CHAPTER ONE- RESEARCH SKILLS

WHAT ARE THE SAFETY MEASURES DURING HEATING?

a. Always hold a test-tube or a boiling tube using a holder when heating
b. Do not dip hot tubes in water
c. Always turn off the gas taps after conducting an experiment.
d. Putting off other burners, like stoves after an experiment.

RISK FACTORS IN SCIENCE LABORATORY

a. Burns as students use Bunsen burners, candles, paraffin lamps to burn during investigations
b. Poisoning as a result of conduct with poisonous chemicals may be used in the laboratory to carry out experiments.

SOME OF THE LABORATORY RULES

a. Do not enter the laboratory without permission of the teacher or laboratory technician
b. Do not run or rush into and within the laboratory
c. Avoid unnecessary movement while in the laboratory
d. Do not carry out any activity in the laboratory before getting permission from your teacher or laboratory technician
e. Do not eat while in the laboratory
f. Do not tamper with electricity or gas fittings in the laboratory
g. Do not interfere with the experiments of other students etc.

APPARATUS

Apparatus refers to the set of equipment used for particular activity or purpose in the laboratory.

Laboratory apparatus can be put into various categories as follows

a. Measuring apparatus.
b. Heating apparatus
c. Other apparatus**.**

In chemistry, different apparatus are used to measure volume, mass, temperature and time.

LABORATORY APPARATUS AND THEIR USES

APPARATUS/EQUIPMENT	**USES**
Hands lens	to make objects look bigger or to magnify the objects
Test tubes	For heating substances or holding liquids during reactions.
Ignition tubes	For heating small substances and for other experiments
Boiling tubes	for heating and carrying out experiments
Test tube holders	For holding test tubes during experiment
Test tube rack	For keeping the test tube safely
conical flask	Diluting and storing solutions
Measuring cylinder	Measuring volume
Beaker	Holding and boiling liquids
Petri dish	Holding materials
Dropper	For measuring and pouring solutions drop by drop
clamp and clamp stand	For clamping and holding other apparatus.
Spring balance	Weighing mass
Thermometer	Measuring temperature
Microscope	viewing and magnifying tiny specimen that cannot be seen easily
Hand lens	Magnifying relative small specimen
Goggles	Protecting the eyes against chemical spillages and fumes.
stop watch	Measuring time
Ruler	Measuring length

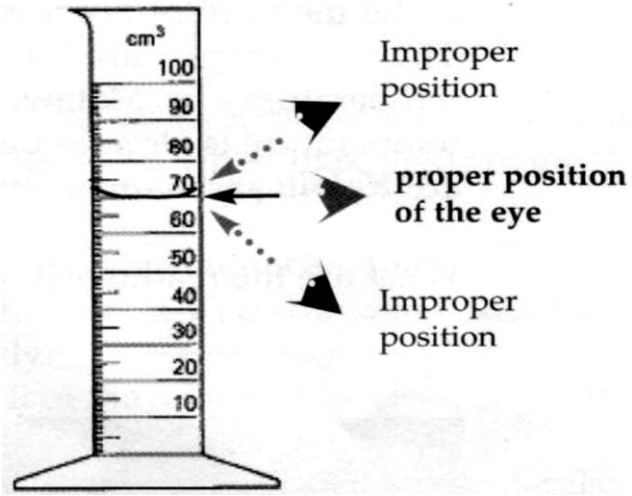
scalpel	cutting and dissecting species

MEASUREMENT OF VOLUME

- Volume is defined as the amount of space occupied by an object.It is measured in cubic millimeters, cubic centimeters, cubic meters and in litres.
- The international system of units**(Si**) for volume is cubic meters(m^3).

EXPLAIN HOW TO MEASURE THE VOLUME OF WATER

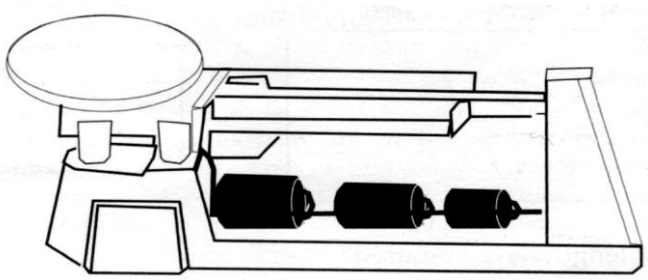
- In Biology laboratory, the following is an example of measuring the volume of water directly in millimeters using a graduated cylinder to measure 70ml. To do this, fill the graduated cylinder to the mark of 70 m^3. To do this properly, you have to make sure that the lowst margin of the water level or the meniscus is at 70 m^3 mark as shown in the figure below.



- Then ask your friend to read the volume and find out if you agree with him or her.

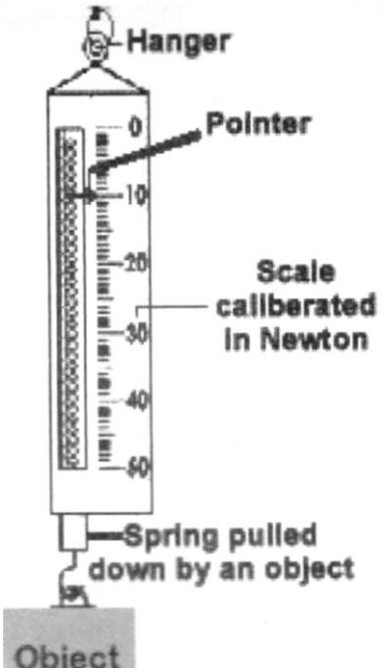
MEASUREMENT OF MASS

- Mass refers to the quantity of mater.
- The SI unit of mass is kilograms(kg).
- Other units of measuring mass include milligrams(mg)grams(g), tonnes(t)
- The instruments that are used for measuring mass are spring and tripple beam balances.
- The figure below shows Tripple beam balance



MEASUREMENT OF FORCE

- Force is a push or a pull.
- The Si unit of force is Newtons(N)
- It is measured using a spring balance.
- The figure below shows a spring balance.



MAKING BIOLOGICAL DRAWINGS

Outline the characteristics of a good biological drawing.

- Use a sharp pencil, not a pen.
- Look carefully at the specimen and identify its main characteristics.
- Sketch an outlie a little to show how big the drawing is.
- Do not shade the biological drawingss.

- Do not use coloured pencils or crayons.
- Use a ruler and a pencil to draw label lines, to the right or left, or both, whichever is the neatest. Labelled lines should not have arrows.
- Write the labels at the ends of label lines.
- Use pencil for the ends of labels in case you make any mistake.
- Give a title to your drawing.
- Work out the magnification of your drawing by using the following formula.

Magnification = $\frac{Length\ of\ drawing}{Length\ of\ object/specimen}$

For example, if the drawing length is 80mm long and the specimen is 40mm long, the magnification of the drawing is calculated as follows**:**

Magnification = $\frac{Length\ of\ drawing}{Length\ of\ object/specimen}$

= $\frac{80mm}{40mm}$

= x 2

The **multiplication sign** indicates how much the specimen has been enlarged or reduced in the drawing.

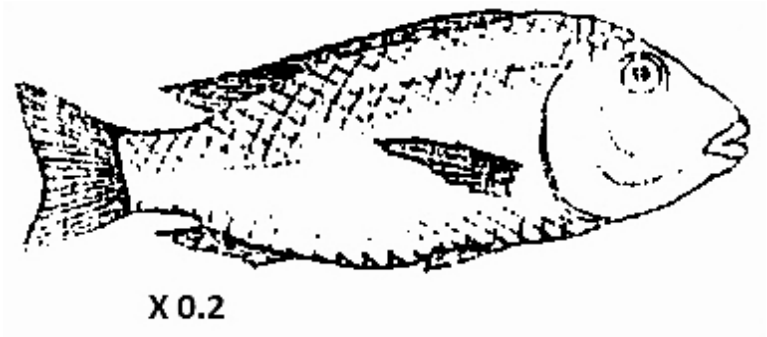
HOW TO CALCULATE THE MAGNIFICATION OF A BIOLOGICAL DRAWING

The magnification of the biological drawing culd be calculated from the length of a specimen by divinding the length of the drawing by the actual length of the specimen.

Magnification = $\frac{Length\ of\ drawing}{Length\ of\ actual\ specimen}$

EXAMPLE

Figure below is a diagram of a fish . Use it to answer the questions that follow.



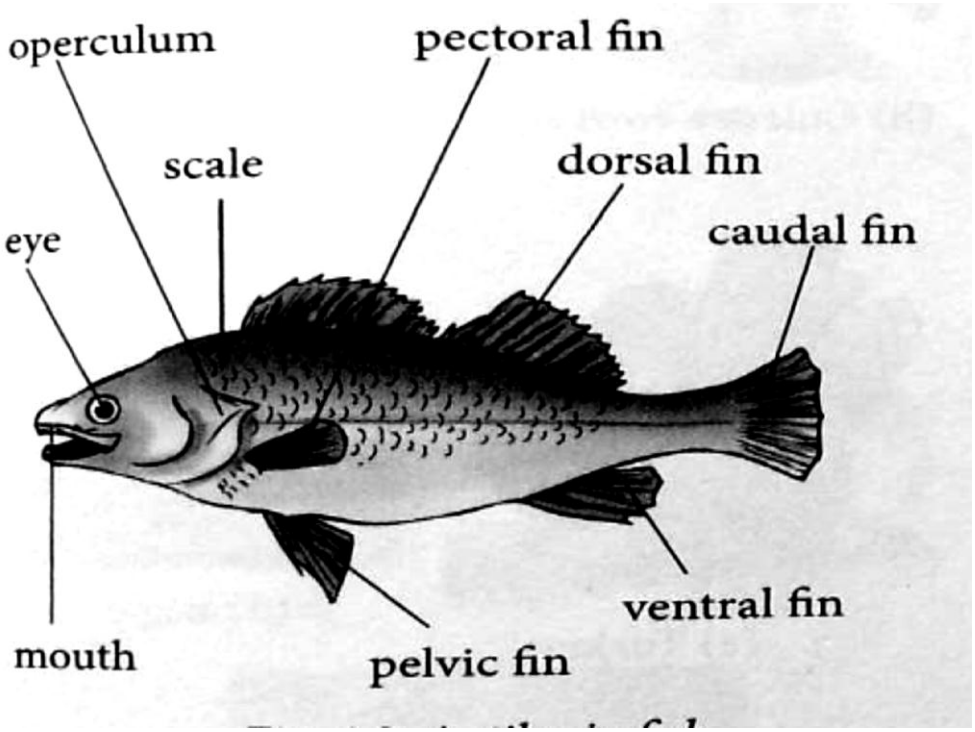
Calculate the actual length of the fish. Show your workings.

Length of specimen = $\frac{Length\ of\ drawing}{Magnification}$

= $\frac{7cm}{0.2}$

= 35cm

PARTS AND FUNCTIONS OF THE FISH



The structure that is used for locomotion in fish is the fins

The fish has the following fins

1. **Paired fins (pectoral fins and pelvic fins)**

Paired fins are used for

a. Changing direction
b. Allowing fish to move up and down (pitching)
c. Acting as brakes or enable the fish to stop.
d. Helping the fish to prevent unnecessary pitching caused by water current

2. **Unpaired fins (dorsal fin and ventral fin)**

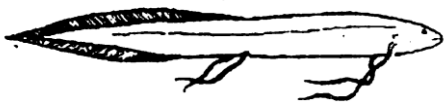
Unpaired fins are used for preventing yawning of the fish. Yawning is the tendency of the fish to move side by side as the fish swims.

ADAPTATIONS OF FISH FOR LOCOMOTION

It is adapted for locomotion because of the following structures

1. Fish has streamlined shape which reduces force of drag as its forward in water.
2. The scales overlap facing backwards. They help the fish to reduce drag in water as it moves forwards.
3. They have paired fins which act as elevators and brakes to fish as it moves in water.
4. They have unpaired fins, that is, dorsal fin and ventral fins, which control pitching of fish in water.
5. They have caudal fin which helps to propel the fish forward.
6. They have swim bladder which control buoyancy of fish in water. The swim bladder controls buoyancy (able to float and sink) and depth at which the fish swims in water. The swim bladder contains air. When it is full of air, the fish swims upwards and float while it is empty of air, the fish sinks into water.

Figure below is a diagram of an African lung fish with its magnification. Use it to answer the questions that follow.



African lung fish x 0.1

a. Calculate the actual length of the of the lung fish from which the diagram was drawn.
b. What would the magnification be it the diagram was the same size as the actual specimen?

MICROSCOPE

The function of the microscoipe is to enlarge the specimen.

TYPES OF MICROSCOPE

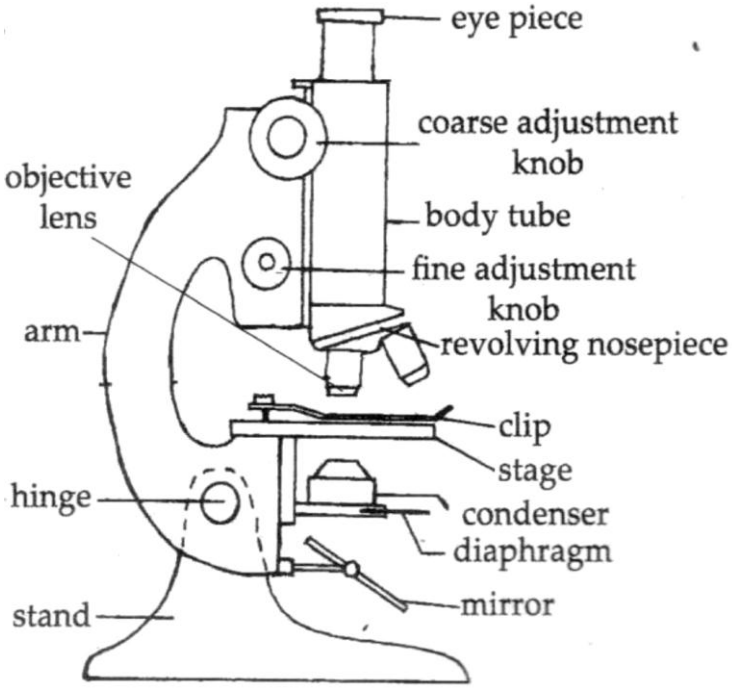
The two types of microscope are

a. Simple microscope

b. Compound microscope

PARTS OF THE MICROSCOPE AND THEIR FUNCTIONNS

The figure below shows the microscope and its related parts

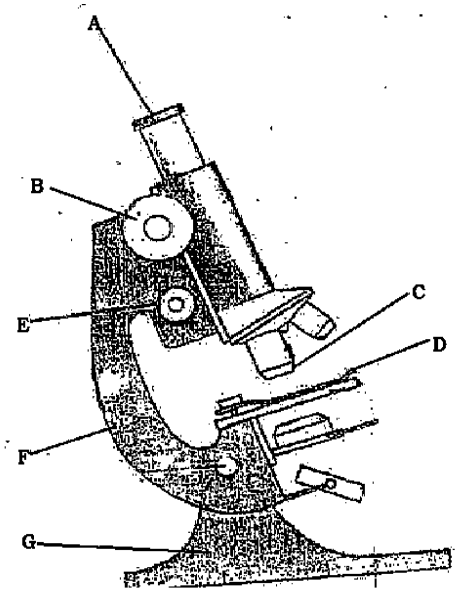


The following are the functions of the different parts of the microscope

Eye piece	It enlarges the specimen being viewed or magnifies the objects It is used to examine or view a specimen
Body tube	It pemits up and down movement of objective lens It attaches the eye piece to the objective lens
Nose piece	It allows the viewer to select objective lens to be in use It fits different objective lenses
Objective lens	They enlsrge the specimen
Stage	It is wherethe slide is placed or held
Stage clips	They are metal clips that hold the slide in place of focus.
Irish diaphragm	It controls the amount of light on the specimen

Condenser	It gathers and concentrates light from source of mirror onto the specimen.
Lamp illuminator.	It is a light source for a microscope.
Coarse adjustment knob	It is used in lowering or raising the body tube.
Fine adjustment knob	Fine tunes the specimen or object focus and increase the detail of specimen.
Arm	It connects the body tube to the base of the microscope. It is used to carry the microscope.
Base	It is used to support the microscope. It is where the lamp illuminator is located.

Figure below is a diagram of a microscope. Use it to answer the questions that follow.



Name the parts marked A,B,C,D,E,F and G.

A	Eye piece
B	Coarse ajustment knob
C	Objective lens

D	Clip
E	Fine adjustment knob
F	Arm
G	Stand

State the functions of the parts A,B,C,D,E,F and G.

Eye piece	It enlarges the specimen being viewed or magnifies the objects. It is also used to examine or view a specimen
Objective lens	They enlsrge the specimen
Stage clips	They are metal clips that hold the slide in place of focus.
Coarse adjustment knob	It is used in lowering or raising the body tube.
Fine adjustment knob	Fine tunes the specimen or object focus and increase the detail of specimen.
Arm	It connects the body tube to the base of the microscope. It is used to carry the microscope.

EXPLAIN HOW WOULD YOU CARRY THE MICROSCOPE TO ENSURE ITS SAFETY

To carry a microscope, use one hand to hold it horizontally by the metal arm. Or use both hands, one hand to hold it vertically by the metal arm and the other hand for extra support under the base.

WAYS OF HANDLING THE MICROSCOPE

1. To carry a microscope, use one hand to hold it horizontally by the metal arm. Or use both hands, one hand to hold it vertically by the metal arm and the other hand for extra support under the base.
2. Place the microscope on the surface of a cleared lab bench or a clean desk.

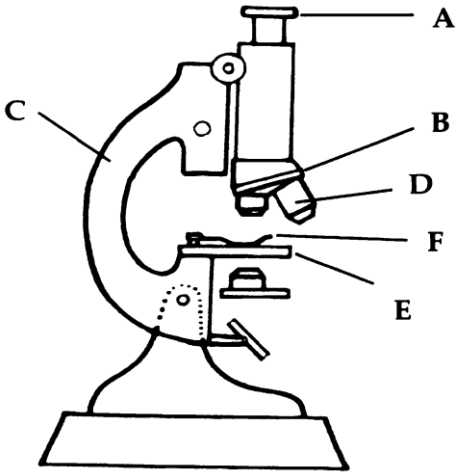
3. Keep the microscope in upright position when it is not in use and when using liquids.
4. Start by focusing the low-power objective lens. Observe the microscope from the side as you use the coarse adjustment knobs.
5. When you focus, look through the eyepiece and slowly turn the coarse adjustment knobs so that the lens move upward from the stage.
6. When you finish using the microscope, remove the glassslide, place both stage clips so that they point forward, and place the low-power lens below the eyepiece.
7. Cover your microscope when it is not in use.

What is Wet Mount?

It is a glass slide prepared for viewing, using water and a square plastic cover slip.

REVIEW QUESTION

Figure below is a diagram of a microscope. Use it to answer questions that follow.



a. Name the parts marked A,B and C.

b. Explain the functions of the parts labeled D, E,F and G.

GIDELINES FOLLOWED WHEN MAKING ACCURATE BIOLOGICAL DRAWINGS OF PLANTS AND NIMALS

1. Make large drawings and leave enough space around them for headings and labels.
2. Label in pencil and keeps the words in horizontal.
3. Never cross label lines
4. Dawings should be clear with firm lines and simple outlines.
5. Do do not draw a structure before you have identified it.
6. Never put aside a drawimng to be finished later.
7. Identify each structure of the specimen and include it in the drawing.
8. Use a suitable referencve book to identify each structure of the specimen.
9. Drawing using a sharp pencil.

CHAPTER 2:ENVIRONMENT-LIVING THINGS

BIOLOGY

Biology is the science that involves the study of living things.

CHARACTERISTICS OF LIVING THINGS IN THEIR HABITAT

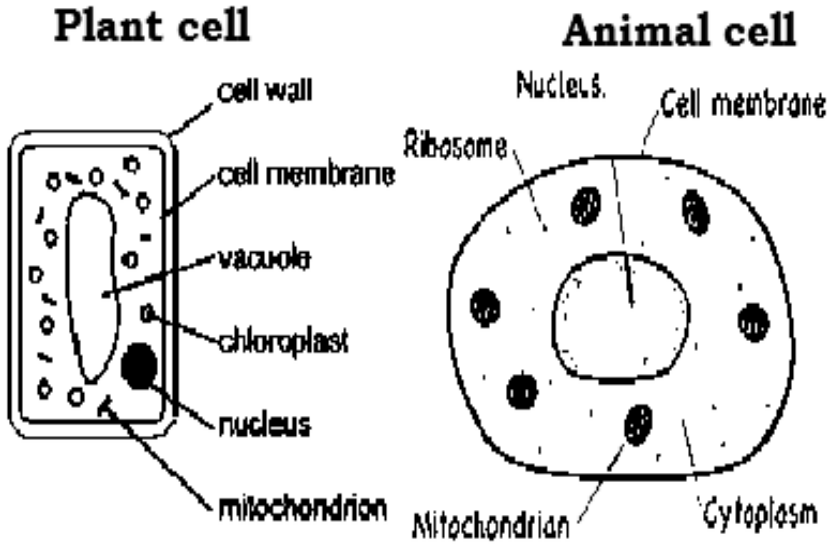
The following are the characteristics of living things (living organism**)**

1. **Reproduction -** All organism reproduces in order to continue to exist
2. **Irritability -** Irritability/sensitivity is the ability to respond to changes in the environment which living things must do in order to survive.
3. **Nutrition/Feeding -** All organisms produce or take in food. Some organisms are able to make their own food
4. **Growth-** The ability of living things to increase in the size.
5. **Movement-**All organisms have the ability to move from one place to another.
6. **Respiration -** The process by which energy is released from food in the body of an organism
7. **Excretion –** All organisms excrete. Excretion is the removal of toxic materials, the waste products of metabolism/cell activities and substance in excess.

   These characteristics of living things can be abbreviated as **RING-MR- E**

PLANT AND ANIMAL CELLS

- The cell is the basic and structural unit of all organisms.
- The cell is the smallest unit of life and is often the building block of life.
- The major components of cells include cell wall, cell membrane, chloroplasts, mitochondria, vacuole, cytoplasm and nucleus as shown in the figure below of the plant and animal cells.



The following are the parts of the plant cell with their associated functions:

1. **Cell wall (made up of cellulose)**

   The function of the cell wall to plant cell is that it gives a cell a fixed shape.

2. **Chloroplasts**

   The functiuoin of the chloroplast is it is the site of photosynthesis process. It contains a green pigment known as chlorophyll which absorbs sunlight energy necessary for photosynthesis process. Therefore, it manufactures glucose by the photosynthesis process.

3. **Cytoplasm**

   The following are the two functions of the cytoplasm in the plant cell:

   - It stores food substances such as glycogen and starch that is produced nin the chloroplasts.
   - It is a medium for reactions in the cell

4. **Cell memranes**

The following are the functions of the cell membranes:

- It encloses or holds the content of the cell.
- It regulates the movement of the materials in and out.

5. Nucleus

The following are the functions of nucleusin the plant cell**:**

- It controls cell activities.
- It stores genetic material of the cell.

6. Vacuoles

The function of the vacuole is that it stores food substances in the cell

NB: It contains a fluid known as cell sap that consists of water, mineral salts, sugars and amino acids, which the cell needs to keep the cell firm or turgid.

It has enzymes which speed up the rate of respiration.

7. Mitochondria

It is a site for respiration process. It is adapted for this function because it is highly flooded to provide large surface area for chemical reaction.

