect of the parasite (Vibro cholera) on the host**

- Once food contaminated and is ingested, the bacterium undergoes an incubation period of one to six days. They then multiply rapidly in the small instestine and produce highly poisonous substances. These substances are responsible for the severe symptoms of cholera which occur suddenly.

**Symptoms of cholera**

a. Watery stool that looks like rice water.
b. Severe diarrhoea.
c. Nausea
d. Severe vomiting and abdominal pain
e. Acute thirst and muscle and muscle clamps.
f. Severe dehydration occurs due to loss of water from the body

**Methods of controlling cholera**

a. Infected patients should be isolated and they, together with people they are in contact with should be given the appropriate medication.

b. All infected people should be isolated and vaccinations given to those under threat of possible infection.
c. Give the person plenty of fluids such as ORS frequently in small amounts to replace water being lost until diarrhoea stops.
d. Do not give the person solid and sweet foods to prevent worsening diarrhoea.
e. Visiting the doctor to get antibiotics to kill the bacteria and saline drip to replace the water and some electrolytes lost from the body
f. Protect yourself and the person by observing general rules of hygiene by washing hands with soap and water before and after touching the person.

**Prevention of cholera**

a. Construction of proper toilets, or pit latrines especially in crowded areas.
b. Discouraging the practice of flying toilets. Flying toilets refers to defecation in plastic bags which are then thrown into waste dumps or roof tops by the inhabitants of slum areas where the toilets are far or few.
c. Education and awareness campaigns on proper use of latrines, importance of washing hands after defecation and visiting a toilet.
d. Boiling water or simple measures of treating water with chlorine tablets to ensure water is safe for drinking.

**DYSENTRAY**

- Dysentery is an intestinal inflammation especially in the colon that can lead to severe diarrhoea with mucus or blood in the faeces.
- -Types of dysentery include

**1. BACILLARY DYSENTERY**

**CAUSATIVE AGENT OF BACILLARY DYSENTERY**

It is caused by bacteria called Shigella

**Mode of transmission**

One may be infected by ingesting contaminated food and drinks.

**SYMPTOMS**

- -Diarrhoea
- Fever
- Nausea
- Vomiting
- Stomach cramps
- Flatulence
- Stool may contain blood, mucus or pus

**TREATMENT**

a. Giving oral rehydration
b. Administering antibiotics

2. **AMOEBIC DYSENTERY**

It is caused by amoeba called **Entamoeba histolytica**

**MODE OF TRANSMISSION**

One may be infected with Entamoeba histolytica by drinking water or eating food that is contaminated by the parasite.

**EFFECTS OF THE PARASITE**

It destroys the gut epithelium and the blood capillaries and causes formation of ulcers. This leads to the release of blood into the intestine. The parasite then feeds on the red blood cells.

**SYMPTOMS**

a. The patient has diarrhoea that comes and goes.
b. The patient gets cramps in the bell and the need to have frequent bowel movements
c. The patient produces many loose stools with a lot of mucus sometimes stained with blood.
d. Blood appears in the faeces of the patient in severe cases.
e. I-n chronic cases , the patient suffers from anaemia

**PREVENTION AND CONTROL**

a. Drink boiled or treated water

b. Good hygienic practices like washing hands properly after visiting the toilet.
c. Thorough cooking of food to kill the amoeba
d. Proper medical treatment by infection by qualified doctor in the case of infection by the disease.
e. Proper sewerage treatments should be done to kill bacteria

**TYPHOID FEVER**

It is caused by bacteria called Salmonella typhi

**Mode of transmission**

The bacteria is spread through poor sanitation which leading to contaminated water and food.

**SYMPTOMS**

a. Fever
b. Headache
c. Abdominal pain
**d.** Diarrhoea.

**Prevention and control**

- Isolation of the patients to avoid spread of the disease by contact.
- Sterilising clothes that the patient has used using disinfectants.
- Food handlers in institutions like hospital like hospitals, schools and restaurants.
- Proper disposal of faeces in the toilet.
- Thorough water treatment and purification in town or city water.

**Discuss ways of preventing and controlling diarrhoeal disease.**

- Drink safe water
- Avoid eating food sold in open places.
- Wash fruits and vegetables with cleaning running water.
- Wash hands after visiting latrines and toilets
- Use toilets and latrines to dispose wastes
- Report- cases of diarrhoea to health workers as soon as possible to enable the government control the spread of the diseases.

- Civic education
- Vaccination
- Water treatment
- Personal hygiene
- Exclusive breast-feeding

**Discuss the home treatment for diarrhoeal diseases.**

- Giving oral rehydration solution to the patients. The fluid enhances faster absorption of water into the body.
- It also helps the body to replace fluids lost during diarrhoea

## CHAPTER 9: SEXUALLY TRANSMITTED INFECTIONS

**What is Sexual Transmitted Infection?**

Sexually transmitted infection (STI) is an infection that can be transferred from one person to another through sexual contact.

**State the common examples of Sexually Transmitted Infections (STIs).**

**HIV AND AIDS**

**CAUSES OF -AIDS**

It is caused by a virus called HIV (Human Immuno - deficiency Virus)

**H- Human-** This means that the virus affects human beings

**I - Immuno- deficiency**

This refers to the fact that the virus destroys the body's immune system allowing the individual to become infected by germs which normally the body could resist

**V-Virus-**The germ that infects people is of a special type called virus.

**AIDS**

**It means**

**Acquired** - This means anything that is got from another person

**Immune** - This refers to the body's defence system which protects us -from diseases

**Deficiency**- This refers to the fact that the immune system is not functioning properly thus reducing the body's ability to fight diseases.

**S- Syndrome-** This is a group of signs and symptoms which are found together in a person who has a particular disease.

**AIDS-** It is the result of a person's immune system becoming so weak that the person is no longer able to fight diseases. The person becomes ill with one or more diseases like pneumonia, tuberculosis among others

**MODE OF TRANSMISSION OF HIV**

HIV is transmitted through the following ways

a. Sexual intercourse with infected person
b. Blood transfusion using infected blood
c. From infected mother to child during pregnancy, birth or breastfeeding
d. By use of unsterilized surgical or piercing instruments such as syringes, blades, needles and scissors.

**SIGNS AND SYMPTOMS OF HIV and AIDS**

- Chronic diarrhoea for more than a month
- Attack by opportunistic diseases such as TB and pneumonia
- Inflammation of lymph nodes
- constant, persistent and severe coughs
- sudden loss of weight

**Effect of HIV and AIDS**

Loss of immunity which leads to death

**CONTROL AND PREVENTION OF HIV and AIDS**

- Abstaining from sex before marriage
- Avoid sharing needles and razor blades
- Avoid using unsterilized surgical instruments
- Screening blood for HIV before transfusion

- Using anti-retroviral drugs
- Being faithful to one partner.

**The care and support services provided to people living with HIVV and AIDS**

- Providing physical care/Love and care- This can be done through giving them company and talking to them kindly, visiting them often, allowing them talk and express themselves as we listen patiently, feeding them and keeping them company as they eat and encouraging them to continue working
- Adequate diet - Providing a balanced diet to the patient.
- Providing good hygiene - They should stay in a clean environment. They should take a bath everyday/Bathing the HIV/AIDS patient.
- Providing medical care. Ensure that they take their medicine properly
- Provide counselling
- People living with HIV and AIDS patients need counselling
- Freedom from discrimination
- Helping them with domestic chores such as washing their beddings, cooking for them and their children and running errands.
- Providing them with material support such as food, soap, medicine, beddings and clothes.
- Providing emotional support by sharing feelings and concerns
- Providing spiritual and moral support. Praying with the patients, sharing a word of the creator for them as a way of binging peace and encouragement to them

**Prevention and control of HIV/AIDS**

- Abstaining from sexual intercourse
- Being faithful to the marriage partner.
- Modest dress code and behaviour to avoid provoking or tempting other persons into sexual arousal
- Self control in drinks such alcoholism, avoiding drugs abuse, screening blood before blood transfusion

- Use condoms especially among unmarried people who have sexual intercourse
- Getting medical treatment
- Avoid sharing skin-piercing instruments such as needles, razor blades etc
- Avoid getting pregnant if you are positive.