DIFFERENCES BETWEEN PLANT CELL AND ANIMAL CELL

Plant cell	**Animal cell**
Has chloroplast	Does not have chloroplasts
Has vacuole	Does not have vacuole
Has cell wall	Does not have cell wall

SIMILARITIES BETWEEN A PLANT CELL AND ANIMAL CELL

The following are the structures which are common to both plant cell and animal cell

a. Cytoplasm
b. Nucleus
c. Cell membrane
d. mitochondria

CLASSIFICATION

Classification is defined as the process of groping organisms based on their differences and similarities in feeding methods or habitats.

IMPORTANCE OF CLASSIFICATION

1. When living things are divided into smaller groups whose members have common characteristics, it becomes easier to study them
2. It makes easier to identify the relationship between groups of organisms.
3. It helps to organise all types of organisms in order to make it easier to find information about them.
4. It helps to provide coherent and universal system of grouping organisms.

WAYS OF GROUPING LIVING ORGANISMS

Livingthings can be grouped in the the following:

a. According to their similarities and differences
b. According to their habitats
c. According to their feeding methpoods.

IDENTIFICATION OF LIVING THINGS

Living things can be identified by

a. Dichotomous key
b. Scientific names
c. hierarchy

DICTOCHOMUS KEY

- A dichotomous key is a method of identification whereby groups of organisms are divided into categories repeatedly. With each sequential division, more information is revealed about the specific features.
- A dichotomous key is used to identify organisms or parts of organisms by using the process of elimination.
- The dictomous key is arranged in steps or stages. At each stage, there is a pair of statements which describe the organism or part of the organism.
- It uses characteristics of the organism that do not change.

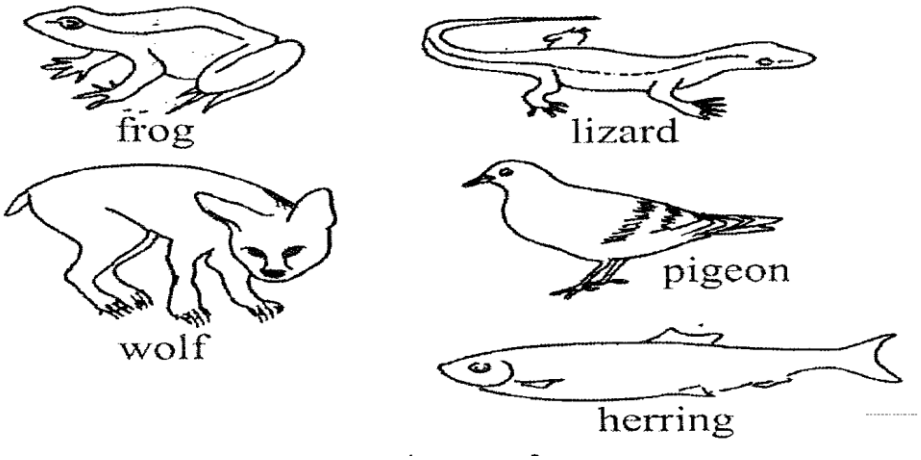
- Each pair of statements in the key divides the organisms or parts of the organisms into two groups.

The two types of dichotomous key are

a. **Spider key/tree key** – it is in the form of a flow diagram

b. **Numbered key**- A numbered key is preferred as it does not take much space

- Dichotomous key always gives two choices in each step.
- Figure below shows diagrams of five animals. Use it to answer the questions that,

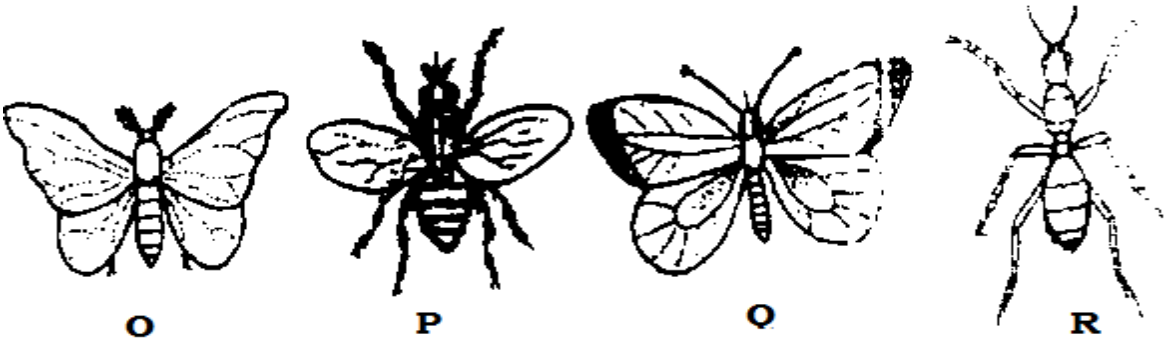


Use the organism, construct the dichotomous key using the organisms.

5. Animals with legs ……See 2
   Animals without legs ……herring.
6. Animals with wings……..pigeon
   Animals without wings…….see 3
7. Animal with a long tail ……..Lizard
   Animals without a tail . …….See 4
8. Animal with webbed fee ……Frog
   Animal without webbed feed……Wolf.

Using the diagram above, construct the dichotomous key that can be used to identify the animals.

Figure below is a diagram of different types of insects. Use it to answer the questions that follow.



Use the following biological key to identify the insects.

1. Has wings……see 2
   Has no wings……..Formica
2. Has one pair of wings……Musca
   Has two pairs of wings……See 3
3. Has club antennae……Papilio
   Has feathery antennae……...Bombyx

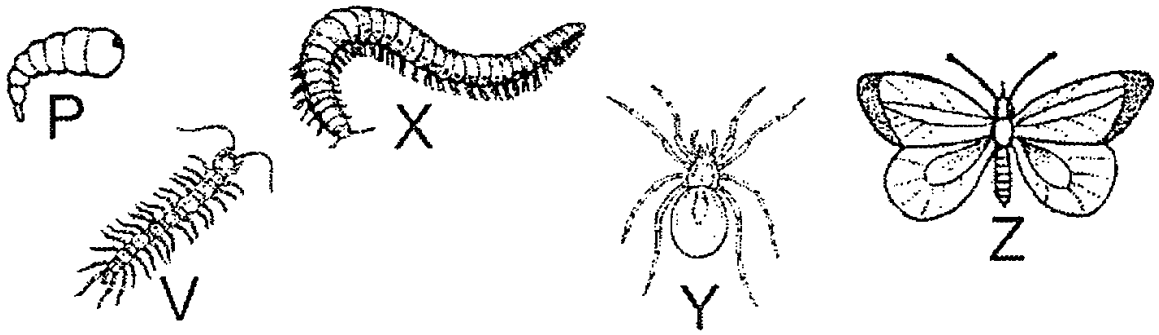
   0.....Bombyx

   P…….Musca

   Q…….Papilio

   R…….Formica.

   Figure below shows five invertebrates and a dichotomous key. Use it to answer the questions that follow.



1. Wings absent……See 2.
   Wings present……Butterfly
2. Legs present……..See 3

Legs absent……Larvae

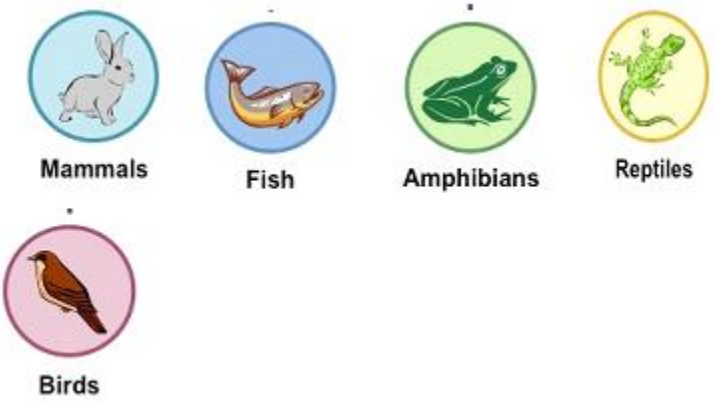
3. More than 8 legs……..See 4

   Eight legs present……Tick

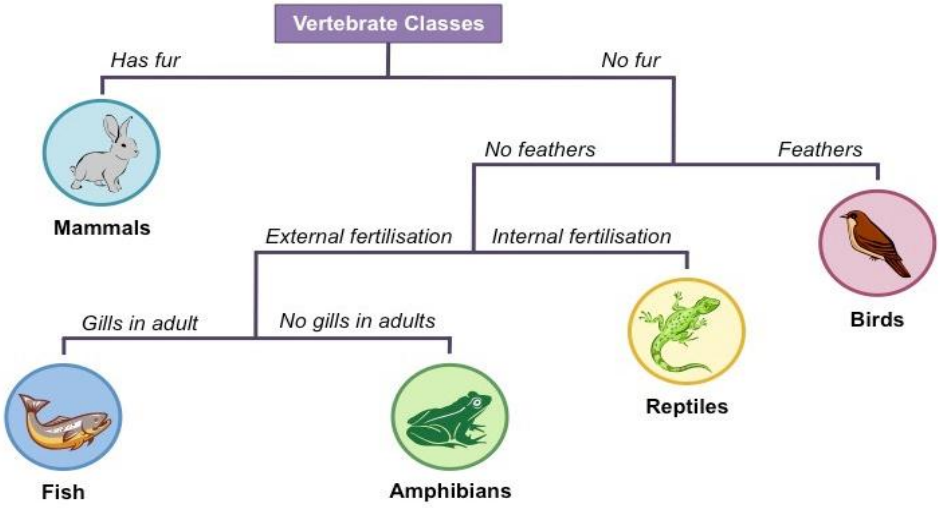
4. Long antennae ……Centipede

   Short antennae……Millipede

a. Identify the vertebrates P,V,X, Yand Z.
b. What two features are common to organisms in X and V?
c. Which of the organisms is still in the develomernt stage?
d. Which of the organisms can tranbsmitt diseases to termed animals?
e. Construct the dichotomous key using the following vertebrates



DICTOMOUS KEY USING TREE DIAGRAM



BIOLOGICAL HIERARCHY-SORTING ORGANISMS INTO DIFFERENT HIERARCHY

Biological hierarchy is another system used to classify and identify organisms. It was also developed by Carolus Linnaeus.

In this system, species are ordered in broad categories. The groups into which organisms are put are called Taxa (Singular Taxon)

The are seven major classification groups or taxa used by Biologists which are

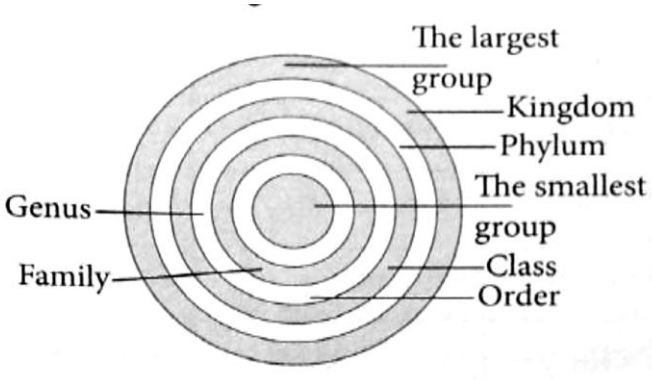
1. **Kigdom**

   Organisms are firstly split into kingdoms such as the plant and animal kingdoms.

   Each kingdom is broken down into a large number of small groups called phyla (syngula phylum)
2. **Phylum-** The phylum is split into classes.
3. **Class-** Classes are split into orders.
4. **Order-** Orders are split into families
5. **Family-** Families are split into genera (singular: genus)
6. Genus

   Genera are split into species.
7. Species

These seven major classification groups or taxa used by Biologists are shown in the diagram below.



- The largest taxonomic unit is the **kingdom.**

- The kingdom contains the highest number of organisms. Each kingdom is divided into smaller groups called **Phyla(Singular Phylum).**
- In plants, **division** is used instead of **phylum**. Each Phylum or division is divided into **classes**.
- Within each class are **orders**.
- Orders are divided into **families.**
- A family consists of of many related genera (singular genus)
- A genus is usually divided into more than one **species.**
- The species is the smallest taxonomic unit.

GENUS AND SPECIES

- **Genus** is a group of similar organism made up of one or more species.
- **Species** is a group of organisms that can freely interbreed and produce fertile offspring. The organisms in a species are similar in characteristics. Each species contains the fewer number of organisms.

The table below shows the clasification of some members of Kingdom Plantae according to taxonomic hierarchy

Rank	**Maize**	**Bean**	**Arabic coffee**	**Sisal**
Kingdom	Plantae	Plantae	Plantae	Protoctista
Division	Spermatophyta	Spermatophyta	Spermatophyta e	Spermatophytae
Class	Anglospermae	Anglospermae	Anglospermae	Anglospermae
Order	Monocotyledona e	Dicotyledonae	Rubiaceae	Monocotyledon ae
Family	Graminales	Leguminosae	Coffea	Asparagaceae
Genus	Zea	Phaseolus	Arabica	Agare
Species	Mays	Vulgaris	Arabica	Sisalana
Scientific name	Zea mays	Phaseolus vulgaris	Coffea arabica	Agare sisalana

The table below shows the clasification of some members of Kingdom Animalia according to taxonomic hierarchy

Rank	**Human**	**Leopard**	**Gazelle**	**Housefly**
Kingdom	Animalia	Animalia	Animalia	Aimalia
Phylum	Chordata	Chordata	Chordata	Arthropoda
Class	Mammalia	Mammalia	Mammalia	Insecta
Order	Primates	Carnovore	Artiodactyla	Diptera
Family	Hominidae	Felidae	Bovidae	Muscidae
Genus	Homo	Panthera	Gazella	Musca
Species	Sapiens	Pardus	Grantii	Domestica
Scientific name	Homo sapiens	Panthera pardus	Gazella grantii	Musca domestica

BINOMIAL SYSTEM

USING SCIENTIFIC NAMES TO IDENTIFY ORGANISMS (BINOMIAL SYSTEM)

- Binomial nomenclature refers to naming of organisms, that is, the study of classification.
- Binomial nomenclature is a system where an organism is given two scientific names. The two names represent the **genus** and the **species** of the organism. For example, the scientific name of maize is **Zea mays**. **Zea** stands for a **genus** while **may**s stands for **species**
- Therefore, the scientific name of each organism has always two parts. The first part is the name of its **genus** while the second part is the name of its **species.**
- Binomial nomenclature was devised by a Swedish scientist called **Carolus Linnaeus** who lived in the 18th Century.
- It is conventional in that it is accepted and used by all scientists all over the world irrespective of the language they use in their scientific studies.

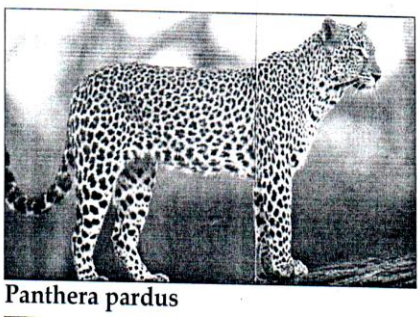
RULES OF NOMENCLATURE

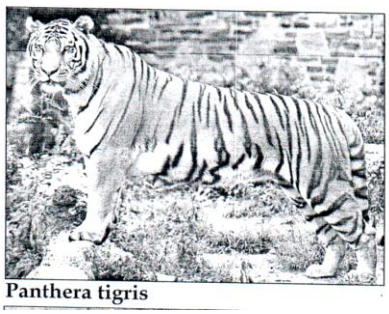
1. The generic name is written first followed first by the Sientific name.

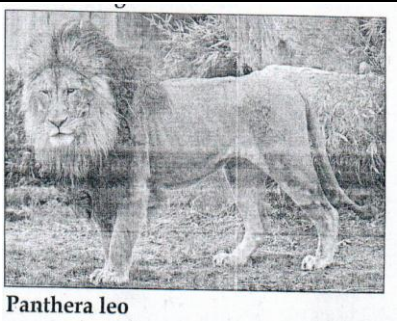
2. The generic name always start with capital letter. The specific name is written in small letters only.
3. The two names should be underlined separately. If typed, they should be typed in italics to make them look different from other words in the paragraph.

EXAMPLES OF SCIENTIFIC NAMES OF SOME ORGANISMS

Scientific name	**Common name**
• *Homo sapien*	Human
• *Pathera leo*	Lion
• *Felis catus*	House cat
• *Schislocerca americana*	Grasshopper
• *Ipomea batatas*	Sweet potato
• *Musca domestica*	Housefly
• *Bos indicus*	cattle
• *Bidens pilosa*	Black jack
• *Mangifera indica*	Mango
• *Pathera pardus*	Tiger
• *Rana anglensis*	Frog
• *Bufo regularis*	Toad


Panthera pardus


Panthera tigris


Panthera leo

- A group of living things may belong to the same genus but different species because they have certain characteristics which are common to all.
- For, the Lion **(Panthera leo)**, the Leopard **(Panthera pardus)** and the Tiger **(Panthera tigris)** all belong to the same species but different species.

- These animals may sometimes mate with each but they do not produce fertile offspring. For example, lions sometimes mate with tigers and produce offspring which are a mixture of a lion and a tiger called **ligers.** The ligers cannot produce offspring.
- For an animal to produce a fertile offspring, it must mate with an animal of the same species. For example **Feliscatus** (cats) must mate with a **Felicatus, Panthera leo** must mate with **Panthera leo**.

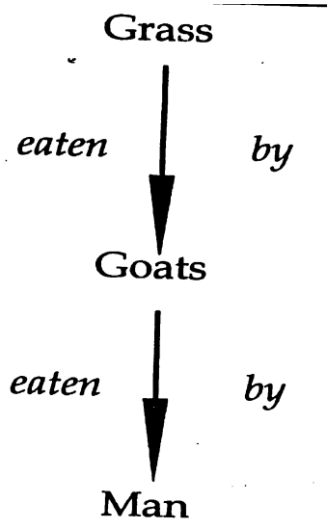
FOOD CHAIN

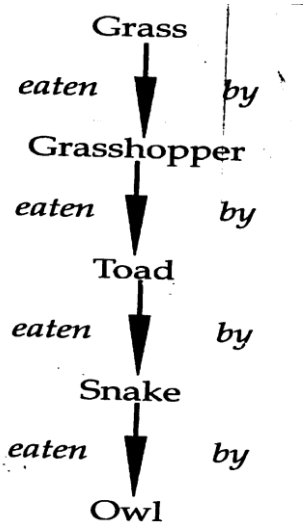
A food chain is defined as

- A sequence showing a feeding relationship between producers and consumers.
- A representation of a feeding relationship between organisms in an ecosystem.
- A flow of energy from a green plant (producer) to an animal (consumer) and to another animal (another consumer) and so on.

ARROWS IN THE FOOD CHAIN

- The arrows in the food chain show the direction of energy flow and they also mean "eaten by". This is demonstrated in the diagram below



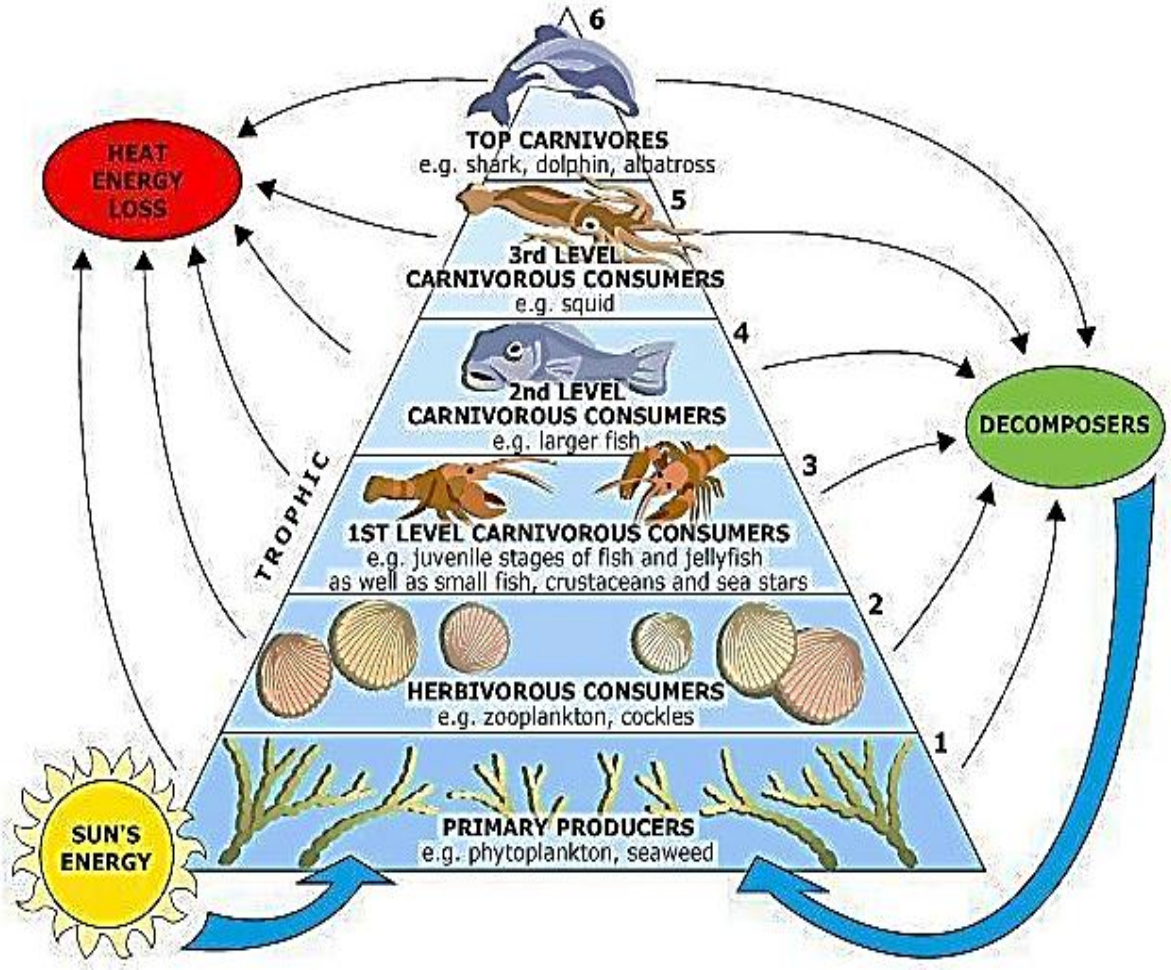


WHAT HAPPENS TO THE NUMBER AND SIZE OF ORGANISMS AS YOU MOVE ALONG FOOD CHAIN?

When constructing a food chain, always start with the producers, the green plants, followed by consumers. When studying the food chain it is important to note that the number of organisms, decreases as you move along the food chain from the producers to secondary order consumers, from secondary consumers to third order consumers and from the thirst order consumers to forth order consumers. However, the size organisms from producers to final consumers increase.

TROPHIC LEVELS/FEEDING LEVELS

- A trophic level of an organism is the position that it occupies in a food web in an ecosystem.
- Food chains usually start with a producer or a green plant: This is the link where energy from the sun enters the food chain.



PRIMARY PRODUCERS IN THE FOOD CHAIN

- A green plant should always be the first link of a food chain.
- Green plants are the only organisms that can directly get the sun's energy and make their own food through a process called **photosynthesis**.
- These are green plants are called primary producers because they are able to make their food by combining carbon dioxide and water in the presence of sunlight energy.
- Green plants are Autotrophs because are able to produce their own food by combining carbon dioxide and water in the presence of sunlight energy

CONSUMERS

- These are animals that are not able to make their food but depend on already made organic compounds.
- They are described as **Heterotrophs** since they are animals that are not able to make their food but depend on already made organic compounds.

CLASSIFICATION OF CONSUMERS

a. **Herbivores**

These are consumers that feed directly on producers/plants.

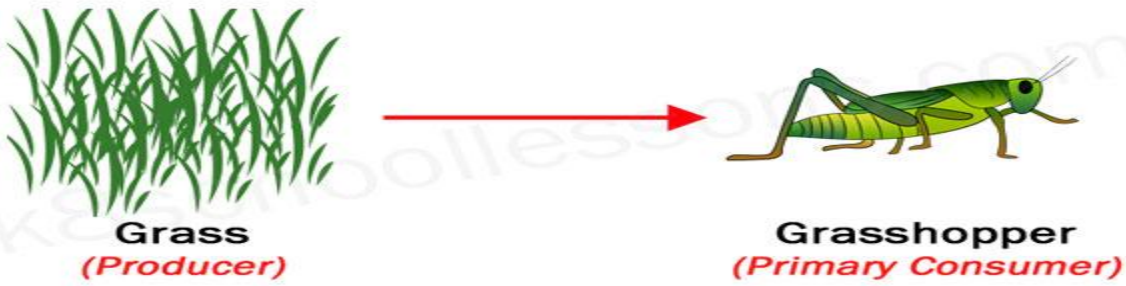
Examples include goats, cattle, grasshoppers, zebra etc.

b. **Carnivores**

These are consumers/animals that feed on fresh of other animals and examples include lion, leopard, toad, praying mantis, snakes, hawks and owls.

c. **Omnivores-** These are consumers/animals that eat both producers (plants) and fresh of other animals. Examples include human beings, pigs, chicken and cockroaches.

EXAMPLE OF A FOOD CHAIN WITH ONE LINK



Grass is a good example of producers

WHAT ARE TOP PREDATORS?

Carnivores are also known as the ***top predators*** as they are at the highest point of the food chain. Top predators have a little or no enemies. They usually consume all lower levels and are not consumed by any other animals until they die. Lions, tigers, crocodiles, eagles are the best examples of top predators.

Eagle is a best example of a top predator

Lion is a best example of a top predator

is a best example of a to predator

WHAT IS A PREY IN A FOOD CHAIN?

Prey is an animal that a predator feeds on. For example, a lion feeds on a zebra. So, the zebra is the prey of the lion.

EXAMPLE OF A GOOD PREDATOR AND ITS PREY

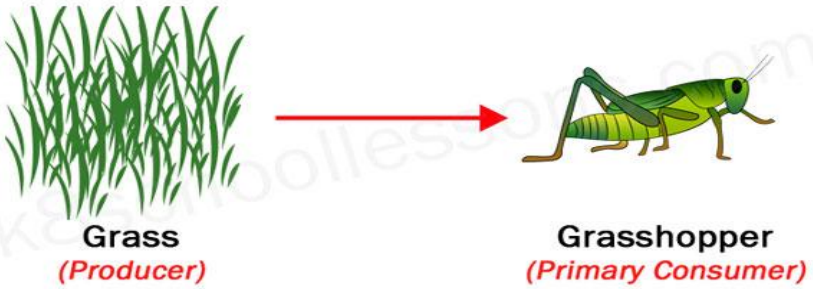
- All animals depend on plants directly or indirectly for food and energy.

PRIMARY CONSUMERS IN FOOD CHAINS

- Primary consumers are the second link of a food chain.
- They are usually ***herbivores*** that eat green plants or sometime ***omnivores*** that eat both plants and animals.
- The green plants are the food of all herbivores that are primary consumers.

EXAMPLE OF A FOOD CHAIN WITH TWO LINKS

Example of a food chain with two links showing the producer and the primary consumer



SECONDARY CONSUMERS IN FOOD CHAINS

- Secondary consumers are the third link of a food chain. They can be either **omnivores** or **carnivores**.
- The herbivores are the food for carnivores that are secondary, tertiary or quaternary consumers.

EXAMPLES OF FOOD CHAINS WITH THREE LINKS

Example of a food chain with three links showing the **producer, the primary consumer and the secondary consumer**

TERTIARY CONSUMERS/THIRD ORDER CONSUMERS

These are carnivores and or omnivores which feed on secondary consumers.

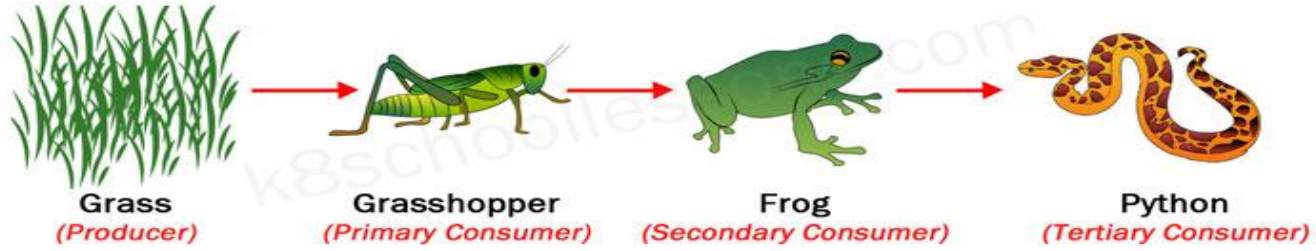
QUARTERLY CONSUMERS/FORTH ORDER CONSUMERS

These are carnivores or omnivores which feed on tertiary consumers.

TERTIARY CONSUMERS

- These are the fourth link of a food chain while quaternary consumers are the fifth link of a food chain.
- They are usually the carnivores that are **top predators**.
- Secondary consumers are the food for carnivores or top predators that are tertiary or quaternary consumers.

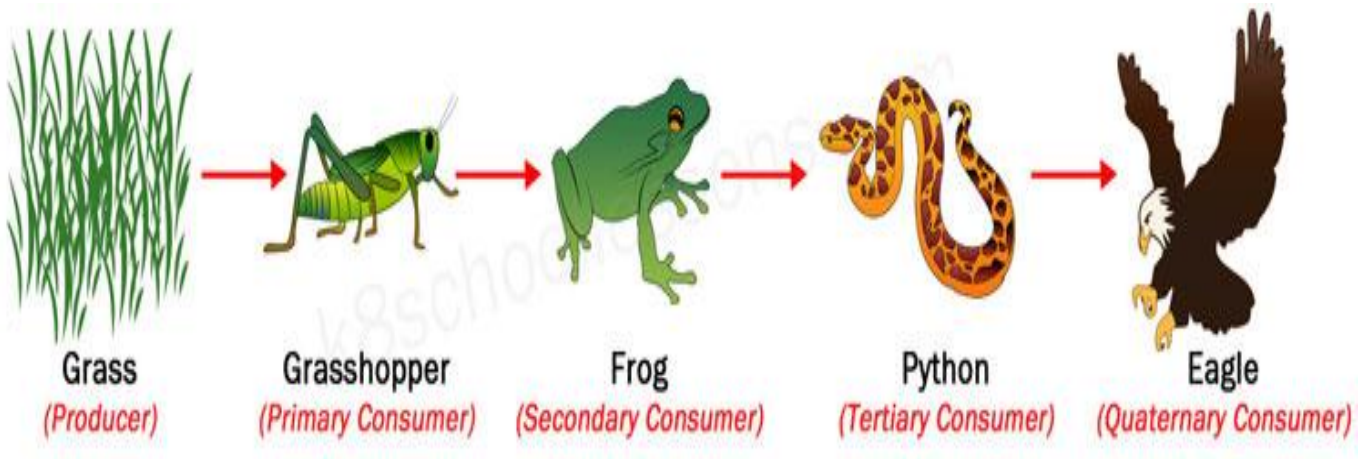
EXAMPLES OF FOOD CHAINS WITH FOUR LINKS



EXAMPLE OF A FOOD CHAIN WITH FOUR LINKS

Sometimes tertiary consumers can be the food for quaternary consumers.

EXAMPLES OF FOOD CHAINS WITH FIVE LINKS



Example of a food chain with five links

Likewise, step by step, the energy in food flows from the producers to consumers.

SCAVENGERS AND DECOMPOSERS IN FOOD CHAINS

When an organism dies, it is eventually eaten by scavengers and broken down by decomposers like bacteria and fungi, and the exchange of energy continues in the environment.

EXAMPLES OF SCAVENGERS IN A FOOD CHAIN

These include

a. Crows
b. Vultures
c. Hyenas
d. Ants
e. Worms
f. Crabs

- Examples of **vertebrate scavengers** include Crows, vultures and hyenas
- The best examples of **invertebrate scavengers** are ants in the environment. They eat dead bodies of animals and plants.

DECOMPOSERS

- These are microbes that break down dead and decaying matter.
- Decomposers act on the dead matter of all primary producers, consumers, and even dead decomposers.
- Decomposers like fungi and bacteria are not allocated to any feeding level.
- Examples of decomposers include **Bacteria, fungi, algae, lichens**
- They break down dead bodies of plants and animals and let the essential nutrients in the dead matter mix with the ecosystem again, so that no waste would pile up.

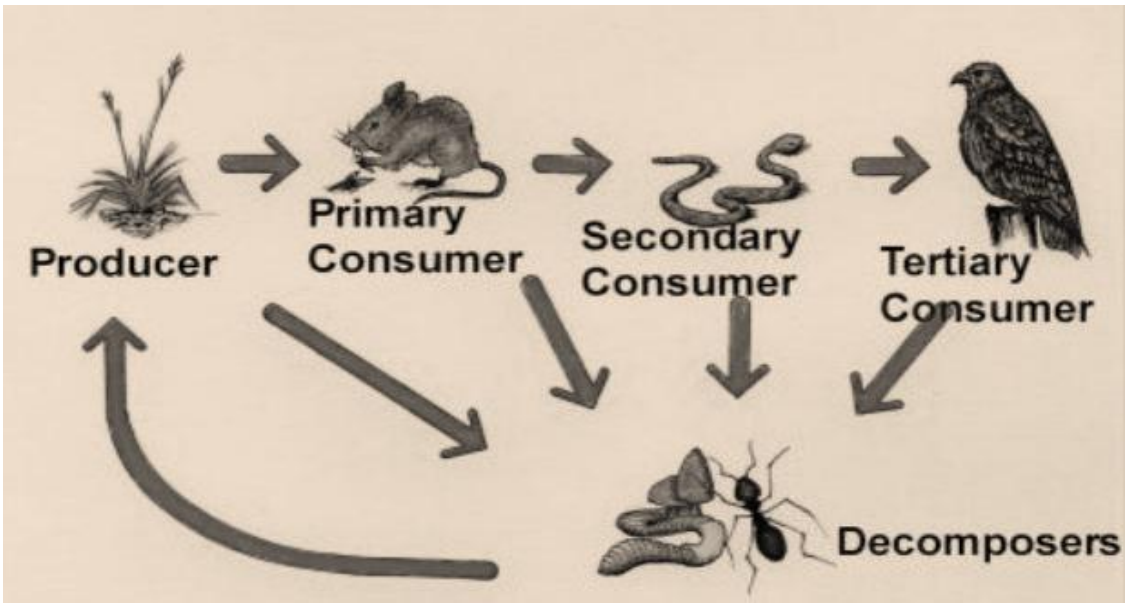
a. DETRITUS

- These are pieces of dead and decomposed matter**.**

b. Detrivores

- These are organisms that feed on partly decomposed matter.
- Examples include ants, earthworms, woodlice, fly maggots.

FOOD CHAIN SHOWING TROPHIC LEVELS AND DECOMPOSERS



ENERGY TRANSFER IN THE FOOD CHAIN

- A food chain is important as it shows how food energy is transferred from primary producers to the succeeding consumers.
- A food chain shows the transfer of energy from one organism to the next, starting with a producer. The source of all energy in a food chain is **light energy from the Sun**
- The arrows in a food chain show the **transfer of energy** from one trophic level to the next
- Energy is transferred from one organism to another by ingestion (eating)

HOW ENERGY IS LOST AS YOU MOVE FROM ONE TROPHIC LEVEL TO THE NEXT?

- In any food chain, there is energy transfer from one trophic level to the next. Usually the source of energy, the sun is not included in the food chains.
- The sunlight energy is absorbed by green plants which convert it to a chemical energy. The chemical energy is available in the form of food substance such as glucose, starch, cellulose, lipids and proteins. When the herbivores consume plants, the energy to them, and when they are consumed by carnivores the energy is transferred to carnivores.
- As you move from one trophic level to the next energy trophic level available energy decreases. There is 90% energy loss, that means only 10% is available

to the next trophic level. This is so because not all the energy from the sun is captured by the plant. Only a small portion of light energy is captured by the plants, while the rest is wasted in the following ways

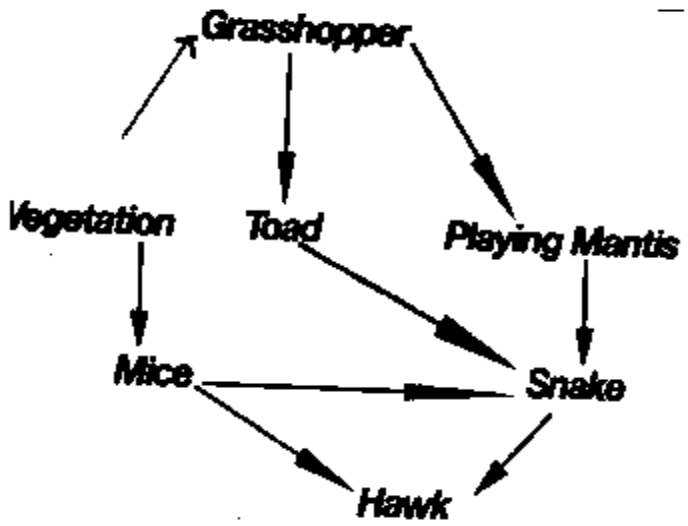
a. Some is reflected from the plant leaf surfaces
b. Some passes straight through the leaf
c. Some is lost in photosynthesis reactions.

- Not all the energy available in the primary producer is transferred to the primary consumers and succeeding consumers because of the following reasons:
  a. Much of the plant lignin and cellulose is not digested by the herbivores
  b. The primary consumer may not necessarily eat the whole plant, rots and stems may not be eaten up.

The primary consumer loses some energy through respiration and some is lost in excretion in form of urine and dung. Some of the energy is used in locomotion.

FOOD WEB

- A food web is the interconnection of several food chains in an ecosystem. It shows a feeding relationship among several species in a natural habitat.
- For example, there are four food chains that are connected in the diagram below that forms the four web.



Vegetation → Grasshoppers → Praying Mantis → Snake → Hawk

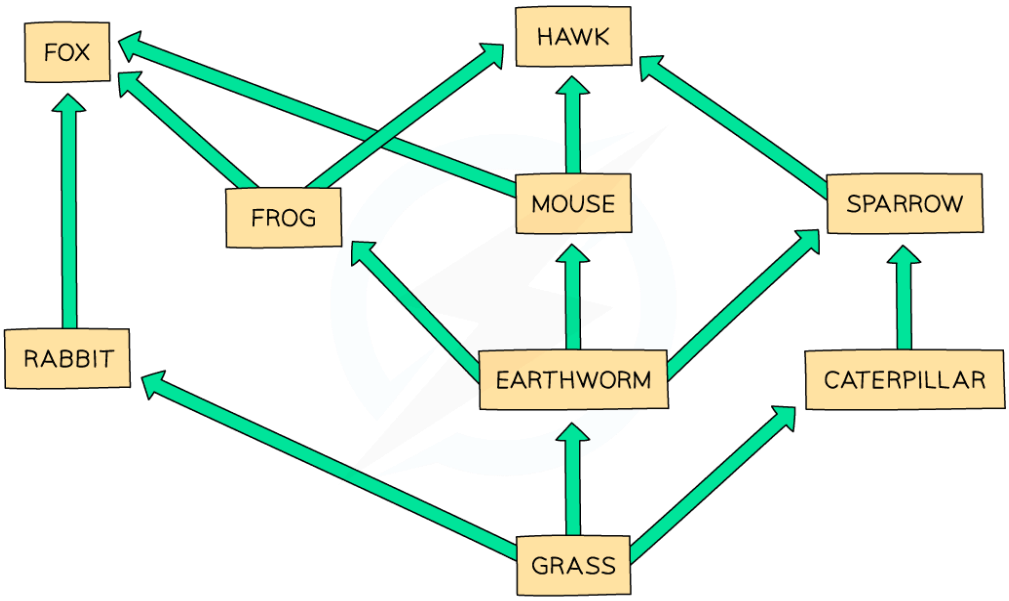
Vegetation → Grasshoppers → Toad ⟶ Snake → Hawk

Vegetation → Mice ⟶ Snake ⟶ Hawk

Vegetation → Mice ⟶ Hawk

- A **habitat** is a natural home of living things.
- Food webs are more realistic ways of showing connections between organisms within an ecosystem as **animals rarely exist on just one type of food source**

Food web below shows the interdependence of organisms



- Food webs give us a lot more information about the transfer of energy in an ecosystem
- They also show **interdependence** – how the change in one population can affect others within the food web
- For example, in the food web above, if the **population of earthworms decreased**:

a. The population of **grass plants would increase** as there are now fewer species feeding off them
b. The populations of **frogs and mice would decrease significantly** as earthworms are their only food source
c. The population of **sparrows would decrease slightly** as they eat earthworms but also have another food source to rely on (caterpillars)

- Most of the changes in populations of animals and plants happen as a result of **human impact** – either by **overharvesting of food species** or by the **introduction of foreign species to a habitat**
- Due to interdependence, these can have **long-lasting knock-on effects** to organisms throughout a food chain or web

REASONS FOR UNBALANCING THE FOOD WEB

Food webs are easily **unbalanced**, especially if one population of organisms in the web dies or disappears. This may happen for a number of reasons, including:

- over–predation or hunting
- disease
- pollution
- use of pesticides
- lack of food (or other resources)
- Emigration.

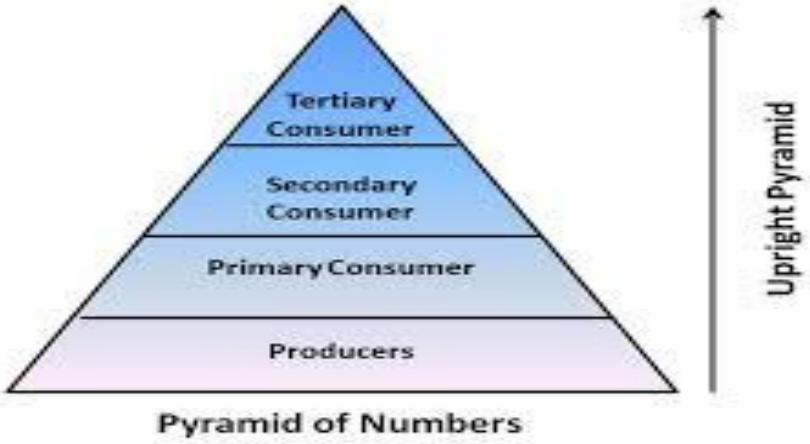
PYRAMID OF NUMBERS

A pyramid of numbers is a graphical representation that shows the number of organisms at each trophic level. It shows the number of individuals at different trophic levels of food chain. It is an upright in the light of the fact that in an ecosystem, the producers are always more in number than other trophic levels.

The pyramid of numbers was advanced by Charles Elton in 1927. Charles pointed out the huge difference in the number of organisms involved in each

level of the food chain. Succeeding links of the trophic structure reduce rapidly in number until there are a very small number of carnivores at the top.

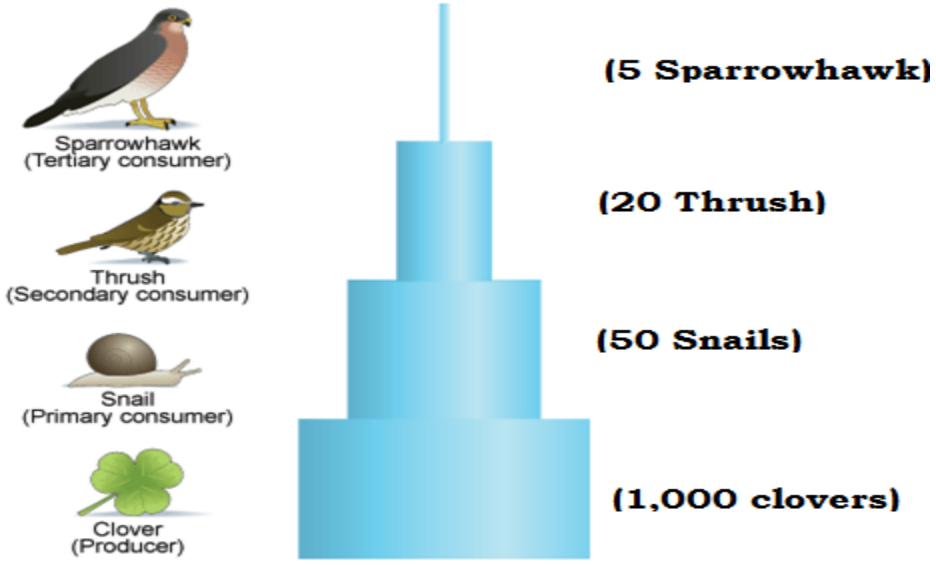
Examples of pyramid of numbers are



Pyramid of Numbers

The reason for the pyramid shape is that there must be enough plants to produce food at the bottom. Otherwise, the entire food chain would collapse. At the higher level, no predator can be as common as its prey.

Below is the diagram showing the pyramid of numbers that is constructed using 10,000 clovers which are eaten by 50 snails which in turn are eaten by 20 Thrush which are eaten by 5 Sparrow hawk.

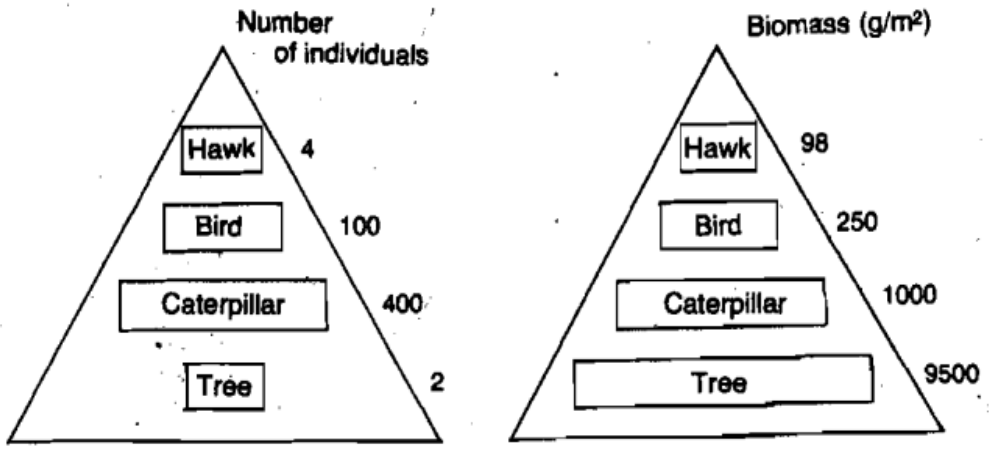


IMPORTANCE OF PYRAMID OF NUMBERS

It is used as the basis for ecosystems quantitative analysis in that it helps to estimate how the population of a given species can affect others

PYRAMID OF BIOMASS

- It is a graphical representation of the relative amount of biomass at each trophic level of the ecological system. It indicates decrease of biomass in each trophic level from base to apex of the pyramid.
- The pyramid of biomass is a diagram showing the total mass of organism at each trophic level in an environment.
- Biomass refers to the quantity of matter in organisms (number of individual's x mass of each individual).
- When constructing the pyramid of biomass, the amount of mass is found by drying the organisms to remove all the water and then weighing it. Primary producers have the highest biomass followed by primary consumers, then secondary consumers, tertiary and lastly the quaternary consumers. This makes it easier to draw the pyramid of biomass to scale.
- There is a decrease in the biomass of organisms and an increase in the size of organism as one moves from the primary producer to quaternary consumer in the pyramid of biomass.
- Below is the diagram showing the pyramid of biomass constructed using 2 trees which is eaten by 400 caterpillars and eaten by 100 birds which are later eaten by 4 hawks in an ecosystem.