**What are the misconceptions about HIV and AIDS?**

- Others believe that the disease is as a result of witchcraft.
- Others believe when they cannot get the disease
- -Others believe that when they contract the disease seek help from witchdoctor.
- Some people believe that the virus can spread by mosquito bites.
- Some people believe that use of protected can kill a woman or make her infertile.
- Some people believe that HIV is contracted by people who are not faithful and trustworthy

**THE EFFECTS OF THE SEXUALLY TRANSMITTED DISEASES, HIV AND AIDS.**

**ON THE INDIVIDUAL**

a. Loss of body weight
b. Can lead STIs can lead to dear./o madness
c. Sterility low productivity

**ON THE FAMILY**

Loss of income

**ON THE NATION**

Low productivity

**GONORRHOEA**

- It is caused by a bacteria known as Neisseria gonorrhoea
- The bacteria affect urethra in males and vagina in females.

**MODE OF TRANSMISSION OF GONORRHOEA**

- Sexual intercourse with infected persons

- At birth, for newborn babies, if the mother is suffering from the disease

**SIGNS AND SYMPTOMS OF GONORRHOEA**

**In females**

- Pain in the lower abdomen
- Menstrual problems
- Discharge of pus from vagina
- Burning of painful sensation when urinating because the urethra becomes narrow

**IN MALES**

- Yellowish discharge from urethra
- Pain while passing out urine
- Sores at the tip of penis

**BABIES**

Blindness and severe conjunctivitis in babies born from the infected mother when the mother's vaginal fluids come into contact with the baby's eyes.

**EFFECTS OF GONORRHOEA**

a. Blockage of sperm ducts or oviducts which leads to sterility
b. Destruction of red blood cells thereby causing anaemia
c. Destruction of liver cells causing yellowish of eyes and skin

**CONTROL AND PREVENTION OF GONORRHOEA**

a. Abstaining from sex before marriage
b. Early diagnosis and treatment using antibiotics
c. Health education to the community to avoid its spread
**d.** Engaging in safe sex through the use of condoms.
**e.** Married partners must be faithful to each other
**f.** Infected persons must abstain from sexual intercourse to avoid infecting their partners until the infection is fully cured

**SYPHILIS**

**CAUSES OF SYPHILIS**

It is caused by a bacterium called Treponema pallidum

**MODE OF TRANSMISSION**

- Sexual intercourse with infected persons
- At birth, for newborn babies, if the mother is suffering from the disease

**SIGNS AND SYMPTOMS**

**FIRST PHASE (PRIMARY SYPHILIS)**

This the first stage of the infection that occurs in two to four weeks after intercourse.

This stage shows signs such as painful sore appear on the cervix or the top of penis.

**SECOND PHASE (SECONDARY SYPHILIS)**

This stage occurs two to six weeks after infection where signs appear on different parts of the body.

**EXAMPLES O SIGNS DURING THIS STAGE INCLUDE:**

- Rashes appear on the skin
- Falling of hair
- Mild fever
- Enlarged lymph nodes
- Sores in the throat, nose and rectum
- Body pains and loses hair in the form of bald patches on the head.

The patient is highly infectious at this stage

**THIRD PHASE (TERTIARY SYPHILIS)**

This is a fatal stage where infection reaches the nervous system and the heart. This stage is characterised by paralysis, blindness and or madness/insanity, heart failure. Death may eventually occur.

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**EFFECTS OF SYPHILIS**

- Heart diseases
- Blindness or insanity
- Paralysis
- Death

**CONTROL AND PREVENTION**

- Abstaining from sex before marriage
- Early diagnosis and treatment using antibiotics such as penicillin
- Health education to the community to avoid its spread
- Engaging in safe sex through the use of condoms.
- Screening blood before transfusion
- Refraining from sexual intercourse when one gets infected

- Trace any sexual contacts of infected persons so that they are treated promptly

**CANDIDIASIS**

It is caused by a fungus called Candida albicans

**TYPES OF CANDIDIASIS**

1. **OROPHARYNGEAL CANDIDIASIS**

   This occurs when the fungi attack the mouth. It is commonly known as oral thrush

2. **VAGINAL CANDIDIASIS**

This occurs when the fungi occur when the fungi attack the vagina

**MODE OF TRANSMISSION**

- Sexual intercourse with infected persons
- Kissing can spread Oropharyngeal candidiasis

**SIGNS AND SYMPTOMS**

- White patches
- Red inflamed skin under patches
- Burning and Itching of the vagina or severe irritation of the vagina
- Vaginal discharge
- Sensations of pain when urinating

**PREVENTION AND CONTROL**

- Abstaining from sex before marriage
- Treatment with antifungal
- Engaging in safe sex through the use of condoms

**GENITAL WARTS**

It is caused by Human Papilloma Virus

**MODE OF TRANSMISSION**

Sexual intercourse with infected persons

**SIGNS AND SYMPTOMS**

- Bump-like growths on the genitals and anus.

- Itching sensation or discomfort around the genital
- Bleeding may occur

**PREVENTION AND CONTROL**

- Removal of the warts using the liquid nitrogen
- Treatment using drugs
- Abstaining from sex before marriage
- Use of condoms

**HEPATITIS B**

It is caused by hepatitis virus

**MODE OF TRANSMISSION**

- Sexual intercourse with infected persons
- Through blood transfusion with infected blood

**SIGNS AND SYMPTOMS**

- Production of dark coloured urine
- Yellow-orange faeces
- Jaundice
- Inflamed liver which swells and stops functioning
- Pain in the stomach
- Muscle ache, fatigue, nausea, vomiting and diarrhoea

**PREVENTION AND CONTROL**

- Treatment using drugs
- Abstaining from sex before marriage
- Use of condoms

**GENITAL HERPES**

It is caused by Herpes virus

**MODE OF TRANSMISSION**

- Sexual intercourse with infected persons
- At birth, for newborn babies, if the mother is -suffering from the disease

**SIGNS AND SYMPTOMS**

- Sores on the lips
- Painful blisters on the genitals
- Genital ulcers which may heal and recur

**CONTROL AND PREVENTION**

- Treatment using antibiotics
- Abstaining from sex before marriage
- Use of condoms
- Refrain from unsafe sexual intercourse when one gets infected

**TRICHOMONIASIS**

It is caused by a protozoan Trichomonas vaginalis

**MODE OF TRANSMISSION**

Sexual intercourse with infected persons

**SIGNS AND SYMPTOMS**

- Painful sores on the vagina walls
- Smelly discharge from the vagina
- Burning sensation while passing out urine
- Itchy penis with lesions

**CONTROL AND PREVENTION**

- Treatment using antibiotics
- Abstaining from sex before marriage
- Use of condoms

**CHLAMYDIA**

It is caused bacteria

**MODE OF TRANSMISSION**

Sexual intercourse with infected persons

**SIGNS AND SYMPTOMS**

- Inflammation of the pelvis
- Pain and discomfort
- Infertility

- Loss of manpower

**CONTROL AND PREVENTION**

- Treatment using antibiotics
- Abstaining from sex before marriage
- Use of condoms

**RISK**

A risk is a situation whereby one is exposed to danger.