The lowest level of this pyramid is occupied by producer and the top of the pyramid is occupied by carnivores.

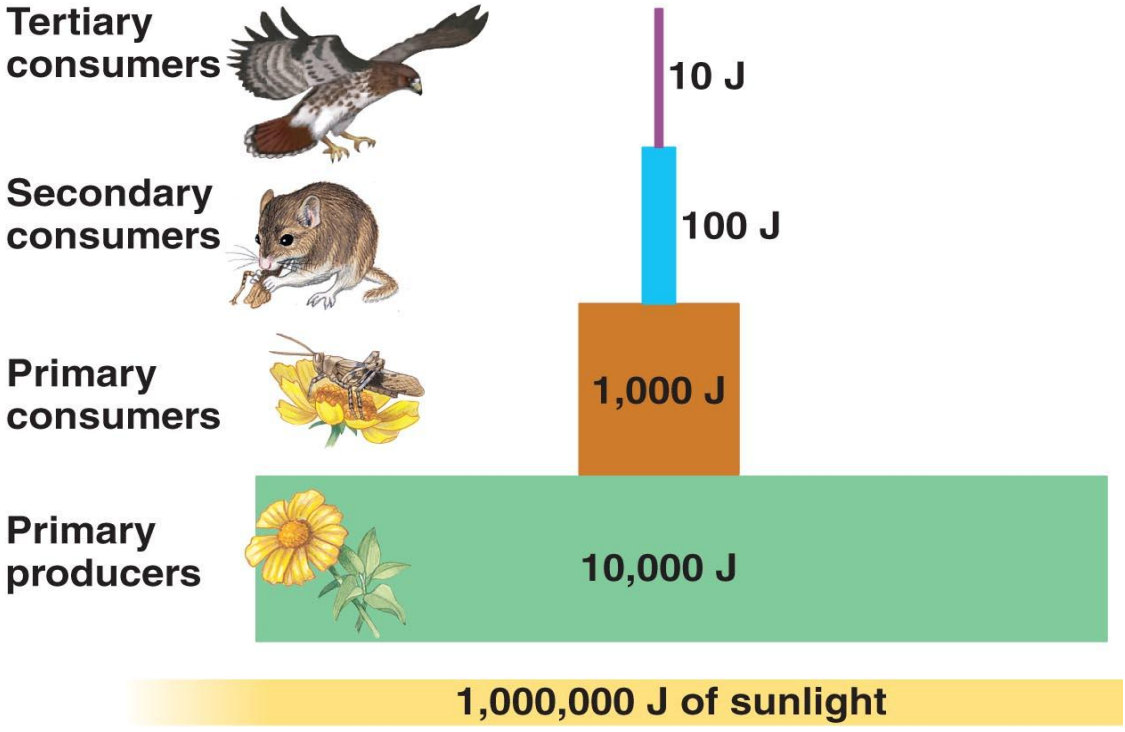
A pyramid of biomass is constructed by collecting all organisms occupying each trophic level separately and measuring their dry weight.

PYRAMID OF ENERGY

Pyramid of energy is a graphical representation of the rates of flow of energy through the different trophic levels of an ecosystem.

Explain how energy is lost as you move from one trophic level to the next.

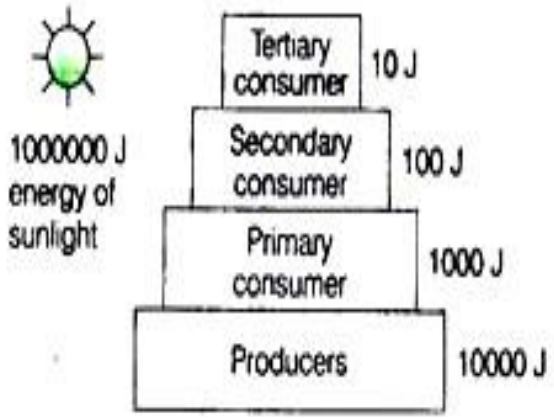
- In any food chain, there is energy transfer from one trophic level to the next. Usually the source of energy, the sun is not included in the food chains.
- The sunlight energy is absorbed by green plants which convert it to a chemical energy. The chemical energy is available in the form of food substance such as glucose, starch, cellulose, lipids and proteins. When the herbivores consume plants, the energy to them, and when they are consumed by carnivores the energy is transferred to carnivores.



- As you move from one trophic level to the next energy trophic level available energy decreases. There is 90% energy loss, that means only 10% is available to the next trophic level. This is so because not all the energy from the sun is captured by the plant. Only a small portion of light energy is captured by the plants, while the rest is wasted in the following ways
  d. Some is reflected from the plant leaf surfaces
  e. Some passes straight through the leaf
  f. Some is lost in photosynthesis reactions.
- Not all the energy available in the primary producer is transferred to the primary consumers and succeeding consumers because of the following reasons:
  c. Much of the plant lignin and cellulose is not digested by the herbivores
  d. The primary consumer may not necessarily eat the whole plant, rots and stems may not be eaten up.

The primary consumer loses some energy through respiration and some is lost in excretion in form of urine and dung. Some of the energy is used in locomotion

Example of pyramid of energy



Each bar of the pyramid represents the amount of energy per unit area or volume through that trophic level in a given time period. The different trophic levels represent groups of organisms that might compose a food chain. From the bottom-up, they are as follow:

a. **Producers** bring energy from nonliving sources into the community.
b. **Primary consumer-** Eat the producers
c. **Secondary Consumers-** Eat the primary producers
d. **Tertiary consumers**- Eats the secondary consumers

Energy pyramid shows that energy decreases as one moves through the trophic levels from the bottom to the top of the pyramid. Thus, the energy pyramid is always upward.

$$TLTE = \frac{\text{Energy transferred to next level}}{\text{Energy received during transfer}} \times 100$$

IMPORTANCE OF PYRAMID OF ENERGY

It shows the total energy flow

FEEDING STRUCTURES IN ANIMALS- TYPES OF TEETH

1. **Incissors**

- These are located on front part of the upper and lower jaw.
- They are are sharp and chisel shaped for biting and cutting food.
- The figure below shows incissors.

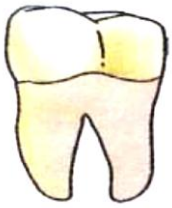
2. **Canines**

- These are next after the incissors.
- They are long and pointed.
- They are used for piercing and tearing food.

3. Premolars

These have a broad crown with ridges or cusps on the upper surface.

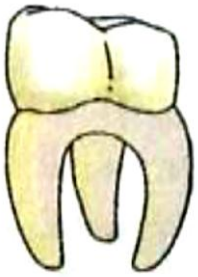
They are used for grinding and chewing food.



4. Molars

These come after premolars and have a broader crown with ridges than premolars.

They are suitable for grinding and chewing food.

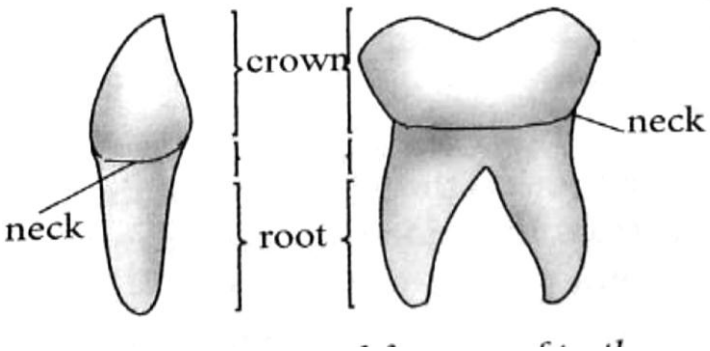


TEETH OF ANIMALS

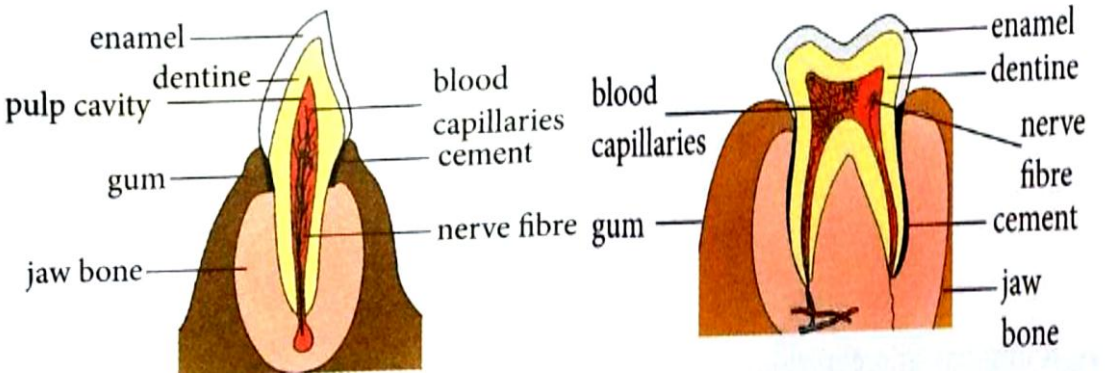
A tooth has three regions

a. **Crown**- The crown projects above the gum
b. **Root**- It is fixed in a socket in the jaw-bone
c. **Neck** – It is the narrow part which lies between the root and the crown.

The diagram below shows the three region of a tooth



INTERNAL STRUCTURE OF A TOOTH



AN INCISSOR **MOLAR**

1. **Enamel**

- It is the outer part of the tooth.
- It is the hardest substnce in the human body. It is made up of non-living tissue.

Functions

a. It protects the inner parts of the tooth from infection by bacteria and other micro-organisms.

b. It protects the inside of the tooth from mechanical damage by hard food material such as bones.

c. It provides a hard biting surface for effective chewing of food.

2. **Dentine**

It is the part of the tooth found immediately beneath the enamel.

It is not as hard as the enamel. It is made up of living cells

Functions:

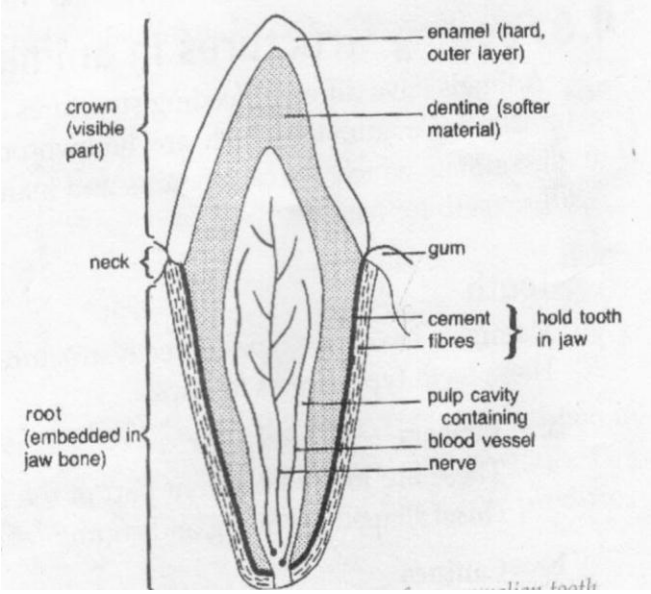
a. It forms the bulk of the tooth

b. It replaces worn out enamel.

c. It prevents the teeth from cracking

3. **Pulp cavity**

- It is found at the centre of the tooth.
- It contains numerous blood capillaries and sensory cells.
- The diagram below shows the position of the pulp cavity.



- The blood capillaries and sensory cells enter the pulp cavity through a small opening at the bottom part of the tooth.

Functions:

a. The blood capillaries supply nutrients and oxygen to the cells of the pulp cavity. They also transport waste material and carbon dioxide from the tooth.
b. The sensory nerve fibres have nerve endings that make the tooth sensitive to temperature and pain.
c. Special cells in the pulp cavity produce dentine which forms the bulk of the tooth.

4. Cement

It lines the root and holds the tooth in its socket in the jaw.

5. Periodontal membrane

This is a membrane which is found between the cement and the jaw in the socket of the tooth.

Functions

a. It contains cells that secrete cement.
b. It allows the tooth to move slightly to avoid breaking during chewing.

TEETH ARRANGEMENT IN HERBIVOURS ANIMALS

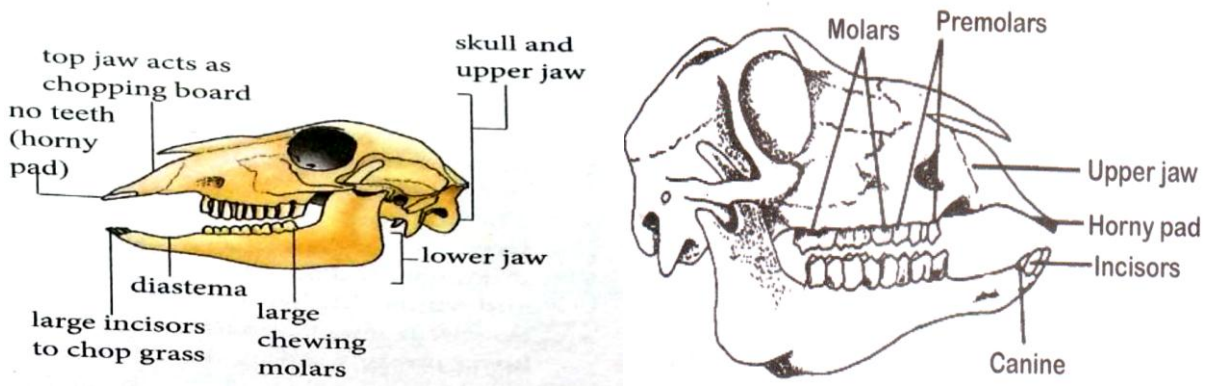
Herbivores are animals that feed on plants.

Examples of herbivores are sheep, cattle, goayte etc.

The main features in the teeth of herbivores include

1. There are no upper incissors or canines. In their space there is a **honny pad**.
2. There is a gap called the **diastema** between the front and the back teeth in the lower jaw. **Diastema provides space for tongue to turnm the eaten vegetation.**
3. The incissors in the lower jaw are large.
4. Premolars and molars are large in size and similar in shape.
5. Powerful cheek muscles move the lower jaw upweards and sideways.

   The diagram below shows the teeth arrangement in herbivores.



Examples of herbivorous animals which tthis arragement of teeth are sheep, catttle, goats, elephants etc.

TEETH ARRANGEMENT IN CARNIVORUS ANIMALS

Carnivores are animals that feed on the fresh.

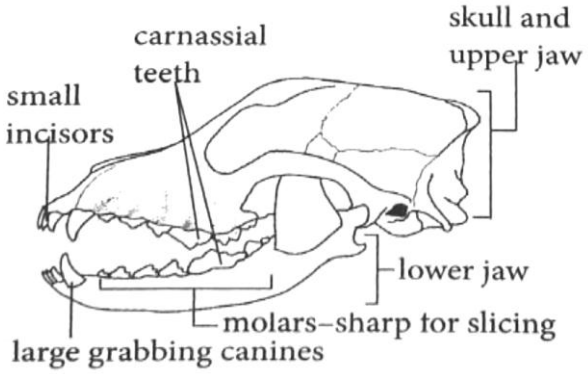
They are efficient in capturing and killing their prey.

They are adapted in capturing and killing their prey because

1. Dogs have small, pointed incissors which are used for picking up and stripping off small pieces of flesh or meat from the bone.
2. Carnivores have sharp, pointed and long canines for stabbing and killing prey. They also use them to pierce and penetrate the flesh so that the animal can hold firmly onto its prey to prevent it from escaping

3. The molars and premolars in the dog have a broad surface with pointed cusps which meet each other to crush and crack bones and to slice flesh.
4. The dog has large canssial teeth which have sharp cutting edges
5. The jaw muscles are strong and the hinge joint between the two jaws allow up and down movement of the lower jaw.
6. They have large canine teeth
7. The lion feeds on other animals which it has caught. The foot and hand are clawed and are used for catching or holding its prey. Its skull has powerful jaws with teetth for catching, tearing and cutting the food. The food canal is much shorter, compared with the size of the body, than in plant feeders because digestion of animal food is quicker. Good sight is also an advantage in stalking its prey.
8. **Insect feeders**, like the frog and chameleon, posses sticky tongoues which are flicked out (frog) or stuck out a long way (chameleon) in oder to catch their prey.
9. In other carnivores such as snakes, the jaws are loosely connected and so the animals are able to open their mouths very wide to swallow food bigger than their head.

The diagram below shows the teeth arrangement in carnivorous animals.



Examples of carnivorous animals which this arrangement of teeth are dogs, lions and leopards.

FEEDING STRUCTURES OF BIRDS- BEAKS OF BIRDS

1. EAGLE

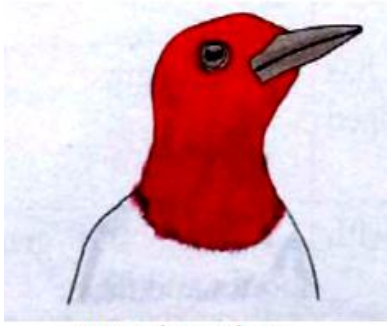
Has short , thick curved and pointed beak for tearing meat. It is found in all large carnivorous birds.

The diagram below shows the beak of the eagle which is an example of carnivorous bird.

Eagle

2. **Wood peaker**

It has thick and strong pointed beak that acts as both chisel and a cowbar to remove bark and find hiding insects.



Wood peaker

3. **Chicken**

Chickens have pointed beak for picking seeds

Chicken

4. **Stork**

Stork have long beaks suitable for catching small aquatic animals such as small fish, frogs and crabs.

Stork

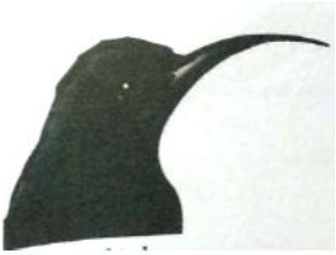
5. **Hornbill**

Has strong beak for eating fruits. The diagram below shows the beak for hornbill

Hornbill

6. **Sunbird**

Has long sharp beak for sucking neckar from flowers.



Sunbird

7. **Parrot**

Has strong hooked beak for cracking nuts.

Parrot

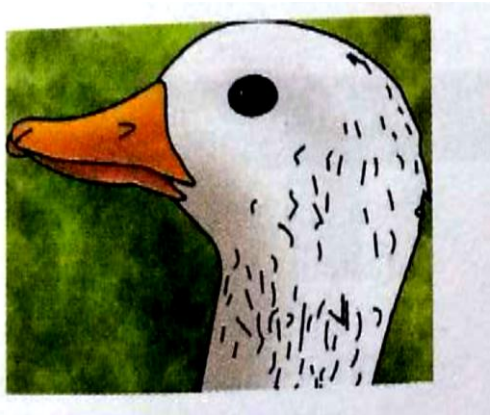
8. Swift

The figure below shows the a beak for swift used for feeding on seeds.

Swift

9. Duck

Has a wide beak for searching food in the mud.



FEEDING STRUCTURES- THE FEED OF THE BIRDS

1. Hawk

Hawks feed on chicks, rats, small birds and other small birds. Hawks are adapted to feed on other animals because

a. Hawks have sharp claws called talons which are curved and strong.
b. They also have rough bumps on their toes to hold on to slippery fish

The diagram below shows feet for a hawk

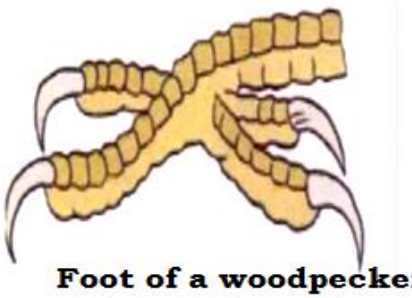
Foot of a hawk

2. Woodpecker

Woodpeckers have feet that are equipped with two toes, two up front and two in the back. This helps to give them powerful grips to cling on the sides of trees.

Woodpeckers feed on insects found in tree trunks, nuts and sap from trees.

The figure below shows a a foot of woodpecker.



Foot of a woodpecker

3. Chicken

Chickens have feet which have five toes with short claws at the tip which they use for scratching food such as seds and insects from the soil.

The figure below shows a foot of a chicken.

Feet of a Chicken

4. Heron

The heron has long toes suitable for walking on mud since they feed on small animals found in swampy areas.

Foot of a heron

5. Sparrow

The sparrow have feet that are adapted for perching and grasping twigs.Sparrows feed on seeds.

The diagram below shows a foot of a sparrow:

Foot of a sparrow

6. Pigeon

Pigeons feed on seeds and fruits. Therefore, they have feet which are feet made up of four toes that are adapted to hopping and clinging on branches.

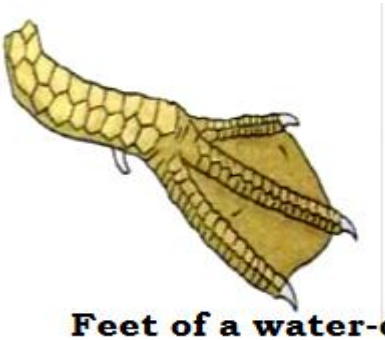
The diagram below shows a foot of a pigeon:

Feet of a pigeon

7. Waterduck

The feet of water-ducks have the three front toes connected with a web of skin. This helps them to paddle through water and walk on mud to be able to obtain food such as fish from the water.

The figure below shows the feet of a water-duck:



Feet of a water-duck

CHAPTER 3- FLOWERING PLANTS AND NON FLOWERING PLANTS

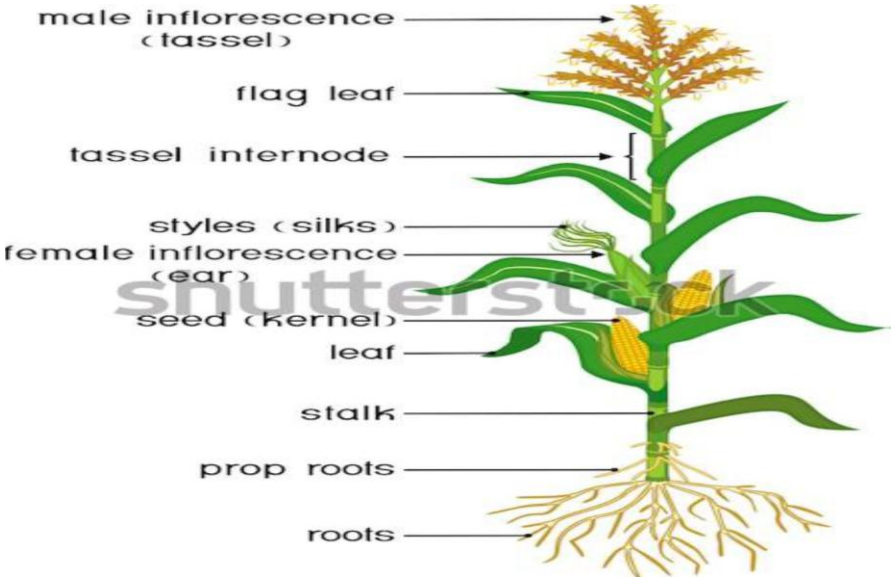
There are two groups of plants which include

1. Flowering plants
2. Non flowering plants

CHARACTERISTICS OF FLOWERING PLANTS

Flowering plants are plants which have true leaves , stems and roots and produce seeds.

The diiagram below shows the flowering plants



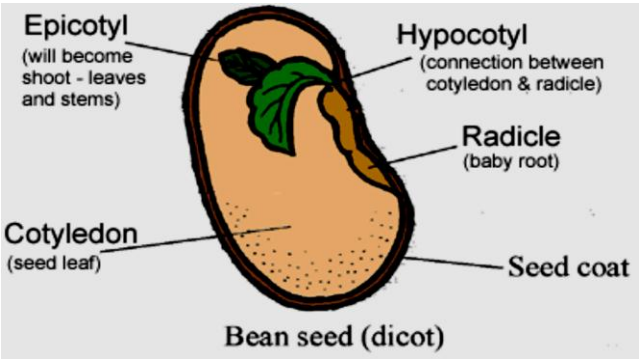
TWO MAIN GROUPS OF FLOWERING PLANTS

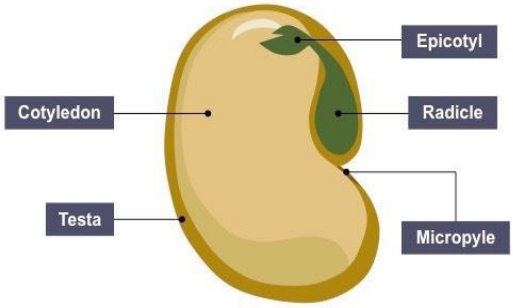
These include

a. The dicots

The dicots have two cotyledons in their seeds. Examples include beans, groundnuts and peas

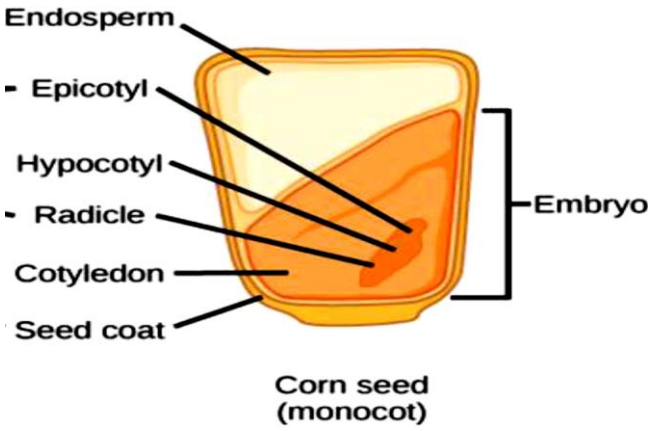
These are plants that grow from seed with a single cotyledon (seed leaf) only. They have fibrous roots. They have leaves with veins which run parallel. Examples include grasses which include maize plant, elephant grass etc.





b. The monocots

These are flowering plants which have just a single cotyledon. Example include maize, maize, rice, sorgum etc . The diagram below shows the monocot seed.



The diagram below shows the differences thart exist between **monocots** and **dicots**

Dicot (two cotyledons)

Pollen grains have three pores or furrows

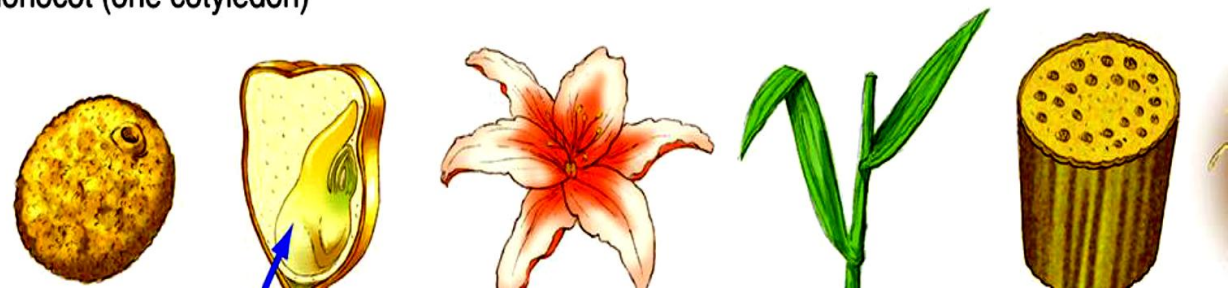
Seeds have two cotyledons

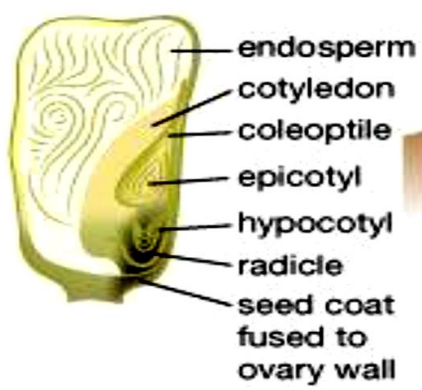
Flowers have four or five floral parts (or multiples thereof)

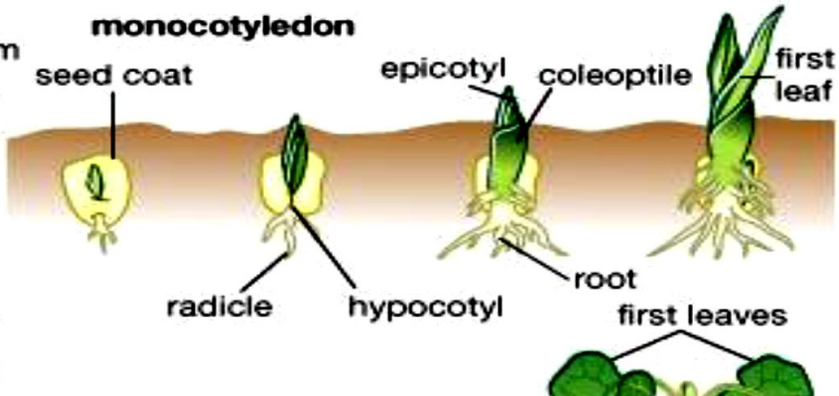
Leaves are oval or palmate, with net-like veins

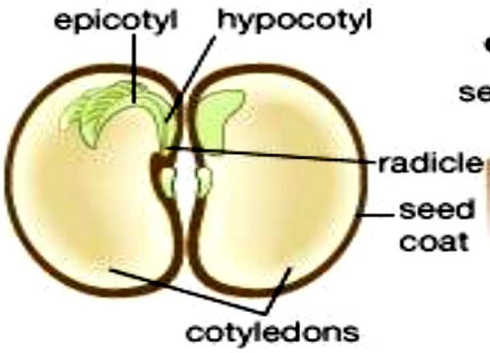
Vascular bundles arranged in a ring around stem

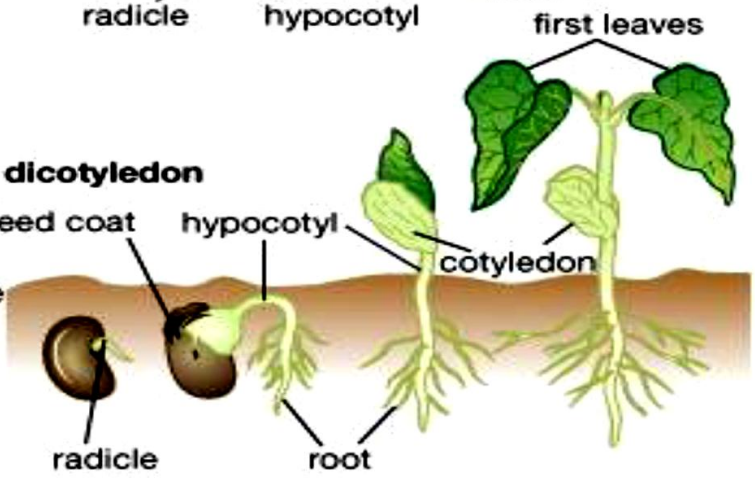
Monocot (one cotyledon)



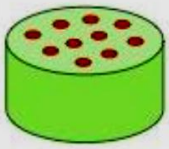
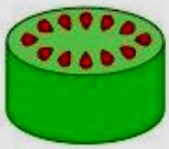








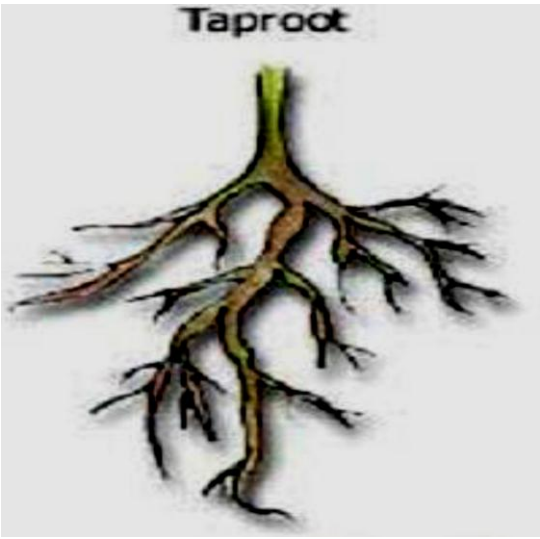
The differences between the monocots and dicots in terms of the seeds, roots, vascular, leaves and flowers are shown below

	Seed	Root	Vascular	Leaf	Flower
Monocot					
	One cotyledon	Fibrous roots	Scattered	Parallel veins	Multiples of 3
Dicot					
	Two cotyledon	Tap roots	Ringed	Net-like veins	4 or 5

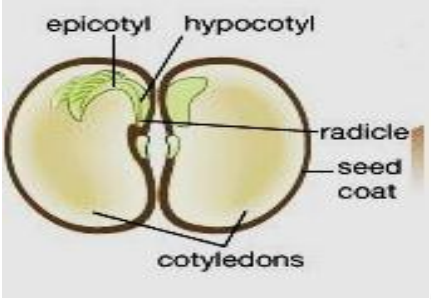
The diagram above shows that the **dicots h**ave

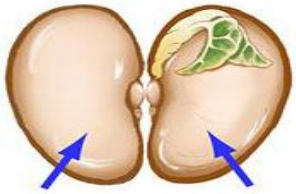
a. Tap roots

This is a very large main root which is developed directly from the radical. In addition, there are several lateral roots branching from the main root. The figure below shows the tap root system



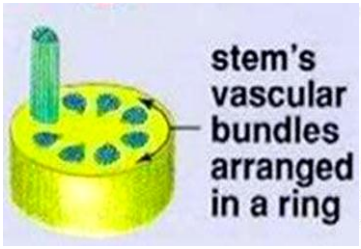
b. Two cotyledons

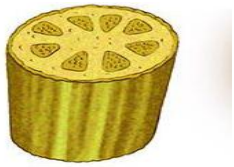




Seeds have two cotyledons

c. Ringed vascular





Vascular bundles arranged in a ring around stem

d. Net-like veins

e. Four oor five flowers

The monocot plants have

a. Fibrous roots

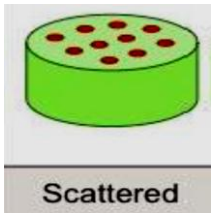
These are roots where the radical stops growing much earlier and are dominated by a mass of branching adventitious roots developed from the stem base.

Functions of the roots

- To anchor or fix the plant in the ground.
- To absorb water and dissolve mineral salts from the soil.
- To act as a conducting material between the stem and roots.
- Some roots act as storage organs.

b. One cotyledon

c. Scattered vascular



d. Parallel veins

e. Multiples of three flowers

STEM

The following are the types of stems

a. Underground stem such as bulbs like onions shown below

b. Upright stems such as most trees, maize etc.

c. Climbing stems such as pumpkins, sponges and pigeon peas.

FUNCTIONS OF THE STEMS

a. To hold the leaves to light for food manufacturing

b. To support the flowers in suitable position for pollination

c. To transport substances like water and dissolved mineral salts between roots and leaves.

d. To act as storage organs

e. Some stems are used as planting materials

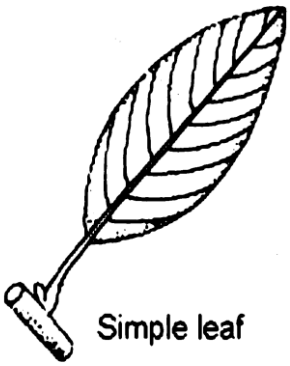
f. Green stems manufacture food by photosynthesis.

TYPES OF LEAVES OF FLOWERING PLANTS

1. **Simple leaf**

   This is a leaf with which has a single leaf blade. This include leaves of mango, guava, hibiscus

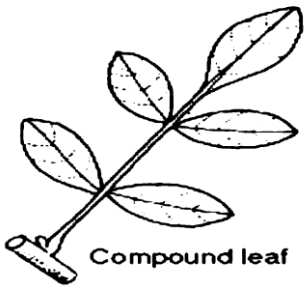
   The diagram below shows simple leaf



2. **Compound leaf**

   These are leaves whose leaf blades are divided into several leaflets. Examples include leaves of cassava, bean, cassia.

   The diagram below shows a compound leaf.



THE TYPES OF COMPOUND LEAVES

The following are the types of compound leaves according to the arrangement of leaflets.

1. **Pinnate**

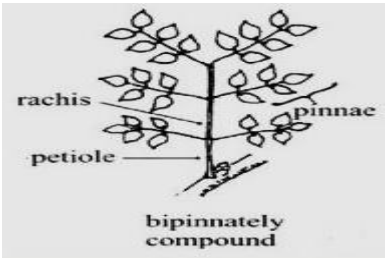
A pinnate leaf has leaflets arranged in pairs opposite to one another along main stalke.e.g. Cassia.

The diagram below shows pinnate leaf

2. Bipinnate

For Bipinnate leaf, each pinnate leaf is itself divided into pinnate leaflets such as jacaranda.

The diagram below shows Bipinnate leaf



3. Digitate

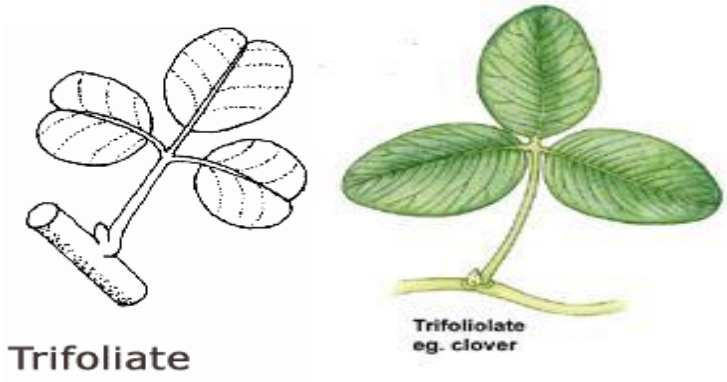
In Digitate leaf, the leaflets radiate out from the end of the leaf stalk like the fingers of a hand e.g. cassava.

The diagram below shows digitate leaf

4. Trifoliate

Trifoliate leaf consists of three leaflets as in a bean plant.

The diagram below shows trifoliate leaf



FUNCTIONS OF LEAVES

The following are the functions of leaves

- For food manufacture
- For diffusion of gases for both respiration and photosynthesis.
- Some leaves are used as food storage organs
- Some leaves act as organs of vegetative propagation e.g. in bryophyllum.

Venation

This refers to the arrangement of veins in a leaf.

Two main ways in which veins are arranged are **net venation** and **parallel venation.**

1. **Net venation**

- This is where veins are arranged in a network. This is very typical of dicotyledonous plants such as peas, guavas, beans.
- The figure below shows net (reticulate) venation

2. **Parallel venation**

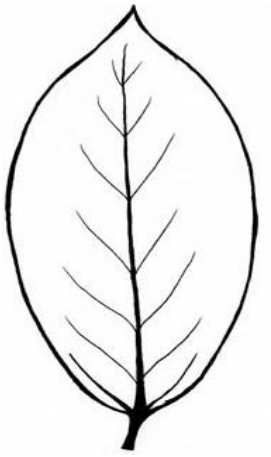
This is where the lamina (leaf brade) contains a series of similar parallel veins. This is typical of monotyledonous plants like banana, sugarcane, maize leaves.

Leaf margins

The following are common leaf margins as shown below

a. Smooth leaf margin

A smooth edge is called an entire margin. There are no teeth or notches taken from the edge. It is smooth and complete



b. Toothed leaf margins

This cover three terms which include serrate leaf margin, dentane leaf margin and cretane leaf margin

- **Serrated leaf margins**

Serrate margins are leaf margins where the teeth are like those of the saw, continuous and forward pointing

- **Dentate leaf margins**

  Dentate margins have continuous teeth which point outwards

- **Cretane margin**

Cretane margins are pretty much the same as dentane ones but the teeth tend to be rounded

THE FLOWER

REPRODUCTION IIN FLOWERING PLANTS

Flowering plants can reproduce asexually or sexually.

ASEXUAL REPRODUCTION

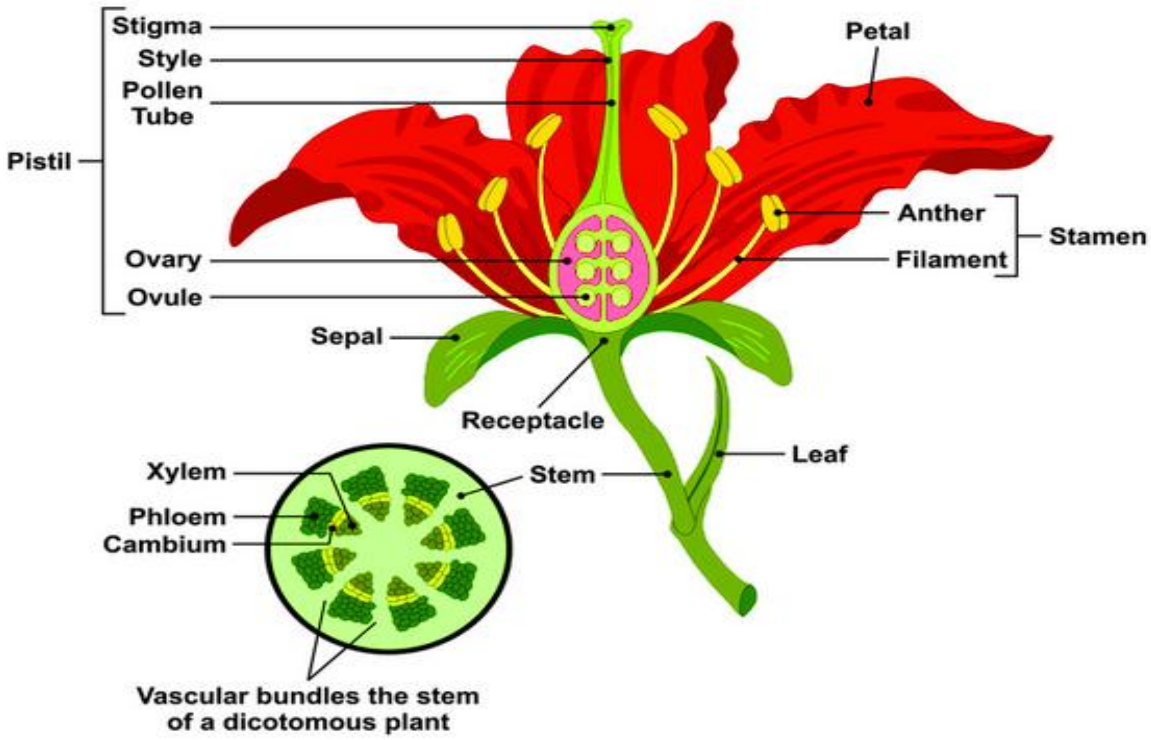
- This involves only one parental plant to produce new individuals.
- This happens through vegetative propagation. The new plant may be be propagated from the stem, leaf, bud or root of the plant.
- Examples of vegetative production include
  a. Cassva is propagated using stems
  b. Onions are propagated using bulbs
  c. Irish potato is propagated using stem tubers.
  d. Grass such as marram are propagated using underground swollen stems.

SEXUAL REPRODUCTION

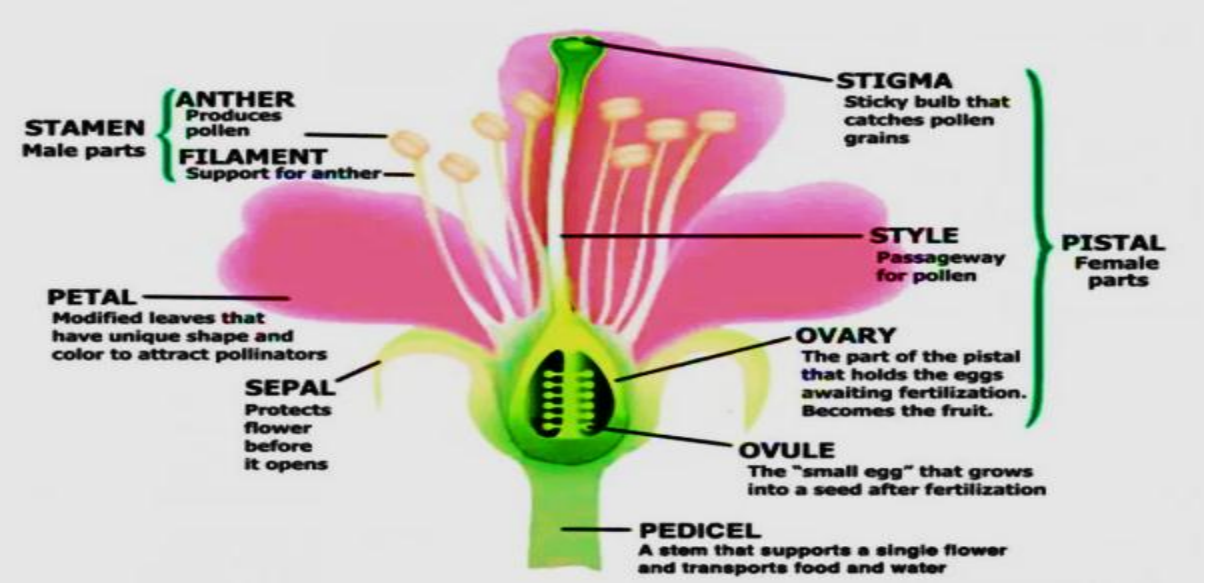
In sexual reproduction, production of new individuals involves two parental organisms. Flowering plants reproduce sexually by producing flowers.