**DEFINE RISKY BEHAVIOUR**

Risky behaviour is any activity -that is associated with dangers or has a harmful effect.

**EXAMPLES OF RISKY BEHAVIOUR**

1. Unprotected sexual intercourse
2. Sharing cutting or peaceful
3. Plasticising practice
4. Practising oral sex with infected partner.
5. Unprotected sexual contact with multiple partners.
6. Taking too much alcohol

**RISKY SITUATION**

- This is situation which exposes.
- Meeting sugar daddies ad sugar mummies.
- Accepting with infected a transfusion a with infector. Draw and draw videoed

**RISKY SITUATION**

This is situation which exposes one to danger of getting infected with a disease.

**EXAMPLES**

a. Meeting sugar daddies or sugar mummies after school
b. The circumstance of a being a pregnant mother infected with HIV
c. Accepting a transfusion with infected blood consumption
d. Receive alcohol consumption peer pressure

e. Poverty

**LIST FIVE SKILLS THAT CAN HELP YOU AVOID RISKY BEHAVIOUR.**

- You should be creative to avoid contracting the disease
- You should developed the ability to be able to solve problem
- You should develop a critical thinking ability before acting on a problem.
- You are required to come with good decisions after analysing a certain issue.
- Self-awareness is another skill which one should have
- Self-esteem. After knowing yourself, be proud of yourself.
- Yu should have communication issues

**IMPORTANCE OF CURATIVE HEALTH CARE FOR STIs &OPPORTUNISTIC DISEASES**

- Early treatment leads to early healing.
- Early treatment prevents further complications
- Helps to control the spread of disease.
- Early treatment prevents the destruction of other internal

**EFFECTS OF DISCRIMATION AND STIGMATISATION**

- Feel isolated
- Feel deprived of their human results
- They lack someone to and share problems
- Feel depressed because they feel unloved.

**RIGHTS OF PEOPLE LIVING WITH HIV/AIDS**

- Right to proper medical treatment and care
- Right to education
- Right to respect and dignity
- Right to their job even if they have HIV and AIDS should never be forced to terminate their services
- Right to keep this knowledge to themselves.

## CHAPTER 10- MICRO-ORGANISMS

**Define the term micro-organism.**

- Micro-organisms are organisms that cannot be seen by use of naked eyes.

- They can only be seen with the help of microscopes.
- The different groups of microorganisms

a. Bacteria
b. Fungi
c. Algae
d. Protozoa
e. Virus

## BACTERIA

It is a prokaryote which means that they have no nucleus.

**FEATURES OF BACTERIA**

1. **Has a cell wall that is rigid and porous**

   The cell wall gives the bacteria a distinct shape and also allows substances to pass in and out of its body

2. **They have an outer capsule**

   The capsule enables the bacteria to stick on surfaces and also protect itself against harm

3. **Some bacteria have long whip-lie projections called flagellum**

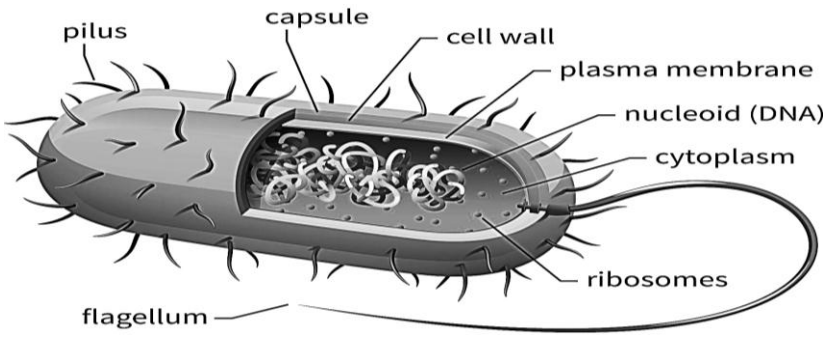
   T-he flagellum rotates rapidly to allow the bacteria to move.

4. **They have a fluid filled cytoplasm**

   The cytoplasm suspends dissolved substances.

5. **They have a nuclear material**

6. The nuclear material is made of structures that carry hereditary information. This structure is called chromosome.



## FORMS OF BACTERIA

### 1. COCCI

**There are three types of cocci**

**a. CRUMPS**

These occur in groups clumped together

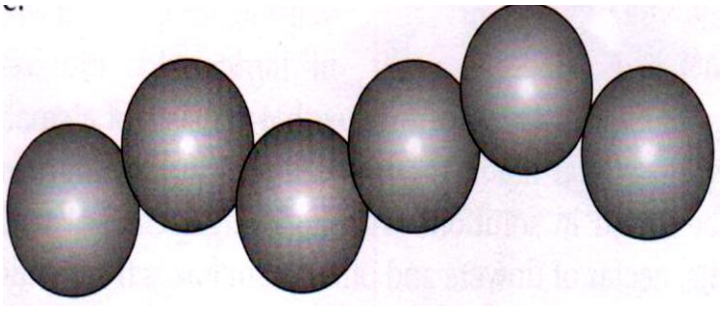
**b. DIPLOCOCCUS**

These occur in pairs but joined together within a membrane like in preumoniae which causes pneumonia

**c. STREPTOCOCCUS**

These occur in chains like in the bacteria that cause sore throat.

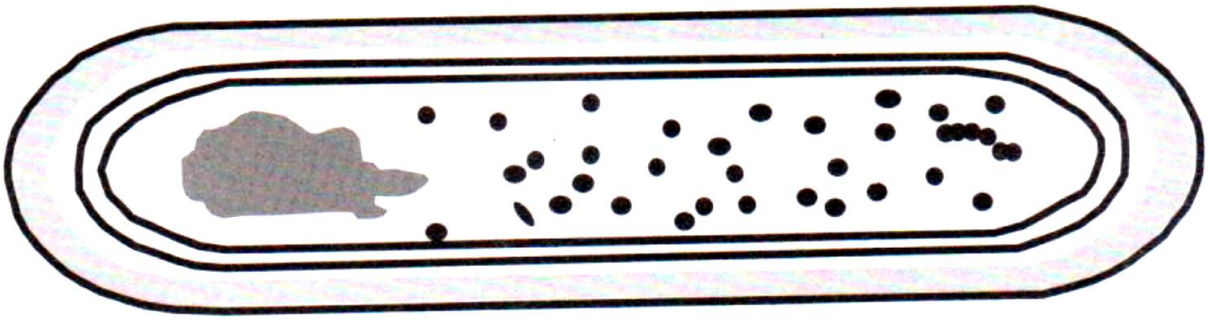
The figure below shows the coccie bacteria



### 2. BACILLI

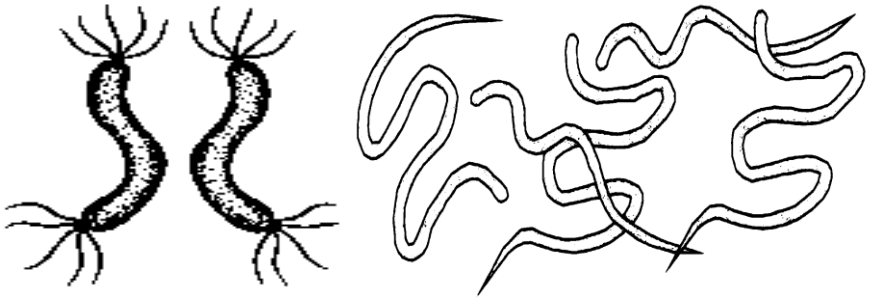
These are rod-shaped bacteria. They may have one or more flagella or may lack flagellum.

Examples include Bacillus anthracis that causes anthrax or Bacilli typhosus that causes typhoid. Others may be rod-shaped but curved like the Vibrio cholera that causes cholera. Figure below shows Bacilli and Vibrio



**3. Spirillum**

- These are spiral in shape. An example is the Treponema pallidum that causes syphilis.



**FUNGI**

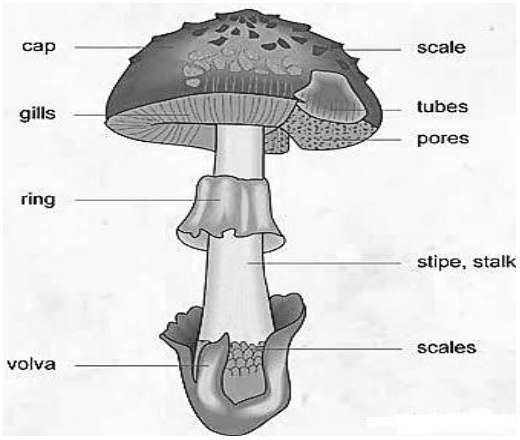
Fungi are composed of whitish body matter and spore producing structure

The fungus has the following characteristics. Examples of fungi include bread mould, mushrooms, toadstools, yeast, pencillium etc

1. Some fungi like yeast are unicellular. Others like rhizopus and mushrooms are multicelluar.

   Bread mould grows on bread when it is left for long time in a damp place. When the bread is left for long time in a damp place, mould spores land on the land bread and a greyish mass soon grows on it. This is because bread contains some food, which the mould uses for its growth.

   Most fungi are made up of a dense mass up of a dense mass (mycelium) of thread-like structures called **hyphae.** Figure below shows mushroom.

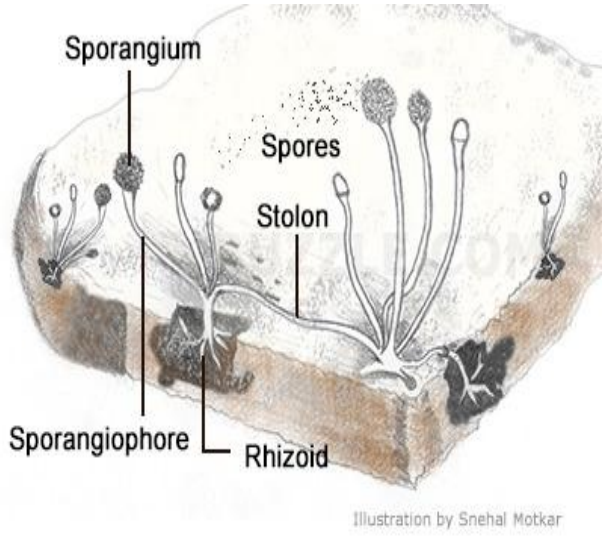


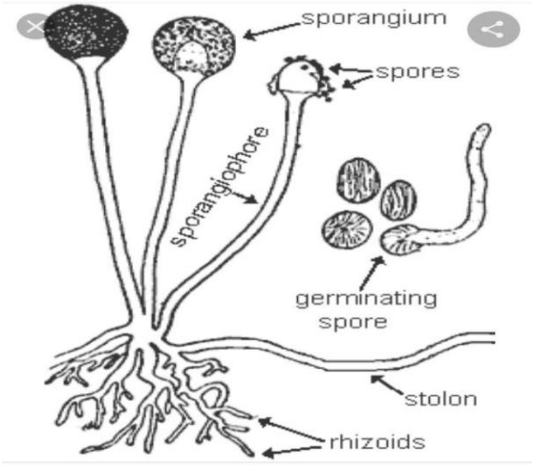
For example, some kinds of mushrooms are edible, that is, a source of food to humans. Mushrooms grow above the ground. They have delicate membranes on the underside which look like pages of a book. This is where spores are formed.

Mushrooms grow in cool and moist areas such as fields, lawns. They do not need light, so they can grow indoors.

2. They do not have chlorophyll in their cells
3. Some are parasitic fungi which obtain their food from other living things. Others obtain it from dead organic matter. This kind of fungus which gets nourishment from dead material is known as saprophytic fungus.

   Bread mould is a saprophyte. In saprophytic fungi, each fungus consists of a mass of thin threads, which grow on its food, digest and then absorb the digested food. The figure below shows the mould growing on bread.




They feed by saprophytic and parasitic feeding. Some are also symbiosis.

4. They have cell walls that are made of substance called chitin
5. They are eukaryotes- that is they have true nucleus surrounded by nuclear membrane.
6. They store sugar in form of glycogen or in form of oil droplets.

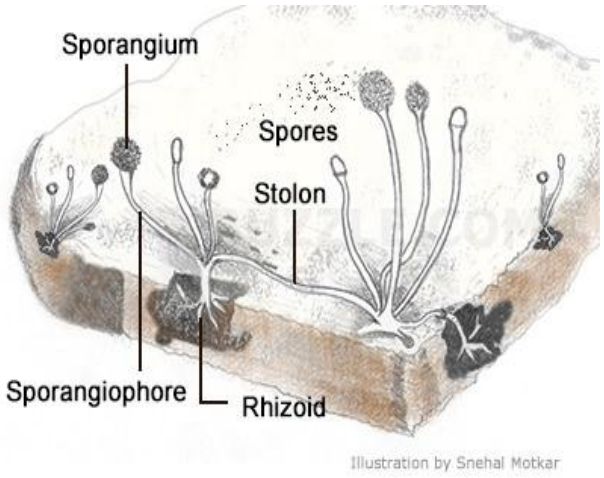
7. Some like rhizomes with simple structures. The bodies are made of threadlike structures called hyphae. Hyphae collects together forming a mass of body called mycelium.

   Hyphae is involved in feeding, gaseous exchange and reproduction.

   The downward hyphae form root like structures for feeding while the upright hyphae forms reproductive structures.

8. They reproduce sexually by conjugation. They also reproduce sexually by fragmentation and by spore formation.

   Fungi reproduce by forming millions of tiny spores, which are carried away by wind. If a spore lands on a piece of bread or any other starchy food, it may begin to grow and produce new threads. See in the diagram below.



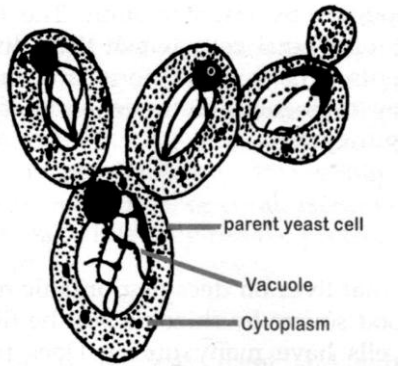

Rhizopus, an example of fungi. **Rhizopus fungi** are characterized by a body of branching mycelia composed of three types of hyphae: stolons, rhizoids, and usually unbranching sporangiophores. The black sporangia at the tips of the sporangiophores are rounded and produce numerous non motile multinucleate spores for asexual reproduction.

## YEAST

Yeast is widely used for baking the different kinds of alcoholic beverages such as beer and wine and for making foods such as cheese and bread. Some fungi are

used to make drugs to cure diseases in man and other animals. For example, pencillium is the drug made from a fungus.

The figure below shows the yeast.




**Importance of fungi**

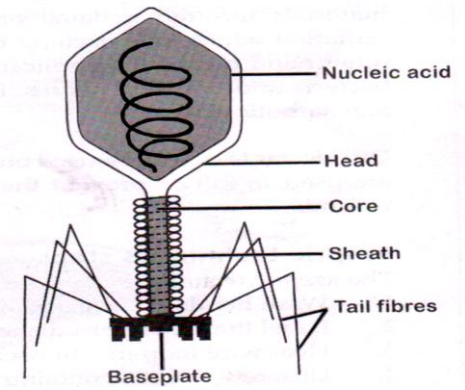
a. They are used to make drugs such as pencillium.
b. They are important in the decomposition of dead plant and animal material.
c. Yeast is used for baking alcoholic beverages such as beer and wine, , mag food such as cheese and breads
d. Some cause human diseases that infect skin, hair and nails such as athlete's food caused by ringworm.