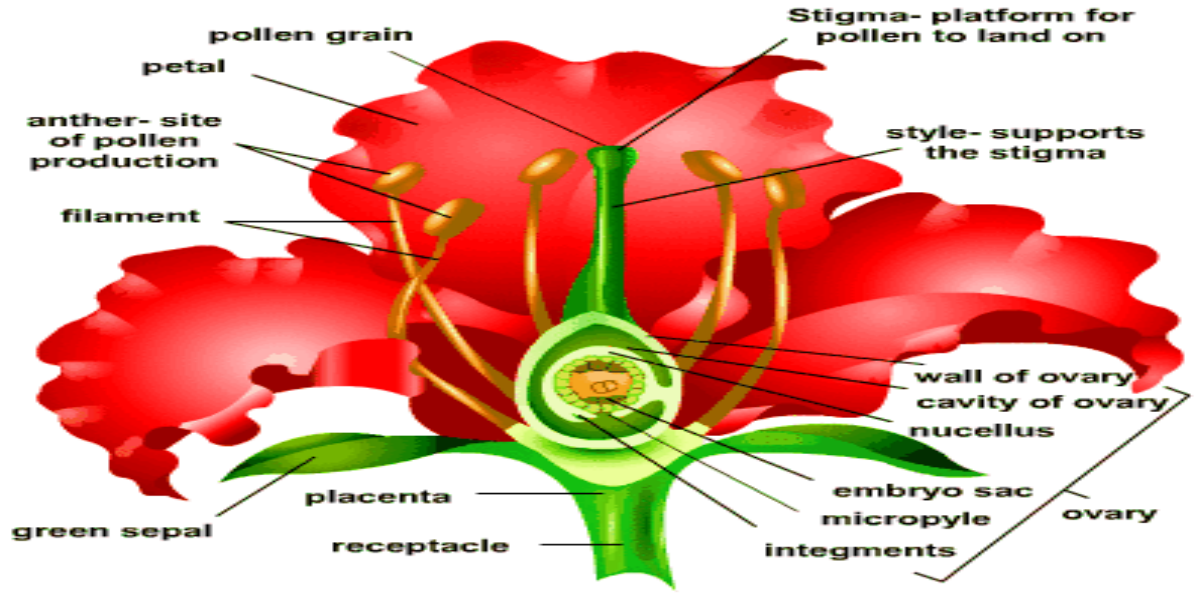
THE FLOWER

This is where reproduction takes place in flowering plants. The flower is composed of the following basic features



Flora part	function
Pedicel	Specialized shoot on which a flower grows
Receptacle	The flower stalk
Whorls	Circular or ring-form arrangement of floral parts on the receptacle
Calyx	The outermost whorl, a set of leaf-like sepals
Corolla	Collective name of petals inside the calyx.
Androecium	Collective name for stamens, which are male parts of a flower. Stamen consist of anther and a filament
Carpels	Collective name for female organs of a flower. Carpel consists of a stigma, style and ovary. Carpels are collectively known as the gynoecium or pistil.





Seeds are the fertilized ripened ovule of a plant containing an embryo that is capable of germinating to produce a new plant.

POLLLINATION

Pollination is the transfer of pollen frm a plant's male part to the female part of the same or another plant. Pollination is required to create viable seed.

Self-pollinator is a plant with perfect flowers containing both male and female parts that usually pollinate themselves and rarely crosses with other plants. This includes wheat, beans, tomatoes and lettuce.

Cross-pollinated plants- These are plants whose flowerers are or can be pollinated by insects such as carrots or onions.

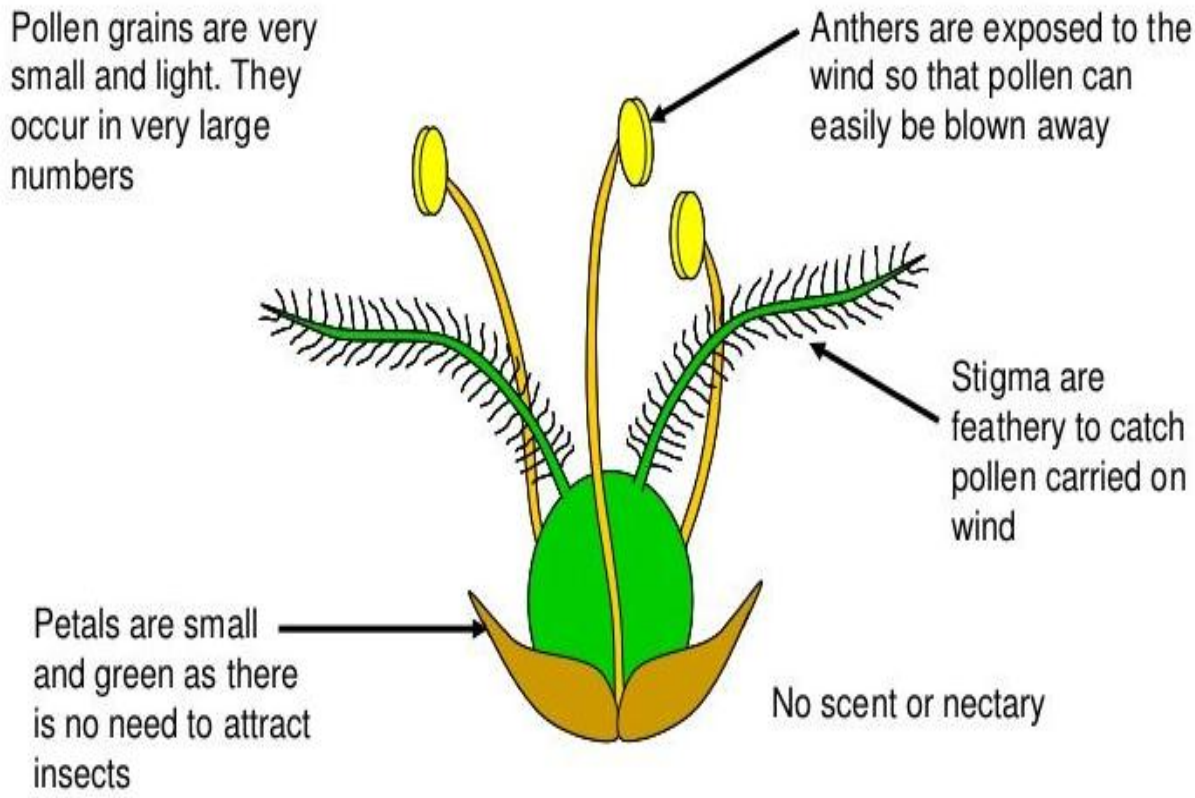
Wind-pollinated plants- These are plants whose pollen is distributed through the wind. This includes beets, corn, and spinach and rye grain

CLASSIFICATION OF FLOWERS BY THE AGENT OF POLLINATION

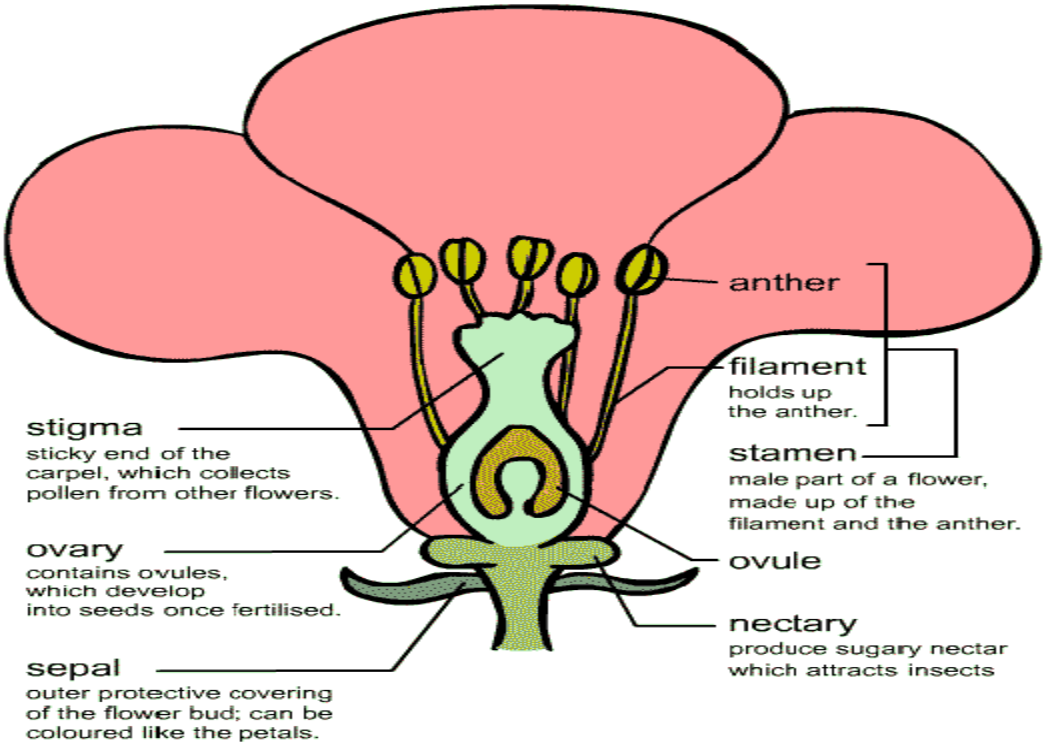
1. Wind-pollinated flowers

- They have very small petals/have dull coloured petals since they do need to attract pollinators.
- They do not produce nectar or scent
- They produce large quantities of pollen to increase the chance of falling on the stigma.
- Pollen produced in light and small so that they can easily be carried in the air.
- They have large anthers loosely attached to filaments. Filaments hang loosely outside the flower so that they shake and shed pollen in even when there is no strong wind.
- Stigmas are wide and feathery to increase the chance of catching pollen.
- Flowers develop long pedicels to make sure that wind reach the flower.

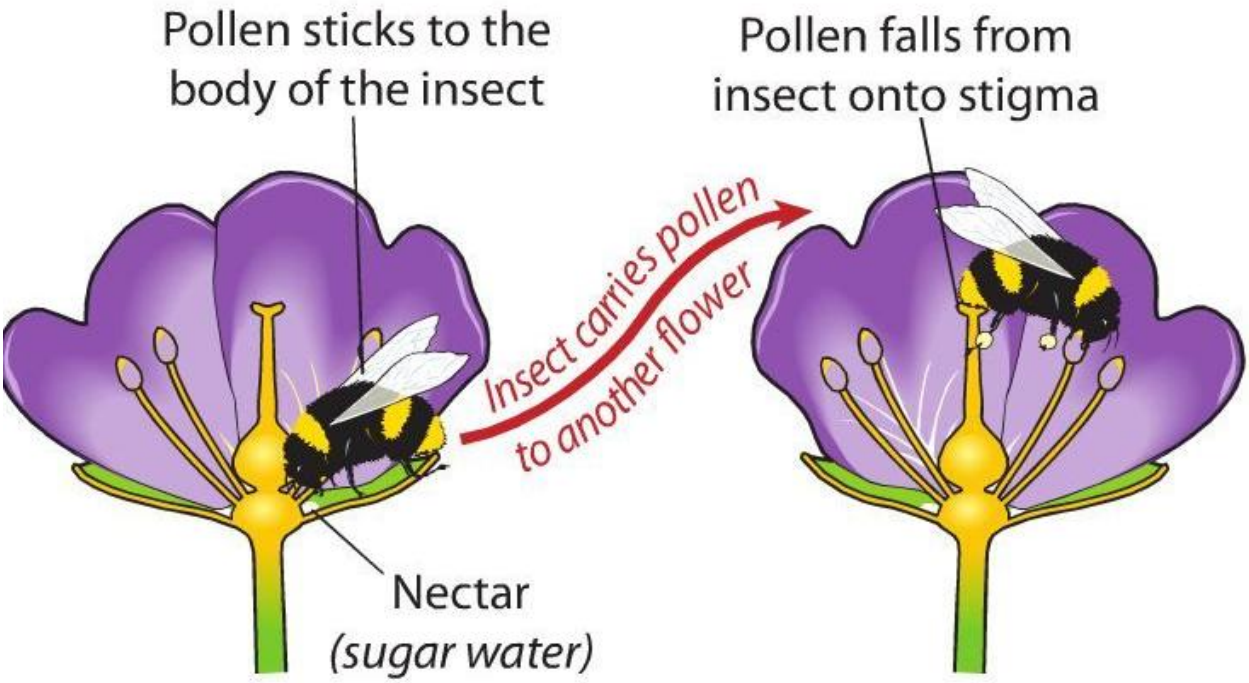
2. Bird and insect-pollinated flowers

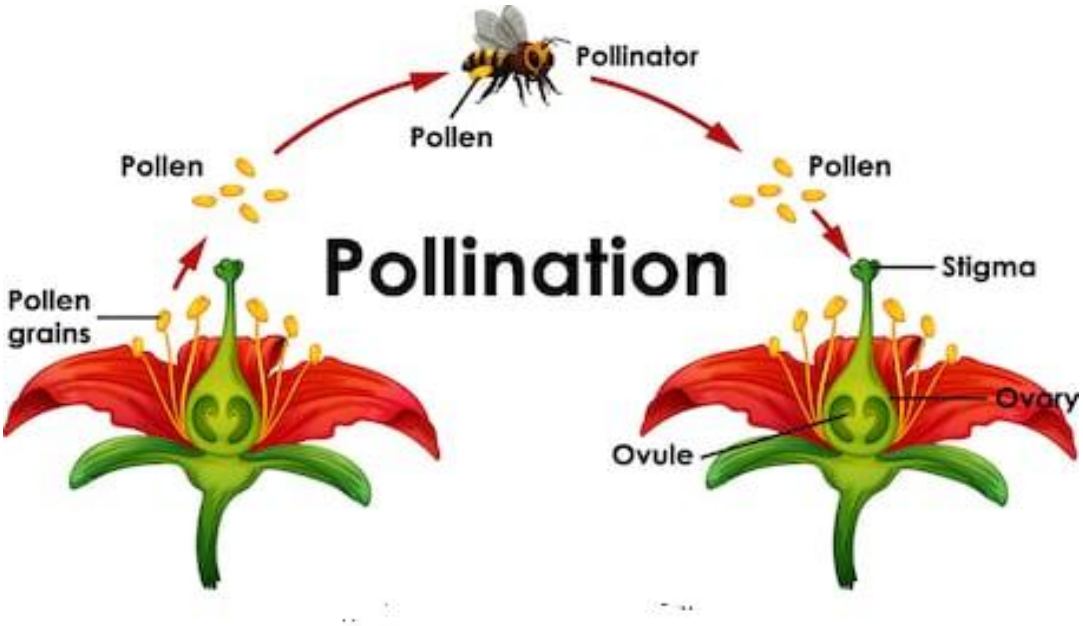


a. These flowers are brightly coloured and attractive to pollinators such as birds and insects.
b. They possess nectar that attracts insects.



c. The petals produce a distinctive scent which attracts pollinators.
d. Pollen grains are larger in size, hairy in some plants, smooth and sticky in others for attachment of pollen to the body of pollinators.

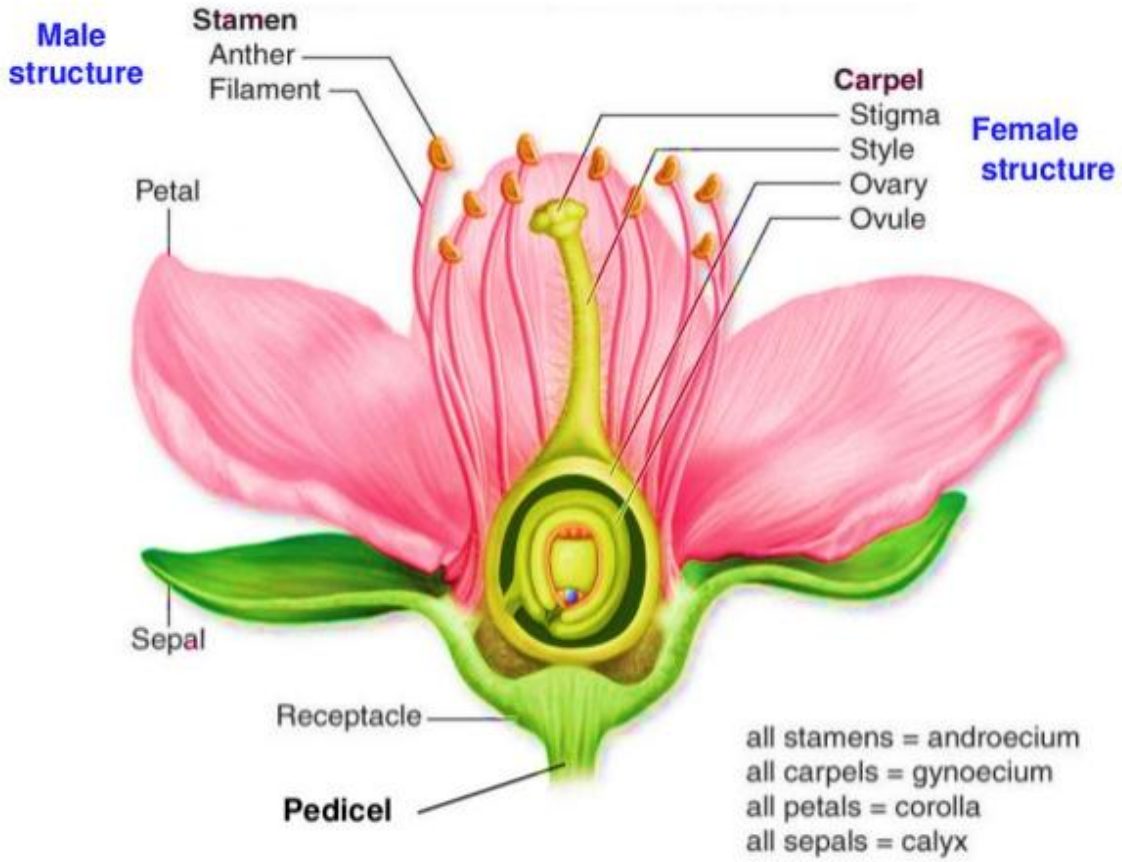


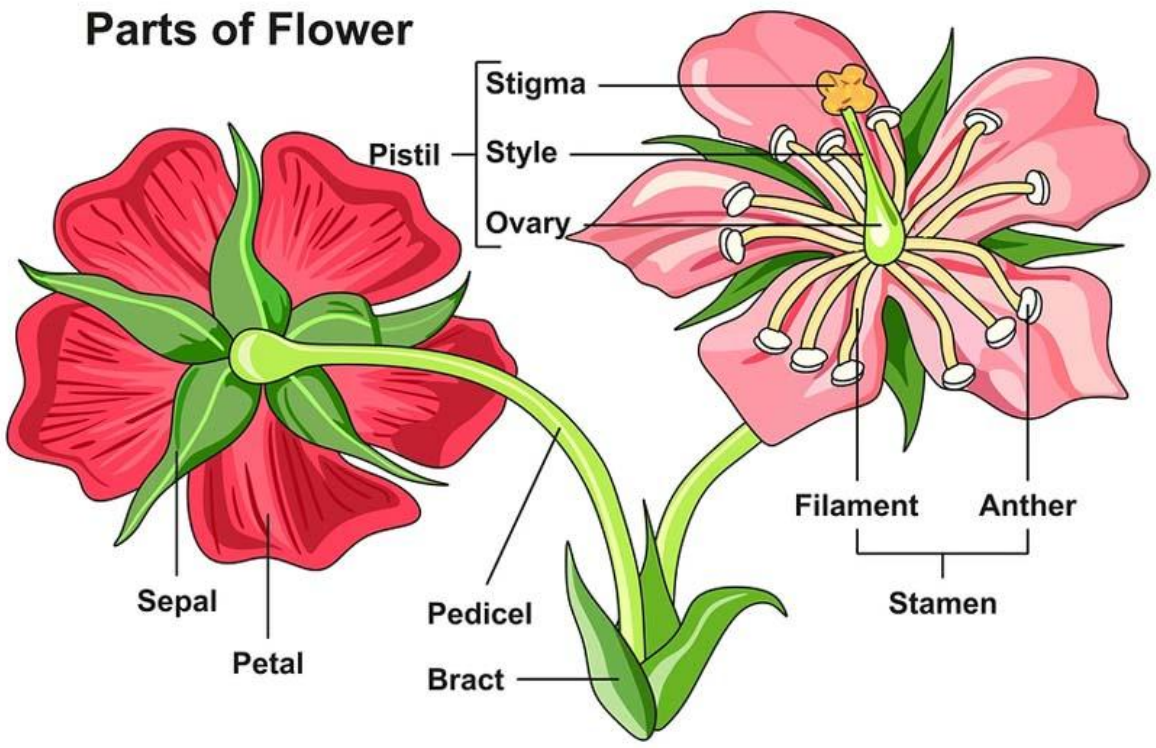


e. Anthers and stigmas are often located inside the corolla.

f. Stigmas are often sticky.

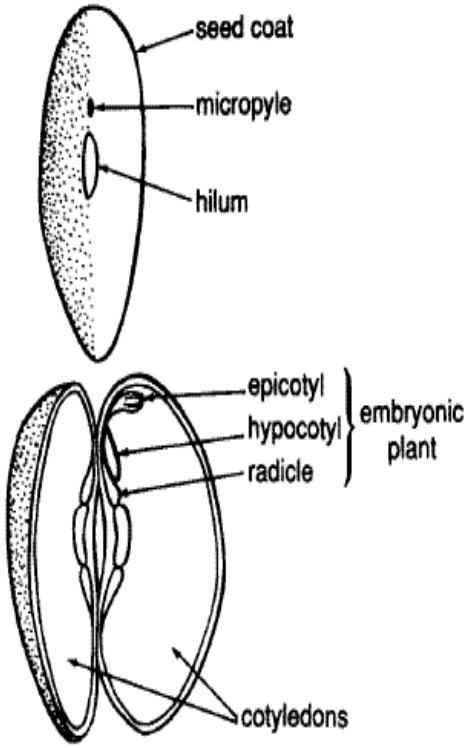
COLLECTIVE NAMES OF DIFFERENT PARTS OF THE FLOWER

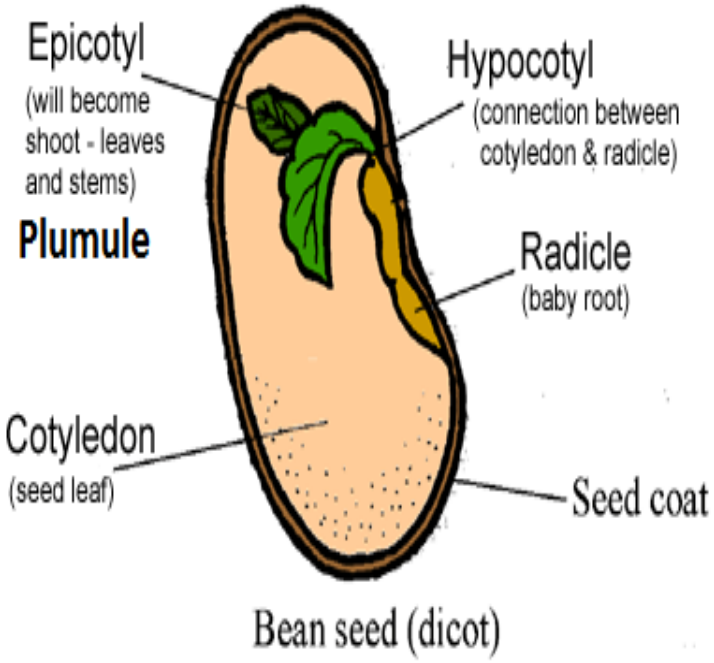




THE SEED

- A seed is a fertilized ovum.





The seed that carries an embryo must be released by the parent plant into a suitable place to germinate. This is important because it reduces competition for resources used to grow and also helps spread the plant widely.

SEED DISPERSAL

Flowering plants produce different types of seeds. The seeds have structures according to the way in which they are dispersed.

IMPORTANCE OF SEED DISPERSAL

The dispersal of fruits and seeds prevents overcrowding and competition among plants of the same species

THE MAIN AGENTS OF SEED DISPERSAL

The common agents of dispersal are wind, animals and explosive mechanisms.