**VIRUS**

- Viruses are small infections agents that replicate only inside the living cells of other organisms

**Structure of viruses**

- The figure below shows the virus.



b. They have nucleic acid-DNA and RNA.
c. Some viruses have projections which spikes that are used to attack organisms such as bacteria.
d. They do not have organelles to carry out processes. They do not have membranes and cytoplasm.
e. They have a protein coat –outer covering made of protein compounds. It surrounds nucleic acids.

- Viruses are small infections agents that replicate only inside the living cells of other organisms that is cells of plant and animals..

## PROTOZOA

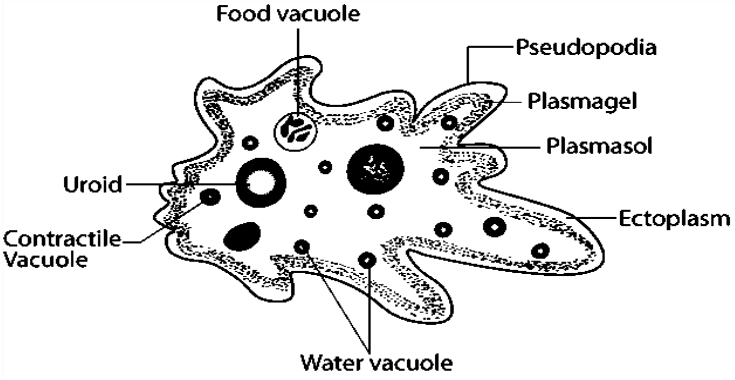
### 1. Protozoa

- Protozoa are micro-organisms with single celled bodies. They are easily observed through microscope.
- They have structures that enable them to move called **flagellum**.
- Others use short finger-like structures called **cilia** for movement.
- Others like the Amoeba move by forming extensions of their bodies called **pseudopodia.**

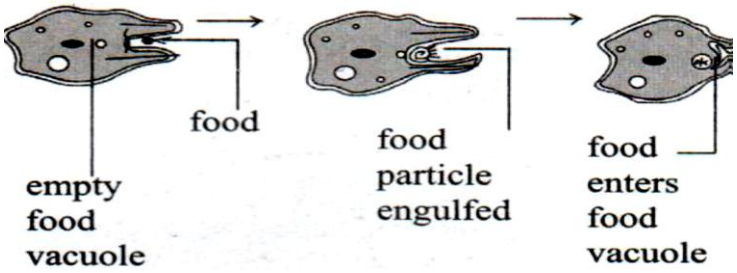
**Example include**

**a. Amoeba**

- This is a unicellular organism that resembles animals. The diagram below shows the amoeba.



- It moves using **pseudopodia.** The cytoplasm flows in a certain direction in order for it to move.



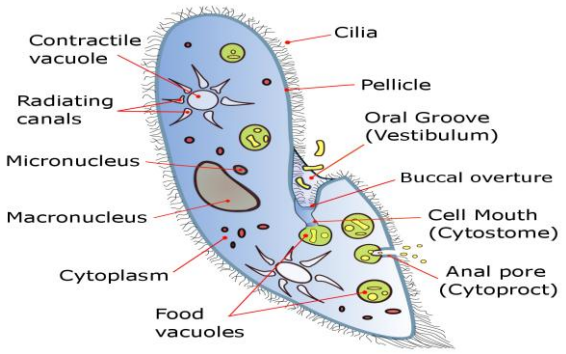

- It has a nucleus and its outer cover is the thin membrane.
- Excess water fills the contractile vacuole which gets with water and then bursts.
- Amoeba reproduces by splitting into two. This splitting is called **binary fusion.**

**FUNCTIONS OF THE STRUCTURES OF THE AMOEBA**

- **Nucleus**- Controls the animal's activities
- **Food vacuole** - For nutrition
- **Pseudopodium** - It is important in movement and feeding
- **Contractile vacuole**- Control of water balance inside the cell
- **Plasma membrane-** It allows some substances to pass through but not others.

**b. Paramecium**

- This is a unicellular animal like organism that moves by using thread like structures called **cilia.** As cilia beats on the water it is propelled forward. Sometimes it is called the **slipper animalcute**. A paramecium lives in water, it has food and **contractile vacuoles** as well as **ectoplasms** and **endoplasm**.



- A paramecium reproduces by means of binary fusion.

**c. Euglena**

- Euglena is an unicellular organism which is both an autotrophy (plant) which means that that it can carry out photosynthesis and makes its own food like plants as well as heterotrophy which means that it can also capture and ingest its food.
- When acting as autotrophy (animal), the Euglena utilizes its chloroplasts to produce sugars by photosynthesis and when acting as heterotrophy, the Euglena surrounds the food particle and consumes it by phagocytosis or in other words engulfing the food through its cell membrane.
- Locomotion comes as a result of rotating flagellum or the flexible pellicle membrane.

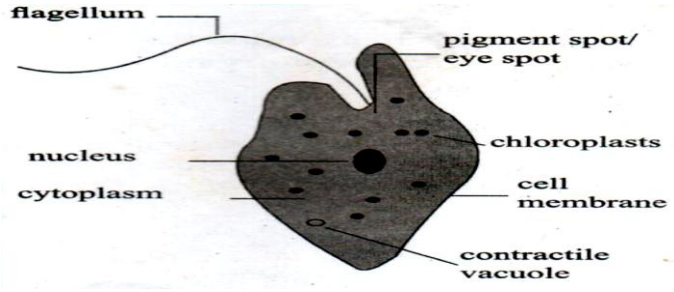
**PLANT LIKE FEATURES OF EUGLENA**

a. It has chloroplasts for photosynthesis
b. It has contractile vacuole used to expel water into the reservoir

**ANIMAL –LIKE FEATURES**

**a.** It has eye spot to detect lights that it moves towards it to conduct photosynthesis
b. It has flagellum for swimming or movement

- Therefore it is difficult to place Euglena under plant kingdom or animal kingdom because it contains both chloroplasts and eye spot.
- Euglena lives in flesh water or in moist soil. and the evidence is that it contains flagellum for locomotion.

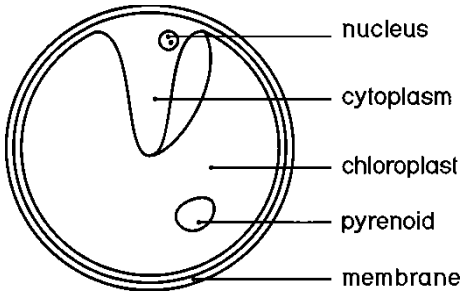


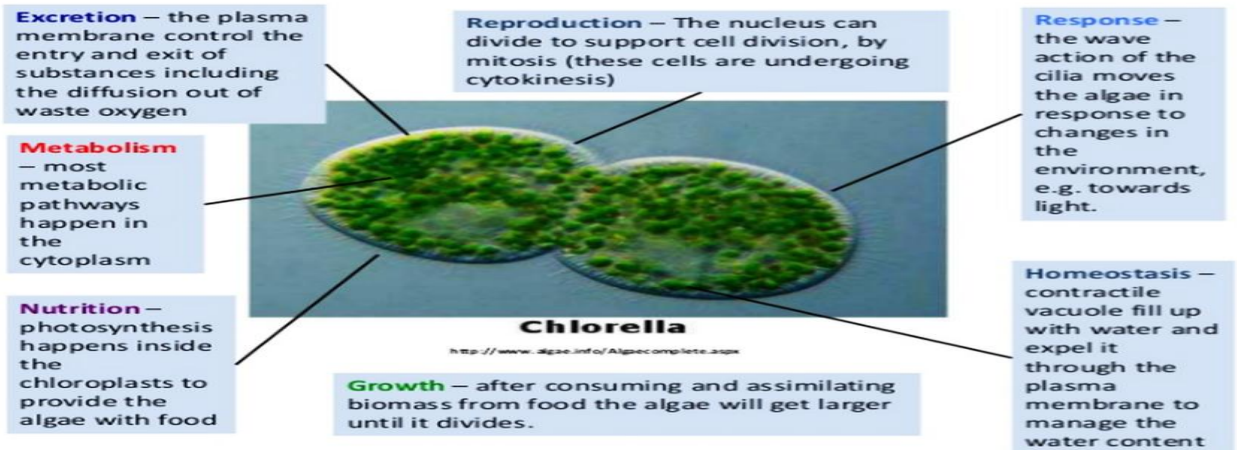

The functions of the following structures of the Euglena

- **Flagellum-** It is used for propelling or movement/locomotion
- **Reservoir-** It is used for storage of nutrients
- **Stigma (eye spot)-** It allows the Euglena to detect lights that it moves towards it to conduct photosynthesis. It allows the volvox to know whre the sunlight is coming from so that it can swim towards it.
- **Chloroplast-** It allows the Euglena to conduct photosynthesis
- **Contractile vacuole-** It used to expel water into the reservoir
- **Pellicle-** It used for locomotion when crunching up and down
- **Nucleus-** It contains DNA and controls cell activity.

**d. CHLORELLA**

- It is a unicellular plant like organism having cell wall and chloroplast. It carries out photosynthesis just like Euglena. It takes in and passes out gasses through surface and takes in water for photosynthesis.
- The diagram below shows chlorella



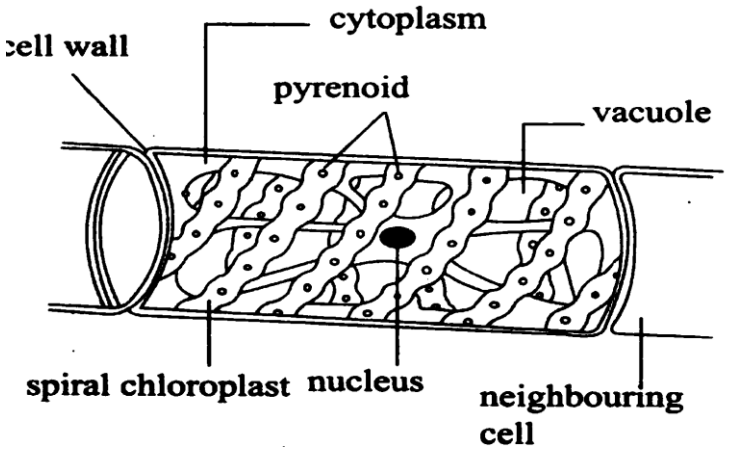




- Its chromosomes are enclosed in the nucleus.

- Chlorella are found on patches which look like green powder on trees while some live within the tissue of coelenterates e.g hydra and various kinds of coral. Here, they are symbionts, making food for the animal while they receive protection, excess carbon dioxide and mineral salts.

**ALGAE**

- Algae appear as many cells in a thin, thread-like filament.
- Examples of algae include **spirogyra, euglena, volvox, protococcus and diatoms.**
- Some algae are single-celled such as **euglena, chlamydomonas** while others are multicellular such as **spirogyra.**
- Spirogyra lives in fresh water and is photosynthetic. An example of algae is - spirogyra which appears as green filaments floating on water. They give the pond water a greenish colour.
- Figure below shows Spirogyra

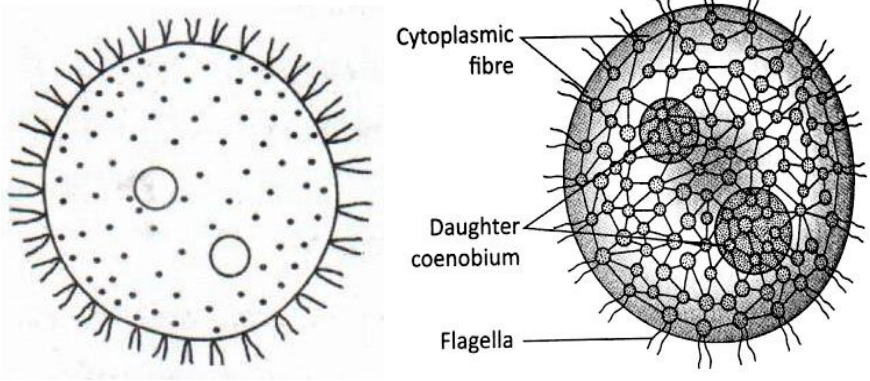



- Under favourable conditions such as plenty of light, warmth and water, spirogyra reproduces by fragmentation. The filaments break up into pieces consisting one of several cells which then divide by cell division to produce new filaments.

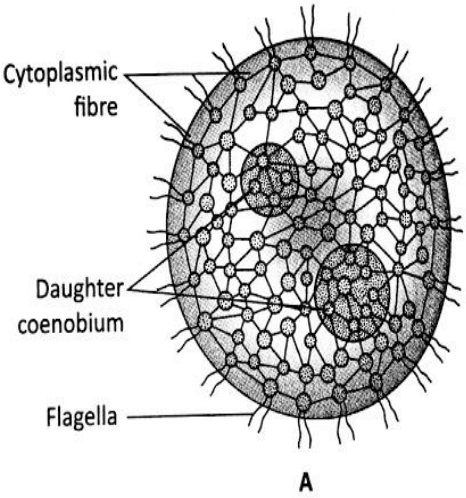
**The volvox**

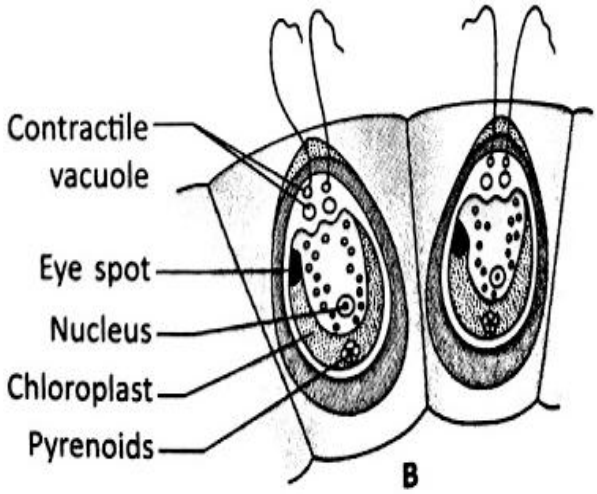
The Volvox is able to move like other cells using flagella similar to the Euglena. However the volvox has many flagella along its outer membrane that keeps all

the green algae on the inside. It manufactures its own food since it has chloroplast. The diagram below shows a volvox.

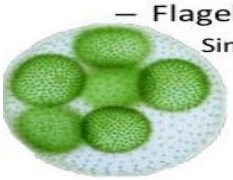


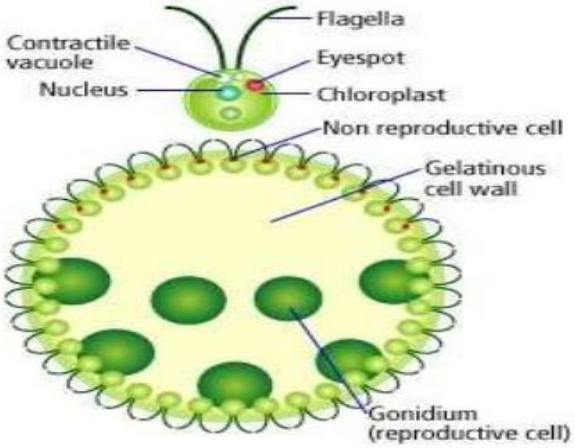

Volvox's produce asexually. They split up NA from one parent cell a daughter cell is divided off from the parent.