1. **Wind dispersal**

The following are the characteristics of the seed dispersed by wind:

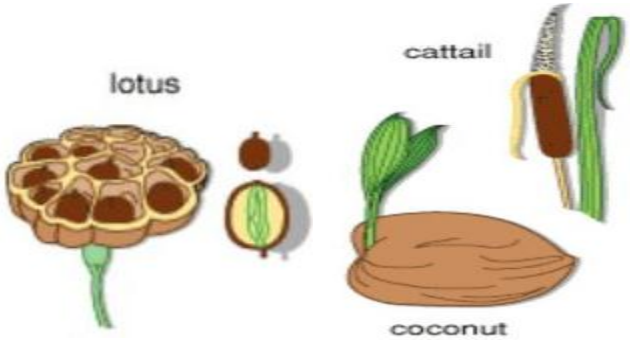
a. They are light enough in order to float in air.
b. Some possess structures that enable them to float in air e.g. hairs, wings

2. **Dispersal by water**

This is a method used by aquatic plants.

The following are the characteristics of the seed dispersed by water

a. The seeds float in water
b. The mature fruit contains an air space inside air space which makes it light enough to float in water e.g. coconut fruit.
c. The diagram below shows the seeds dispersed by water

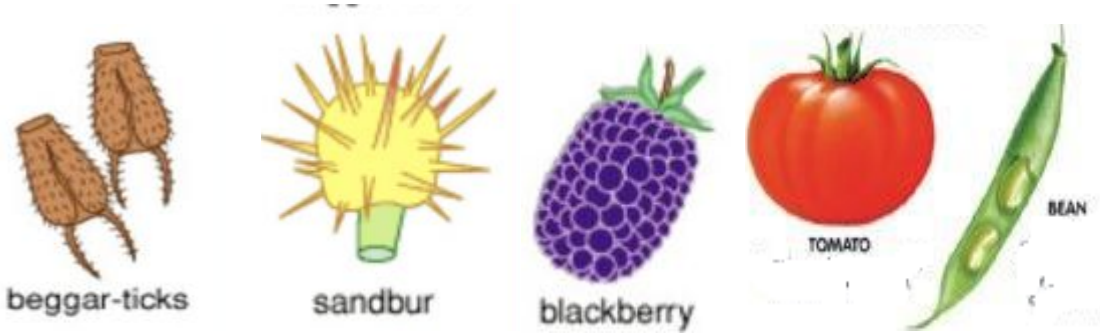


3. **Animal dispersal**

The following are the characteristics of the fruits and seed dispersed by animals.

a. They are attractive and eaten by animals e.g. mangoes and guavas
b. They have hooks which attach to the fur of animals or clothes of people.
c. They have sticky hairs on the fruit for attachment to the animal's body.

The diagram below shows the chisomo fruit that is dispersed by animal.



4. Explosive mechanism/self-dispersal

The seeds are dispersed from the fruit which remains attached to the plant e.g. peas, castor, beans.

The diagram below shows the bursting pods of seeds.

HABITANTS OF DIFFERENT GROUPS OF PLANTS

- A habitat refers to a home or a place where an organisms lives.
- Plants are classified into two main groups depending on presence of flowers or absence of flowers.
- Those without flowers are called **non- flowering plants** and those with flowers are called **flowering plants**.
- **Non – Flowering Plants**
- Examples of non- flowering plants include algae, mosses, liverworts, ferns and conifers.

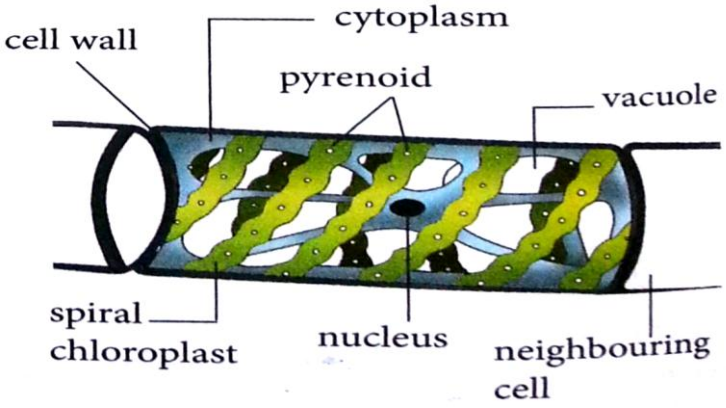
1. MOSS AND LIVERWORTS

- Mosses and liverworts are simple plants with simple structures.

- They do not have true roots, leaves or stems. These roots, leaves and stems are not true because they do not contain vascular bundles. Instead of true roots, mosses and liverworts have rhizoids which anchor the plant and absorb water.
- They reproduce by means of spores which are found in spore capsule.
- They are found in damp places like walls or caves.

2. THE ALGAE

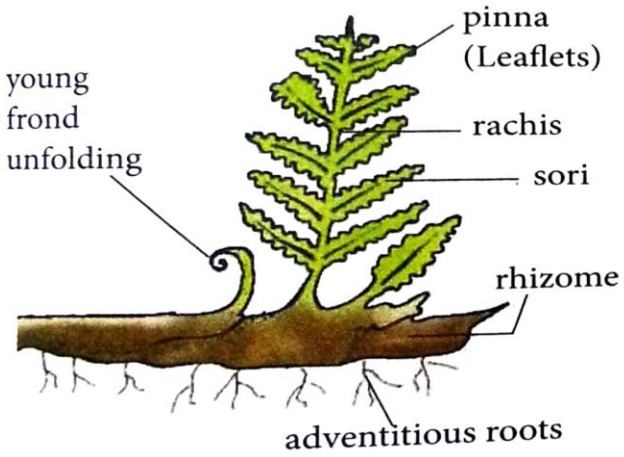
- Algae are simple plant- like organisms.
- They mainly live in water.
- They have chlorophyll and can photosynthesis
- Some are multicellular plant, such as spirogyra, other are microscopic, unicellular plants such as diatoms.



3. FERNS

- Ferns are large green plants with true roots, stems and leaves.
- They have underground stem called a **rhizome** which bears adventitious roots.
- They reproduce through spores which are produced under mature leaves.

- They grow in damp, shady conditions.



4. CONIFERS

- Conifers are mostly found in temperate countries. Some are found at high altitudes in tropics.
- In Malawi, they are common at high altitude areas of Zomba Mountain and Viphya plateau.
- Examples of conifers are pine, cypress, podo and juniper.
- They have well developed roots, stems and leaves that have well developed conducting tubes (vascular bundles) for transportation of water, mineral salts and food nutrients.
- Reproduction is through seeds which are a result of fertilization of pollen grain from male cones and ovules on the female cones.

Pine tree

PLANTS THAT GROW IN THE DESERTS OF DRY AREAS

Examples of plants that grow in deserts include Euphorbia, Acacia, baobab plants, Hydnora Africana, Saguaro Cactus, Jumping Cholla, Baseball plant, Desert ironwood, Silver Torch Cactus, Wollemi pine etc

ADAPTATION PF PLANTS THAT GROW IN DRY AREAS OR IN THE DESERTS.

1. Cacti typically have large, shallow root systems that radiate out from the plant in a circular pattern, his allows a cactus to absorb extensive amounts of water each time it rains.
2. Spines that protect the plant against creatures that would try to open the stem to consume water reserves.



3. Cactus spines have modified leaves with a limited surface that reduces water loss.
4. They have thick bulbous stems to store water. They do not have leaves to reduce loss of water over their leaves



5. They have thorns instead of leaves to minimisise water through transpiration.


Cactus plants

6. **Baobab trees**- They have thick or large stems to store water and have small leaves to minimize water loss through transpiration.

7. **Acacia plant-** They have small leaves to reduce loss of water over their leaves.

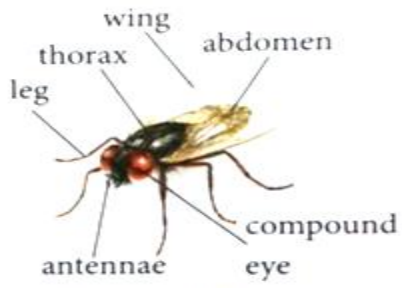
CHAPTER 4- MAIN GROUPS OF ANIMALS

The two main groups of animals are vertebrates and invertebrates.

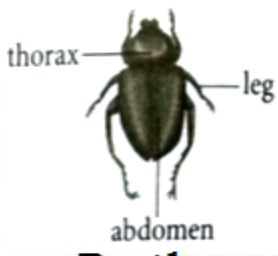
CHARACTERISTICS OF INVERTEBRATES

The following are the external features of insects

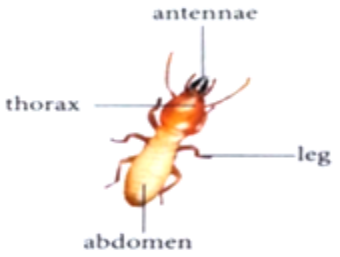
a. The body of the insects is divided into three parts: head, thorax and abdomen.
b. They have three pairs of legs that are attached to the thorax.
c. Some insects have wings while others do not.
d. All insects have antennae and compound eyes.
e. The following diagrams show examples of insects.



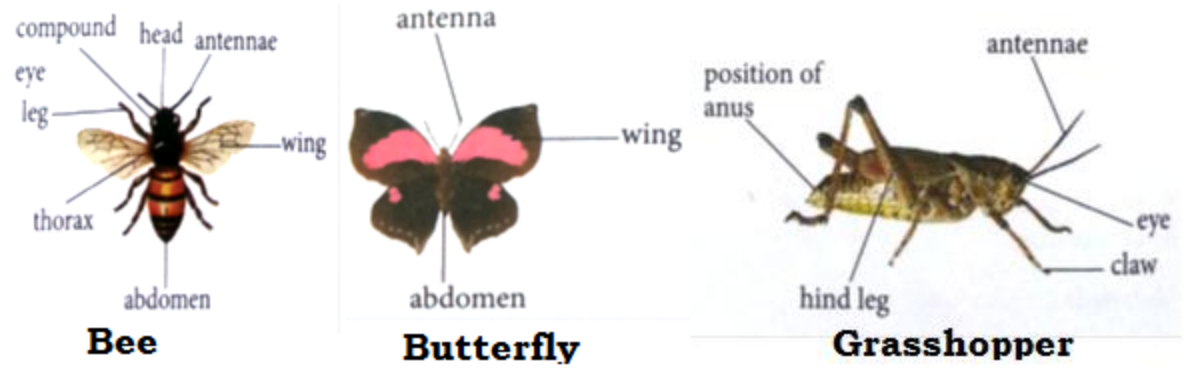
Housefly



Beetle



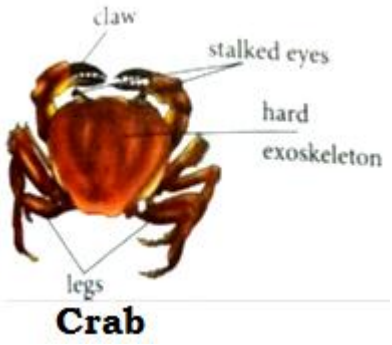
White ant



CUSTACEANS

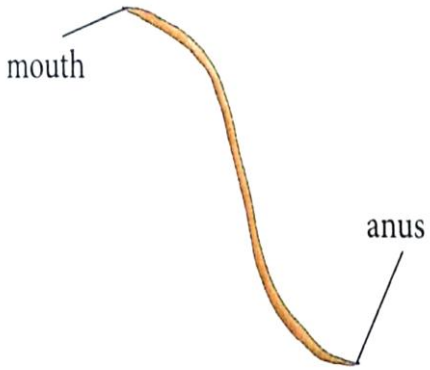
The following are external features of crustaceans

a. They have many legs and two pairs of antennae.
b. Their bodies are divided into two parts and covered with a hard shining coat.
c. The examples of crustaceans include crabs, pawns, crayfish and shrimps. The diagram below shows the crab.



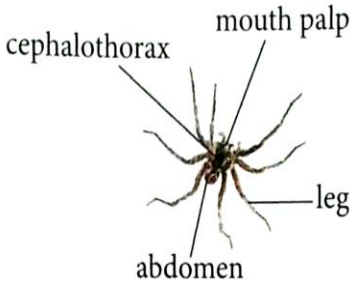
NEMATODES

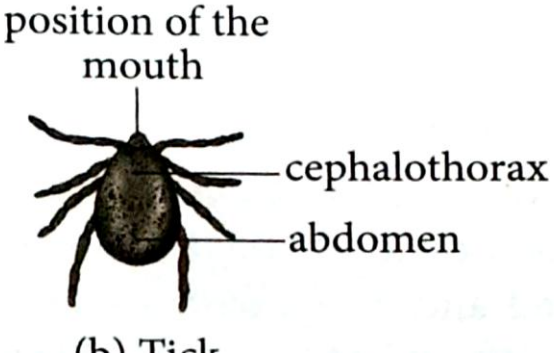
- They have cylindrical bodies which are not segmented and they reproduce sexually, having separate sexes.
- Their bodies are pointed at both ends.
- Examples of arachnids include Ascaris spp and hookworms. The diagram below shows a roundworm



ARACHNIDS

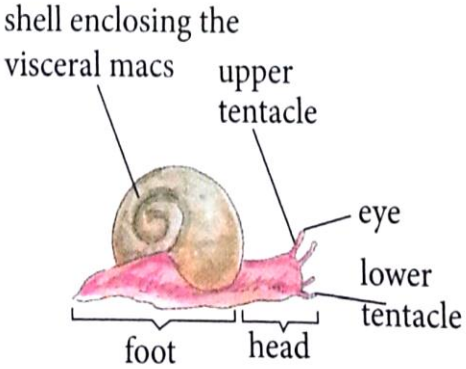
- Their body is divided into two parts: cephalothorax and abdomen. The head and thorax are fused to form a cephalothorax.
- They have no antennae
- They have four pairs of legs that are attached to cephalothorax.
- They have simple eyes.
- Examples include spiders, ticks and scorpions.





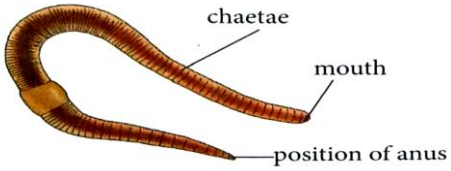
MOLLUSCS

- They have soft bodies
- They have non- segmented bodies.
- They have two pairs of tentacles.
- Examples of molluscs include: snails, slugs, octopuses and oysters.
- Many molluscs are aquatic and some of them live on land.



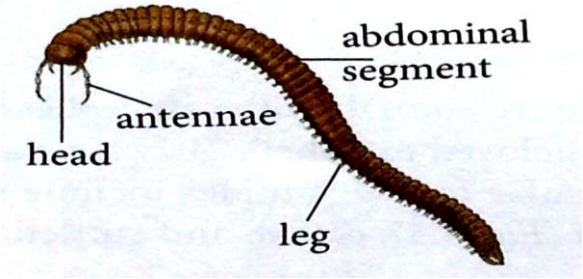
ANNELIDS

- Annelids are segmented worms with chaete/bristles.
- They live in moist soils.
- Examples include earthworms (shown below), lungworms and leeches.



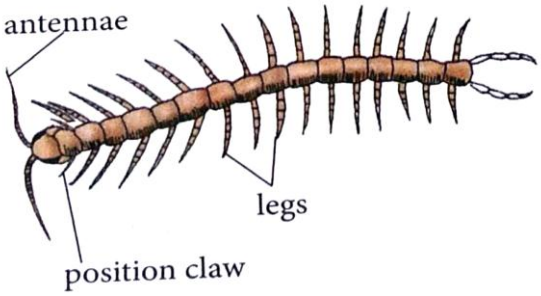
MILLIPEDES

- Millipedes have long cylindrical bodies.
- Their bodies are divided into two parts, the head and a segmented trunk.
- Each body segment has two pairs of legs.



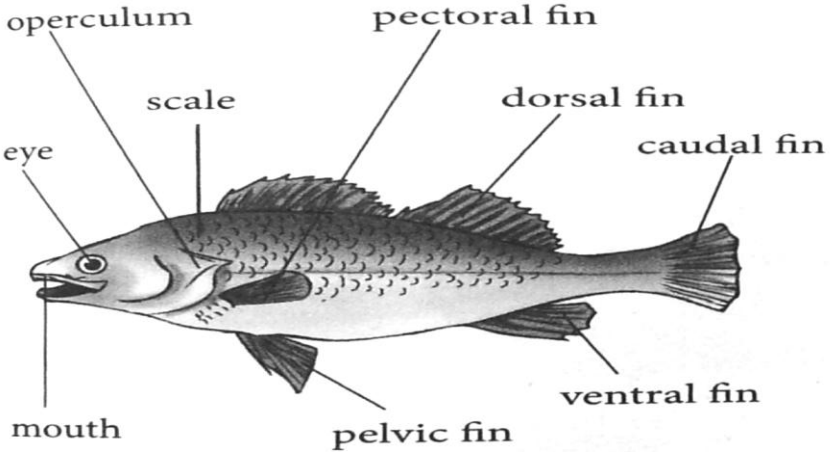
CENTIPEDE

- Centipedes have long flat bodies with legs positioned on either side of the body.
- They have many segments.
- Each segment has one pair of legs.



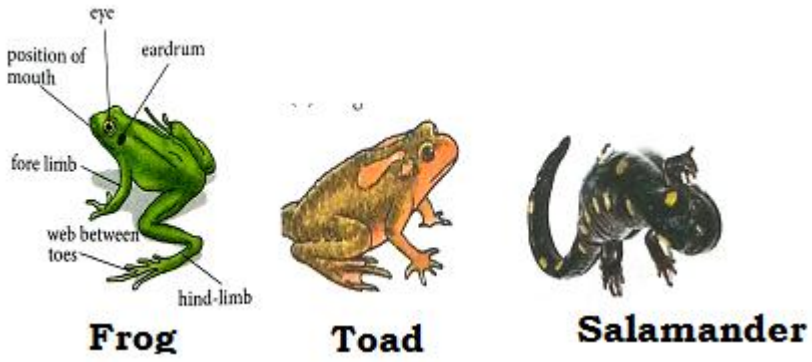
FISH

- All fish live in water.
- Their bodies are covered with scales.
- They have fins for movement.
- They have gills for gaseous exchange.



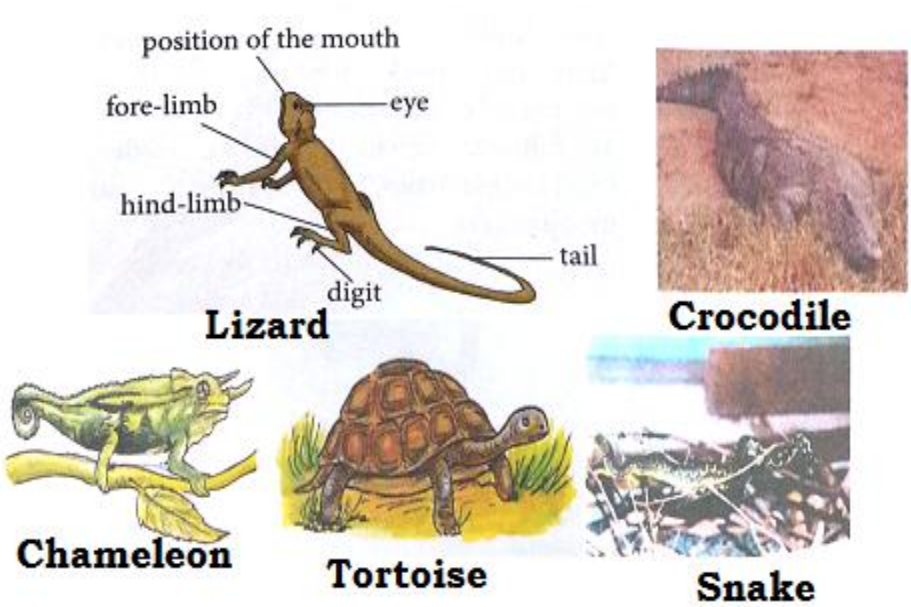
AMPHIBIANS

- The word *amphibia* comes from the word "amphi" which means "dual" or two.
- They live in both land and water.
- They have moist skin.
- They breed in water and fertilization is external.
- They mucous glands under their skin to keep the skin moist.
- Young amphibians have gills and live in water, while the adults live on land and have lungs.
- Examples are frog and toads.



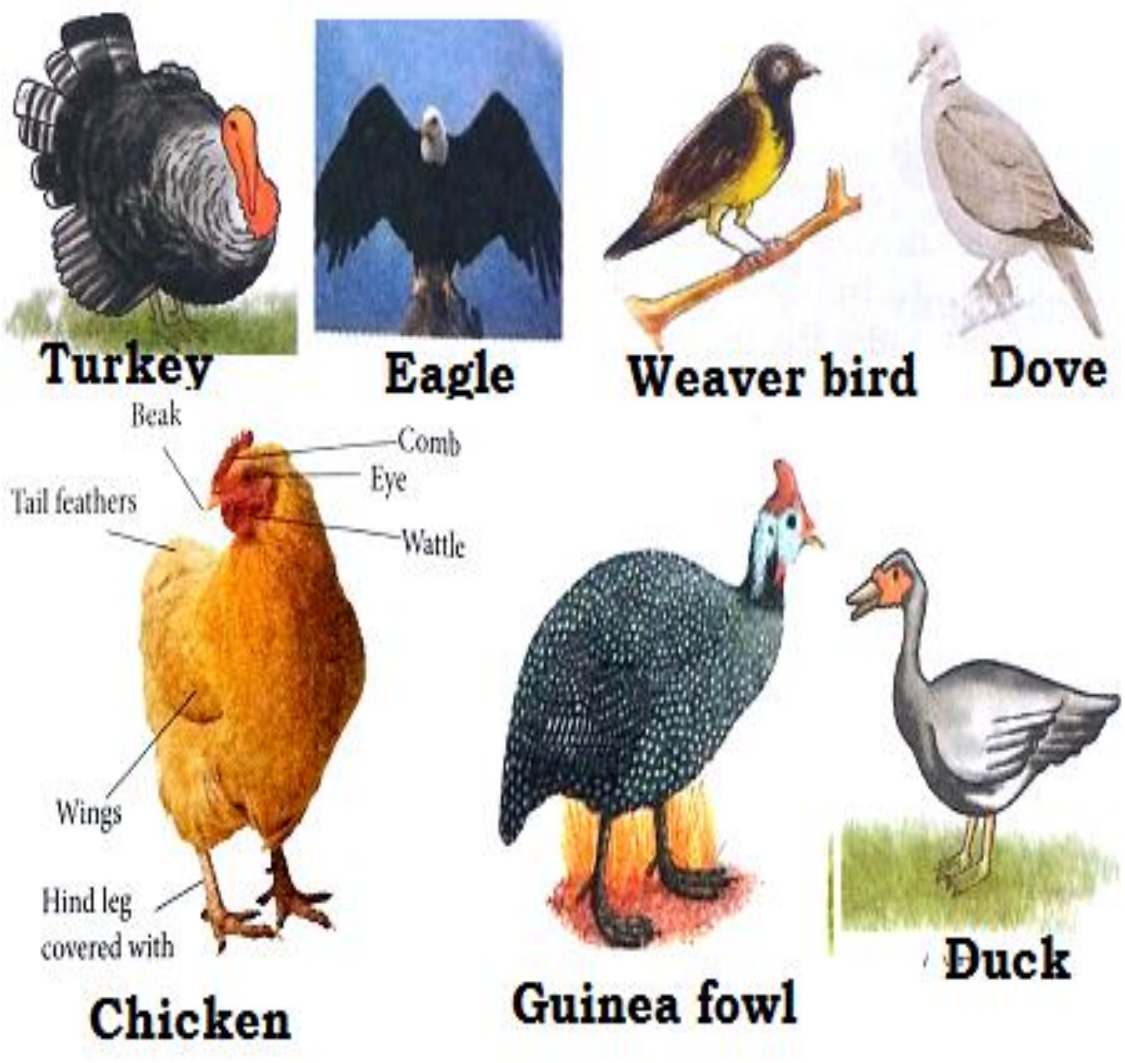
REPTILES

- Reptiles move by creeping or crawling.
- Their fertilization is external
- They have well developed lungs for gaseous exchange.
- Examples are snakes, tortoise, crocodiles and lizards.