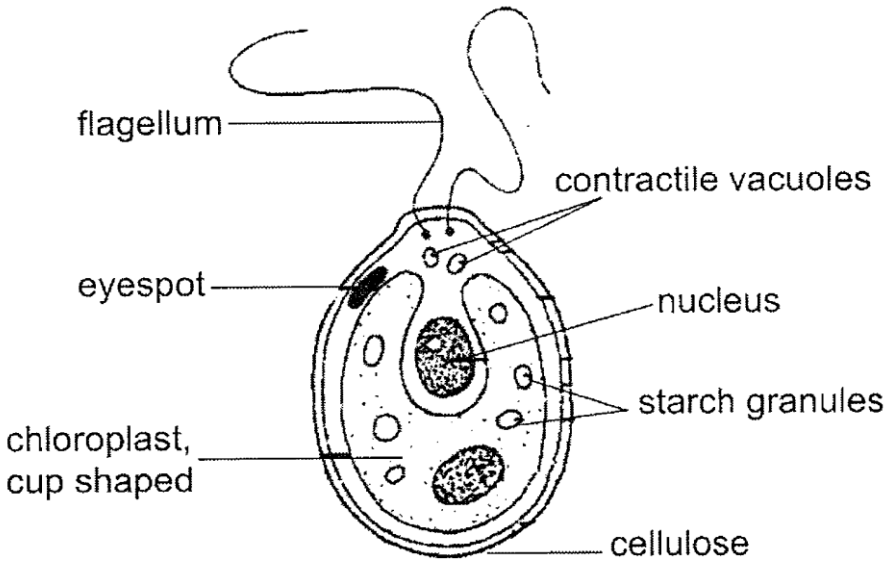

- Structure:
  - Individual cells form colonies (level of organization= multicellular) up to 50,000 cells!!!!- cannot live alone
  - Eyespots that allow them to swim near light
  - Flagellates –locomotion Similar to Euglena





- Volvox produces its own food because it has chloroplasts.
- **Flagellum-** It is used for propelling or movement
- **Stigma (eye spot)-** It allows the volvox to detect lights that it moves towards it to conduct photosynthesis
- **Chloroplast-** It allows the volvox to conduct photosynthesis
- **Contractile vacuole-** It used to expel water into the reservoir

**CHLAMYDOMONAS**




It is a soil-dwelling, unicellular algae but can it can swim.

It practices photosynthesis like a plant due to the presence of chloroplasts but has animal like features.

It is called green yeast.

It has eye spot to study photoreception.

It reproduces sexually by the fusion of male and female gametes.

**Important features of chlamydomonas**

- **Flagellum-** It is used for propelling or movement
- **Stigma (eye spot)-** It allows the Euglena to detect lights that it moves towards it to conduct photosynthesis
- **Chloroplast-** It allows the Euglena to conduct photosynthesis

- **Contractile vacuole-** It used to expel water into the reservoir

**PLANT LIKE FEATURES OF CHLAMYDOMONAS**

a. It has chloroplasts for photosynthesis

b. It has contractile vacuole used to expel water into the reservoir

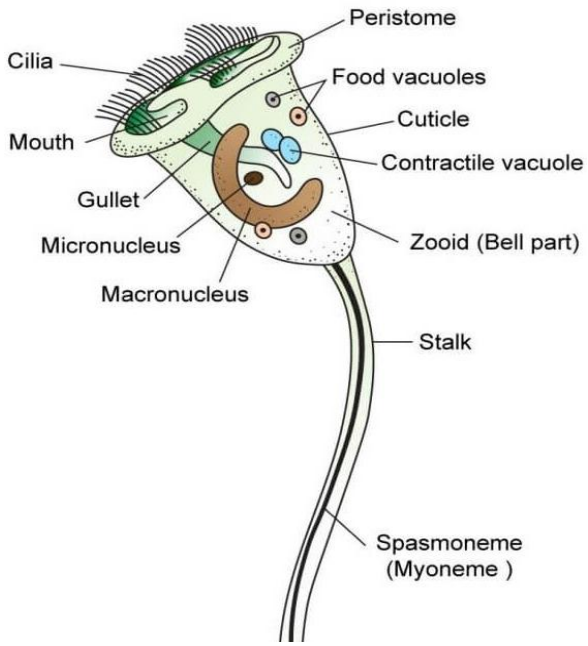
**ANIMAL –LIKE FEATURES**

**a.** It has eye spot to detect lights that it moves towards it to conduct photosynthesis

b. It has flagellum for swimming or movement

**c. Nucleus-** It contains DNA and controls cell activity.

**Vorticella**




**EXPLAIN THE IMPORTANCE OF MICRO-ORGANISMS**

1. Source of food

   Some species of mushrooms are edible.. They are used for relish or soup.

2. Some micro-organisms cause diseases in animals.

3. **Recycling nutrients/decomposition**

   They are involved in the cycling of materials in nature. They decompose dead and animal matter. Some groups of bacteria and fungi break down dead plant and animal matter. They are known to be saprophytes.

Saprophytic bacteria and fungi help to release mineral elements from dead matter for plant use.

4. **Keeping the environment clean**

   When bacteria and fungi decompose the remains of dead plants and animals, it helps to keep the earth's surface clean and free from dead plants and animals..

5. **Increase soil fertility/nitrogen fixation**

   Some bacteria such as rhizobium add soil fertility by fixing nitrogen in the root nodules of legumes and the soil

6. **Treatment of sewage in urban areas**

   Bacteria are used in the treatment of sewage in urban areas. Bacteria are used to break down harmful substances in sewage works

7. **For biotechnology**

   Biotechnology involves the use of living organisms to carry out processes which make substances**.** Some bacteria are used in biotechnology to produce medicine and hormones such as insulin, food, alcohol, antibiotics, fuel etc.

   Antibiotics are drugs which kill or prevent bacteria from growing. Example of antibiotic drugs is penicillin which is manufactured from the fungus penicillin.

- Yeast is used in (**two commercial uses of yeast**)
  a. beer brewing, wind and spirits
  b. Baking bread or bread making

     When sugary or starchy substances are used by yeast they become a source of energy. If the two substances are left standing for a week they go bad just like any other substances in nature.

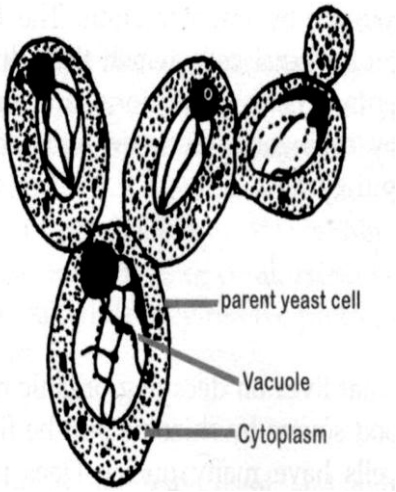
8. Some bacteria live in the colon of some animals where they assist in the manufacture of vitamins B12 and vitamin K that are useful in animals.
9. They are used commercially to produce alcohol. Fungi and bacteria causes' food spoiled and damage to wood in buildings

**EXPERIMENT**

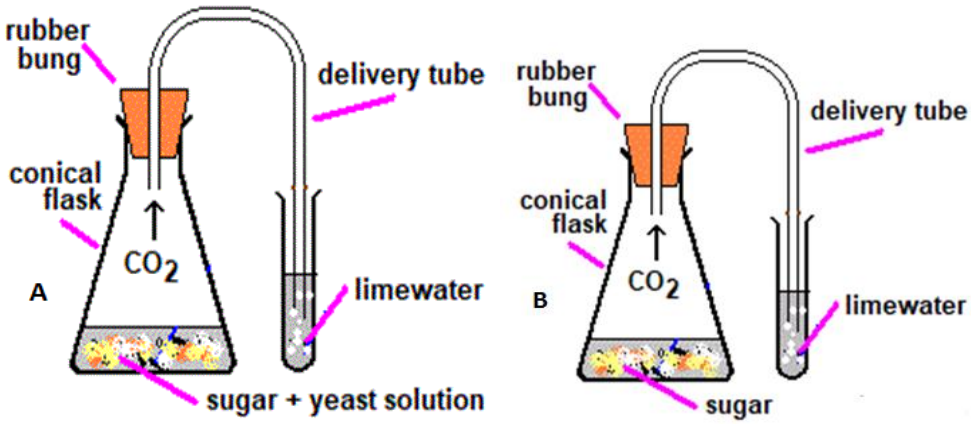
**Aim: To find out the effect of Yeast on Sugar solution**

**Procedures**

1. Put 200cm3 of water in each flask. Add to each about 10g of sugar and stir until the sugar dissolves. Label the flasks A and B.
2. Add about 3g of baker's yeast to flask A. The diagram below shows simple yeast cell

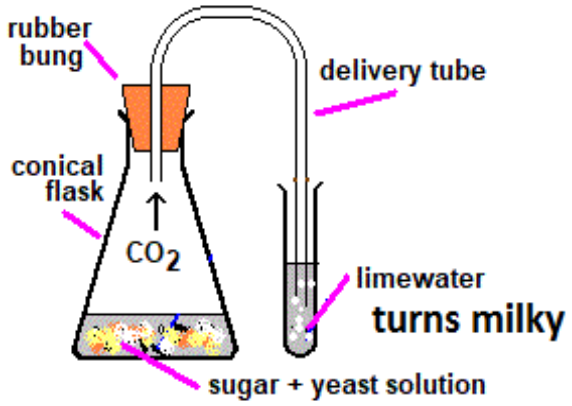



3. Stir until the yeast mixes very well.
4. Figure below shows arrangement of apparatus for experiment on fermentation. The flask would leave for two or three days at room temperature and observe what happens in the flasks and limewater in the test-tubes.
5. After three days, open the flasks and smell the contents. Compare it with the smell of masese or any other beer or alcohol in the laboratory. Take a drop of the contents of flask A and place on a clean slide and examine under the microscope.




**RESULTS**

1. Contents in flask A produces alcoholic smell. This indicates that fermentation was taking place..The process of fermentation takes place when the yeast is changing sugar into alcohol. The yeast uses the sugar for respiration to obtain energy but its kind of respiration differs from ours in that yeast does not use atmospheric oxygen. Hence its respiration is anaerobic respiration.
2. Limewater changes to milky or appears cloudy in flask A. A conclusion can be drawn that carbon dioxide has been produced in the process because its presence changes lime water milky. The carbon dioxide produced gives beer its bulbly appearance.




- Fermentation is the process which takes place when the yeast is changing sugarinto alcohol. The Yeast uses the sugar for respiration to obtain energy.

The carbon dioxide produced in the ine experiment gives beer its bubby appearance.

## BIOTECHNOLOGY

**Explain the role of micro-organism in biotechnology**

- Biotechnology is the use of microbes or life processes to produce materials and products that are useful to mankind.
- Examples of areas where biotechnology is being used today are

1. **Production of insulin hormone by bacteria**. The insulin is used by diabetic - patients to lower their blood sugar.
2. Production of genetically modified organisms**.** These are plants and animals whose genes have been altered to produce certain desired characteristics. For example inserting a gene from bacteria in maize to enable the maize produce toxic substances to kill some pests that attack it.
3. Production of new breeds and types of crops to improve agricultural production.
4. Production of antibiotics. Antibiotics are drugs which kill or prevent bacteria from growing such as penicillin which is manufactured from a fungus called pencillium.
5. Making cheese and yoghurt products- Special bacteria are used with milk and its products to make cheese and yoghurt.
6. Production of biogas from waste materials in the absence of air..Biogas is used for heating, cooking in gas stoves or lighting if the gas is connected to a gas lamp.

## FOOD PRESERVATION

- Food preservation is the process of treating and handling food to stop or slow down food spoilage, loss of quality, maintain edibility or nutritional value and thus allow for longer food storage.

- Food preservation involves preventing the growth of bacteria, fungi such as yeast s and other microorganisms as well retarding the oidation of fats which cause rancidity.

**METHIODS OF FOOD PRESERVATION**

The following are the methods which are used to preserve food

1. **Dehydration and Drying of food substances before storage-** This minimizes moisture which reduces the activity of fungi and bacteria hence no decay can take place. Dehydration involves removal of water from the foods to be preserved**.**
2. **Salting-** Salting involves use of concentrated salt solution which dehydrates the microorganisms. Water is withdrawn from the microorganisms so that their cell activities are stopped and they eventually
3. **Canning and bottling-** This involves keeping food in completely closed cans and bottles. The cans and bottles are closed under carbon dioxide to discourage any growth or any entrance of micro-organisms.
4. **Freezing and refrigeration-** This involves storing the food in extremely low temperatures usually $4^{o}c$ and below. At such temperatures micro-organisms become inactive. In other words, refrigeration involves keeping the temperature low of zero degree Celsius which slows down the microbial growth and activities and also inactivates enzymes.
5. **Boiling-** High temperatures kill micro-organisms in the food. It destroys their pores.
6. **Sterilization and disinfection-** This involves applying chemicals on surfaces to kill micro-organisms. This is done on surfaces where food materials are prepared or stored.
7. **Wood treatment and seasoning-** This involves drying the wood to ensure that it is not easily attacked by fungi. Wood treatment involves infusion of chemicals into a wood to prevent rotting due to fungal attack.

8. **Pasteurization-** This is mainly done for milk where milk is heated to a specific temperature for a short period of time and then it is rapidly cooled.
9. **Adding preservatives-** Lactic acid is used to stop the growth of organisms that cannot withstand acidic environments. Sodium benzoate or benzoate acid or sulphur dioxide are used to preserve fruits, vegetables and fruit juices in order to suppress the growth of bacteria and fungi.

**VARIOUS WAYS OF CONTROLLING MICRO-ORGANISMS.**

1. **Drying of food substances before storage-** This minimises moisture which reduces the activity of fungi and bacteria hence no decay can take place.
2. **Salting-** Salt is applied on food item. Salt causes water to leave the tissues of the micro-organisms and as a result the microorganisms become dehydrated**.**
3. **Canning and bottling-** This involves keeping food in completely closed cans and bottles. The cans and bottles are closed under carbon dioxide to discourage any growth or any entrance of micro-organisms.
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7. **Wood treatment and seasoning-** This involves drying the wood to ensure that it is not easily attacked by fungi. Wood treatment involves infusion of chemicals into a wood to prevent rotting due to fungal attack.
8. **Pasteurisation -** This is mainly done for milk where milk is heated to a specific temperature for a short period of time and then it is rapidly cooled.

9. **Adding preservatives-** Lactic acid is used to stop the growth of organisms that cannot withstand acidic environments. Sodium benzoate or benzoate acid or sulphur dioxide are used to preserve fruits, vegetables and fruit juices in order to suppress the growth of bacteria and fungi.