BIRDS

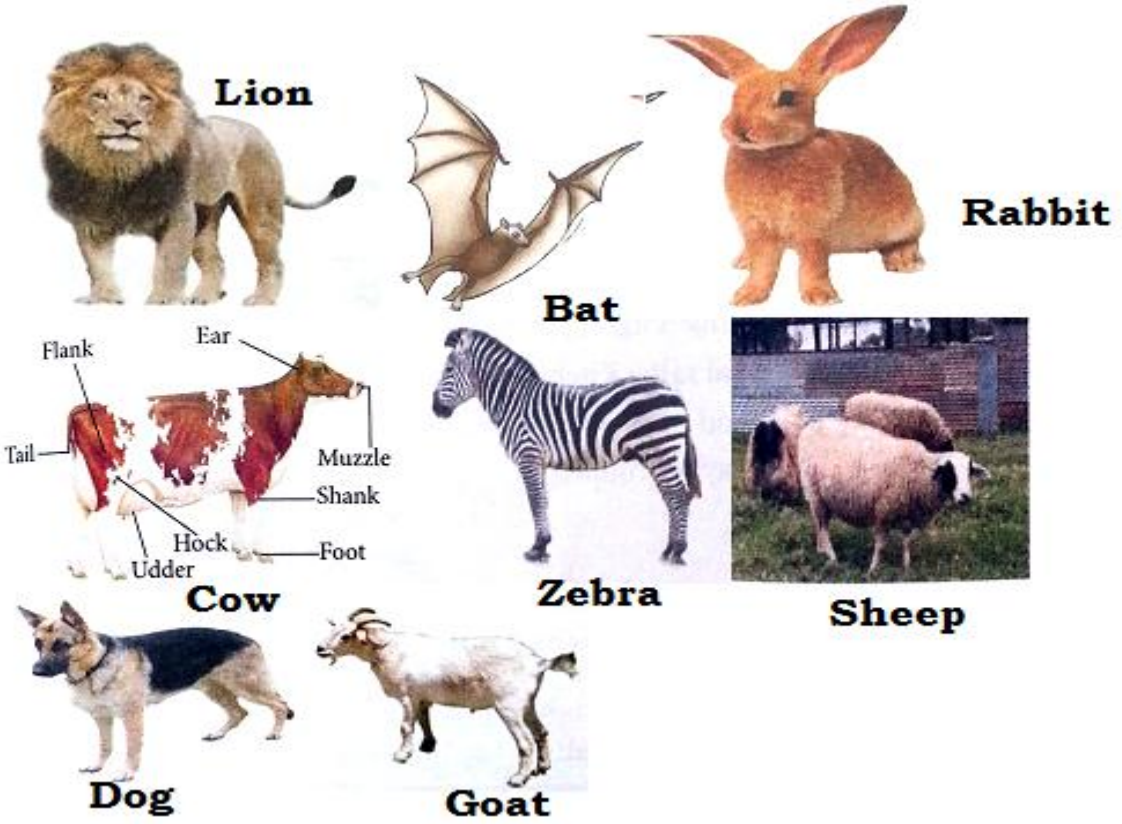
- Birds have bodies covered with feathers; their legs are covered with scales.
- They have wings
- They have beaks for feeding.
- Examples birds include: hawks, sparrows, eagles, chicken, ostriches and parrots.



MAMMALS

- They have fur or hair on their bodies.
- They have mammary glands
- They have teeth of different types and sizes
- They have developed lungs for gaseous exchange.

- Examples of mammals include: cats, dogs, sheep, goats, whales, man, bats and kangaroos.



CHAPTER 5- NUTRITION IN HUMANSTYPES OF FOOD NUTRIENTS

1. CARBOHYDRATES

Carbohydrates are made from the elements carbon, hydrogen, and oxygen.
Examples of carbohydrates include sugar and starch
Sources of carbohydrates include

- Maize
- Wheat
- Sorghum
- Millet
- Cassava
- Yams

THE USES OF CARBOHYDRATES

a. Source of energy for various processes in living organisms.
b. Used for formation of cell walls or cellulose
c. Used as food reserves which are stored within organisms

THREE GROUPS OF CARBOHYDRATES

a. **Monosaccharide** – these are simple sugars and consist of a single sugar molecule.
   Examples of monosaccharide are
   - ✓ Glucose
   - ✓ Sucrose
   - ✓ Galactose

b. Disaccharides- these are sugars that consist of two monosaccharide molecules
   Examples of disaccharides include
   - ✓ Sucrose (sugarcane)
   - ✓ Lactose(milk sugar)

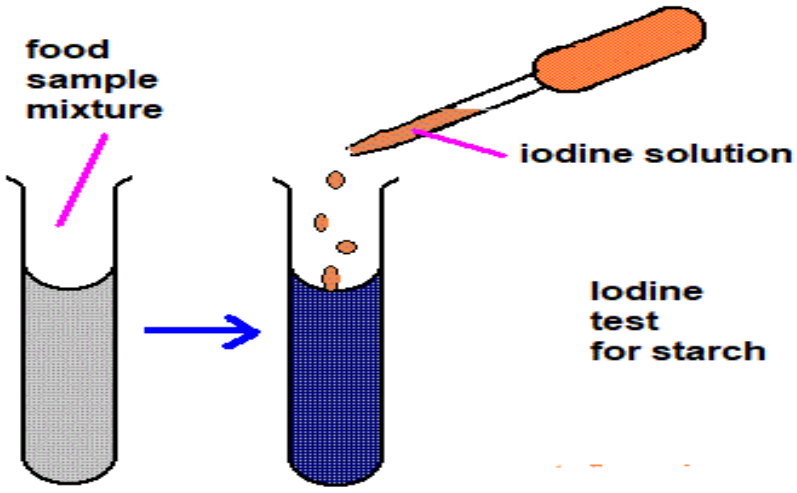
c. **Polysaccharide –** They are made of thousands of monosaccharide molecules.
   Examples of polysaccharides include
   - ✓ Starch found in storage organs such as cassava, bread, sweet potatoes, maize and rice
   - ✓ Glycogen made in the liver and stored in the liver and muscles
   - ✓ Cellulose- which forms part of the plant cells

TESTING FOR CARBOHYDRATES

In testing for carbohydrates, three tests are carried out and these are

a. Test for starch
b. Test for reducing sugars- test for the presence of monosaccharide's and maltose
c. Test for non-reducing sugars such as sucrose

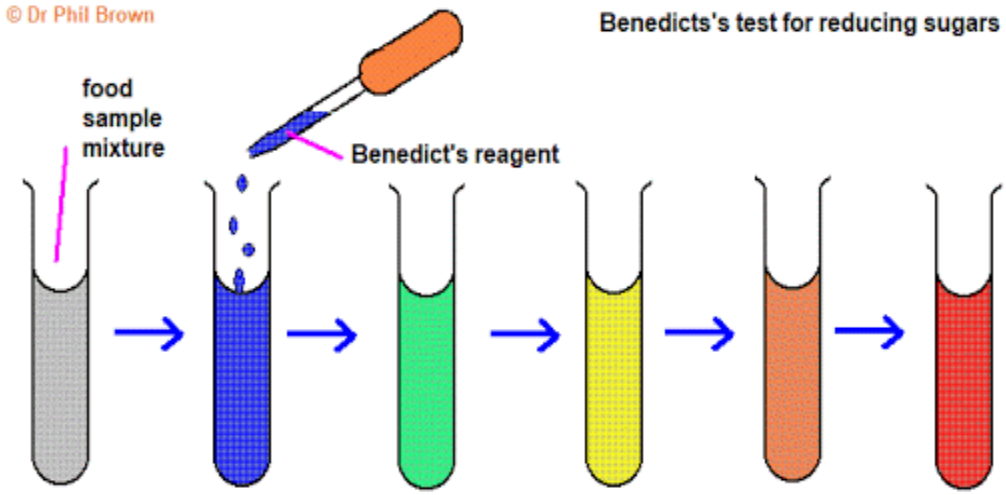
TEST FOR STARCH



The carbohydrate starch is present in many foods such as beans, bread, cereal grains, corn, pasta, peas, potatoes and rice.

Put a few cm^3 of prepared filtered food sample mixture into a test tube.
Add a few drops of a dilute **iodine solution** (pale orange-brown) and carefully shake the mixture gently.
If the food sample contains starch the mixture will turn from pale orange to a **dark blue-black colour**.
If no starch is present, you should not see any significant colour change - the solution remains a pale orange-brown.

REDUCING SUGARS TEST



Take two test-tubes and put $2cm^2$ of glucose solution in one test-tube and put $2cm^2$starch solution in other test-tubes. Label the test- tubes with the solutions in them. To each test-tube, add $2cm^2$ of Benedict's solution (blue). Heat for about two minutes and observe the colour change.

Results- Benedict's solution is the chemical reagent used to test for the presence of reducing. When boiled with glucose an orange precipitate or brick-red colour forms in the testing that contains glucose. In other words, if the food sample contains a reducing sugar, the solution in the test tube will change from the **initial blue** colour through a series of colours from **a green solution ==> yellow solution ==> orange ==> brick-red precipitate**.

TESTING FOR NON- REDUCING SUGARS

- Put a few cm^3 of prepared filtered food sample mixture into a test tube and add a few cm^3 of dilute hydrochloric acid and gently and carefully shake the mixture and then boil
- Set up a water bath and set the thermostat to ~75°C and wait for it to warm up.
- Place the test tube in the water bath using a test tube holder and leave it for at least 10 minutes

- The hydrochloric acid catalyses and **hydrolyses non-reducing sugars like sucrose into reducing sugars like glucose or fructose**.
  e.g. sucrose ====> glucose + fructose
  $C_{12}H_{22}O_{11}$ + H_2O ===> $C_6H_{12}O_6$ + $C_6H_{12}O_6$
- Therefore, you can now test the solution for reducing sugars derived from non-reducing sugars!. Remove the test tube from the water bath and place it in a test tube rack.
- You then add sodium carbonate to neutralise the acid.
- Then test the neutral solution with Benedict's reagent.
- If reducing sugars have been formed, the solution in the test tube will change from the **initial blue** colour through a series of colours from **a green solution ==> yellow solution ==> orange ==> brick-red precipitate**.
- **If the test with Benedict's solution is negative for both tests (a) and (b), the food probably didn't contain any sugar at all.**

2. PROTEINS

Proteins are compounds made up of amino acids. They are made up carbon, hydrogen, oxygen, nitrogen pork, oxygen. Etc.

Sources of p[proteins include milk, beef, eggs, legumes, fish ,pork etc

The functions or uses of proteins

- They are body building nutrients
- They help in the formation of enzymes
- They assist in the formation of hormones in the body.
- Formation of hemoglobin that is used in the transportation of oxygen
- Assist in the formation of antibodies that destroy harmful bacteria.
- Acts as alternative source of energy.

PROTEIN TEST – THE BIURET TEST

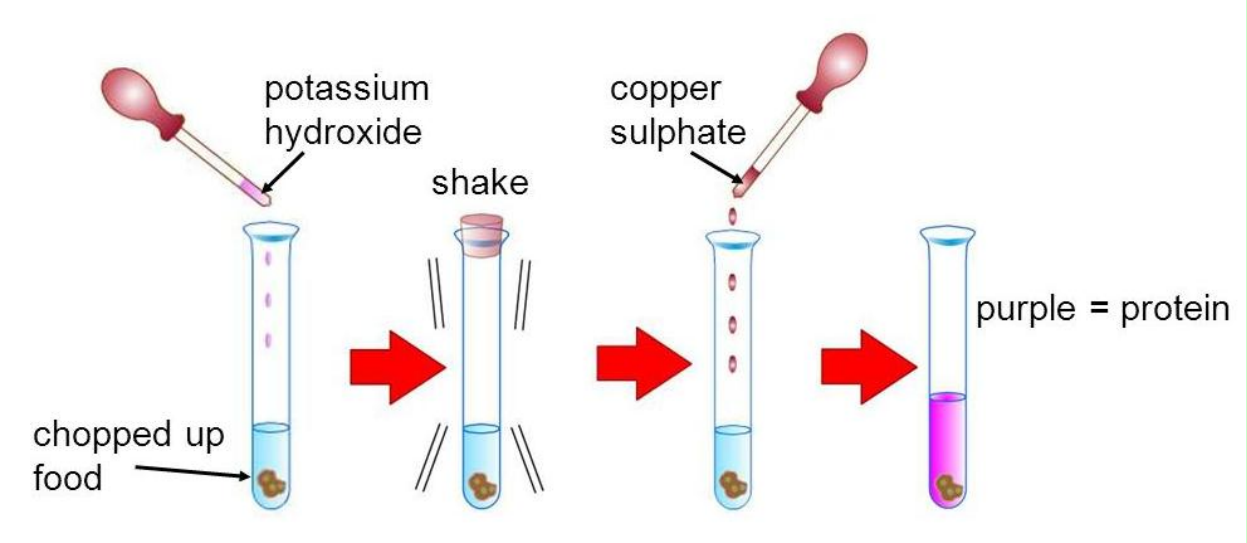
Foods such as meat, fish and cheese are rich in protein.

Put a few cm^3 of your previously prepared filtered food sample mixture into a test tube.

Add a few cm^3 of **potassium hydroxide** followed by a few cm^3 of **copper sulfate** solution to the food sample and carefully gently shake the mixture.

If protein is present in the food sample the solution should turn **from blue to pink or purple**.

If there is no protein in the food sample the mixture just stays the characteristic blue of a copper salt solution.



Result- Copper sulphate is pale in colour. In the presence of a protein, its colour changes purple. The appearance of purple colour, therefore, is a confirmation of the presence of a protein. If the test-tubes is shaken, the contents should violet.

3. LIPIDS-

Lipids are a composition of fats and oils. Sources of fats are groundnuts, cooking oils, fatty meats, butter and margarines.

The uses of lipids

a. They provide energy to the body.
b. They are used for the formation of cell membranes/plasma membranes.
c. They insulate the body against heat loss

LIPID TEST

Put a drop of oil on some absorbent paper, hold it up against light from the window and note what you observe.

Result- A translucent mark indicates presence of oil or fat.

OR

Two tests for lipids (fats)

Foods such as margarine, milk, vegetable oils like olive oil or sunflower oil contain lipids (chemically they are often fatty acid esters).

(a) **The emulsion test for lipids**

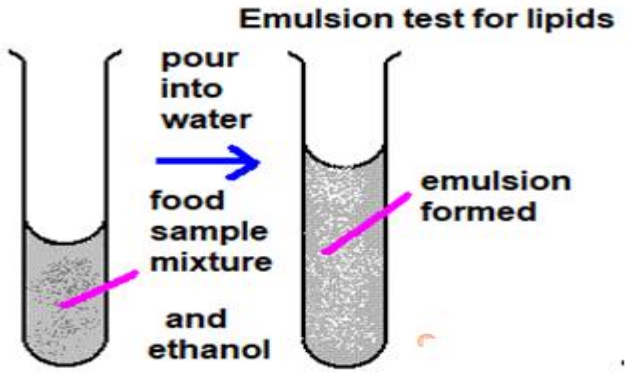
You mash up a sample of food, as before, with a pestle and mortar and mix with a few cm^3 of ethanol (NOT water) and mix up in a test tube for a few minutes (there is no need to filter it).

Let the mixture settle out.

The ethanol dissolves any lipid (fatty/oily) molecules present - lipids are NOT soluble in water.

You then carefully pour the contents of the 1st test tube into a 2nd test tube containing a few cm^3 of pure water and carefully shake the mixture (try to avoid food particles getting into the 2nd test tube).

Since lipids are not soluble in water, any lipids dissolved in the ethanol are precipitated out as fine globules of oil, so you see a **milky emulsion**. If no fatty/oily lipid molecules are present, you don't see a milky emulsion.



4. MINERAL SALTS

	Sources	Functions
Calcium	Beans, milk, cheese, fish	Formation of bones and teeth
Iron	Liver, meat,eggs,beans	Formation hemoglobin
Phosphorous	Red meat, dairy foods,fish,rice	Needed for strong bones and teeth
Iodine	Iodized salt, sea fish, cereals	Needed by the thyroid gland in the neck region
Sodium chloride	Meat products, breakfast cereals	Formation of blood plasma, needed for digestion
Potassium	Fruits, milk,fish,beef	For muscle contraction
Magnesium	Bread, spinach, bread, fish	Reduced rate of clotting of blood
Fluorine		Needed for strong teeth and

		bone development

BALANCED DIET

A balanced diet is one that contains all the food nutrients in the required amounts. In other words, a balanced diet is a diet containing all food nutrients in the right proportion. A balanced diet should contain all of the following: proteins, carbohydrates, lipids, mineral salts, vitamins and water.

How to plan a balanced diet

It requires you to remember a few basic nutrition principles in locally available food. First choose a food from each category like lean protein, low starch, vegetable, healthy fat or oil and a whole grain product.

1. Examples of a lean protein includes skinless chicken, lean meat, eggs and fish.
2. Examples of low starch include cabbage, carrot, green beans, onions, pepper etc
3. Examples of healthy fats include avocado, olive oil, peanut oil and most nuts.
4. Examples of whole grain products include rice, maize, mawere
5. Examples of starchy vegetables include maize, green peas, potatoes, seat potatoes and cassava.

DEFICIENCY DISESASES

These are diseases or disorders that occur in a body when nutrients in a diet are not sufficient.

EXAMPLES OF DEFICIENCY DISEASES

DISEASES

1. GOITRE

- It is caused by lack of iodine in the diet
- The signs of goitre include the swelling of the thyroid gland in the throat.
- Goitre can be treated by surgical removal of the gland

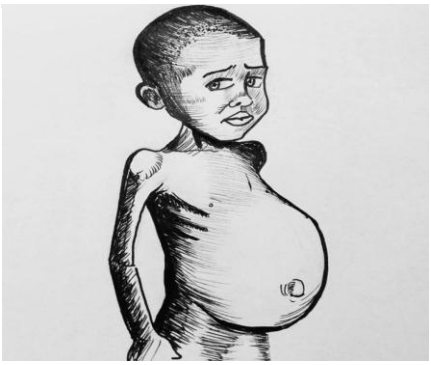
- It can be prevented by adding iodine to the diet in the form of iodised salt.

2. KWASHIORKOR

- It is caused by **lack of proteins** in the diet.

The following are the signs of Kwashiorkor

- Weight loss
- Oedema-swelling of the face because of water retention
- Diarrhoea
- Poor appetite
- Stunted growth
- Miserable looking appearance
- Pale skin which peels easily
- Large and protruding abdomen
- Hair is weak, parse and pail and non-curled



- Kwashiorkor can be treated by having regular well balanced meals.
- It can be prevented by having balanced diet with adequate proteins.

3. MARASMUS

- It is caused by starvation, shortage of protein and carbohydrate in the diet.
- The following are the signs of marasmus
  a. Looking alert but very thin
  b. Monkey-like face
  c. The child has wrinkled skin
  d. Good appetite
  e. Weakness
  f. Stunted growth
  g. Waste muscles
  - Marasmus can be treated by giving the child regular well balanced meals.
  - Therefore, it can be prevented by giving the child regular well balanced meals.

4. PELLAGRA

- It is caused by lack of vitamin B3 or niacin.
- The following are the signs of pellagra
  a. Cracking, crusting and scaling of skin.

  b. Diarrhoea.

c. Nervousness

d. Dizziness

- It can be treated or prevented by eating food that contains more of vitamin B3 which include meat, whole grain cereals and green vegetable.

5. RICKETS

- It is caused by lack of vitamin D in the diet.
- The signs of rickets include curved legs, enlarged and tender joints and bony chest.

- It can be prevented by taking food that is rich in vitamin D.

6. NIGHT BLINDNESS

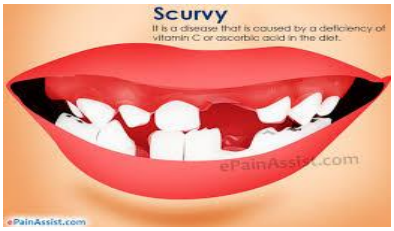
- It is caused by lack of vitamin A in the diet.
- The signs of night blindness include
  a. Dry eyes
  b. Loss of shine in the white eyes**.**
- Night blindness can be prevented by eating food that is rich in vitamin A which includes red and yellow fruits and vegetables in the diet**.**

7. Scurvy

Deficiency of vitamin C can cause scurvy, a disease that is characterized by bleeding gums, skin spots and swelling in joints. It also affects the immune system and can even be fatal in acute conditions. Scurvy is caused by lack of vitamin C in the diet

SIGNS AND SYMPTOMS

- Easily bruised skin
- Softening of the gums and loosing of the teeth



- Failure of the wounds to heal.

- Bleeding gums
- Painful joints
- Reduced resistance to infection
- Loss of energy
- Teeth become loose

PREVENTION AND CONTROL

- It can be prevented by including more sources of vitamin C in the

8. BERIBERI

It is caused by lack of vitamin b1(thiamine)

THE FOLLOWING ARE SIGNS AND SYMPTOMS OF BERIBERI

- Lack of appetite
- Weakness of the limbs
- Lack of nervous sensation in the ends of nerves leading to paralysis
- Mental disturbances
- Weakness and shrinking of muscles which leads to malfunctioning of muscular organs such as heart.
- Stunted growth and paralysis of the legs and arms

Control

- Provide food rich in vitamin B1 such as liver, peas, beans and meat.

8. ANAEMIA

- It is caused by lack of iron in the diet.

CAUSES OF ANAEMIA

1. Excessive bleeding due to injuries and accidents
2. Persistent menstruation
3. Diseases such as malaria and leukemia (cancer of blood)

4. Infestation by worms such as hookworms and bilharzia worms. The worms suck a lot of blood. They also cause injuries in alimentary canal leading to serious bleeding.
5. Lack of iron in the in the diet.
6. Hereditary defects such as sickle cell anaemia and haemophilia. Haemophilia is a condition whereby blood takes long to clot. This leads to excessive blood loss, in case of injury.

THE SIGNS OF ANAEMIA

- General body weakness
- Heart palpitations
- Paleness of mucous membranes, tongue and skin
- Oedema
- Breathlessness

1. BERI-BERI

- It caused by lack of vitamin B1 in the diet.

OBESITY

It is a condition whereby the body weight of a person is considered greater than what is normal.



CAUSES OF OBESITY

The following are causes of obesity

- Consumption of more food than what the body requires.
- Lack of physical activity
- Sedentary lives – having lives with less walking and working.
- Heredity – some individuals are born with traits of growing obese.
- Eating an unbalanced diet – a diet high in fat or carbohydrates

- Use of some medicine that reduce body activity. These medicine slow down break down of sugars to produce energy. All excess sugars are stored as fats.

The figure below shows a person who is suffering from obesity

RISKS/EFFECTS OF OBESITY

Obesity is a health risk. An obese person may be at greater risk of:

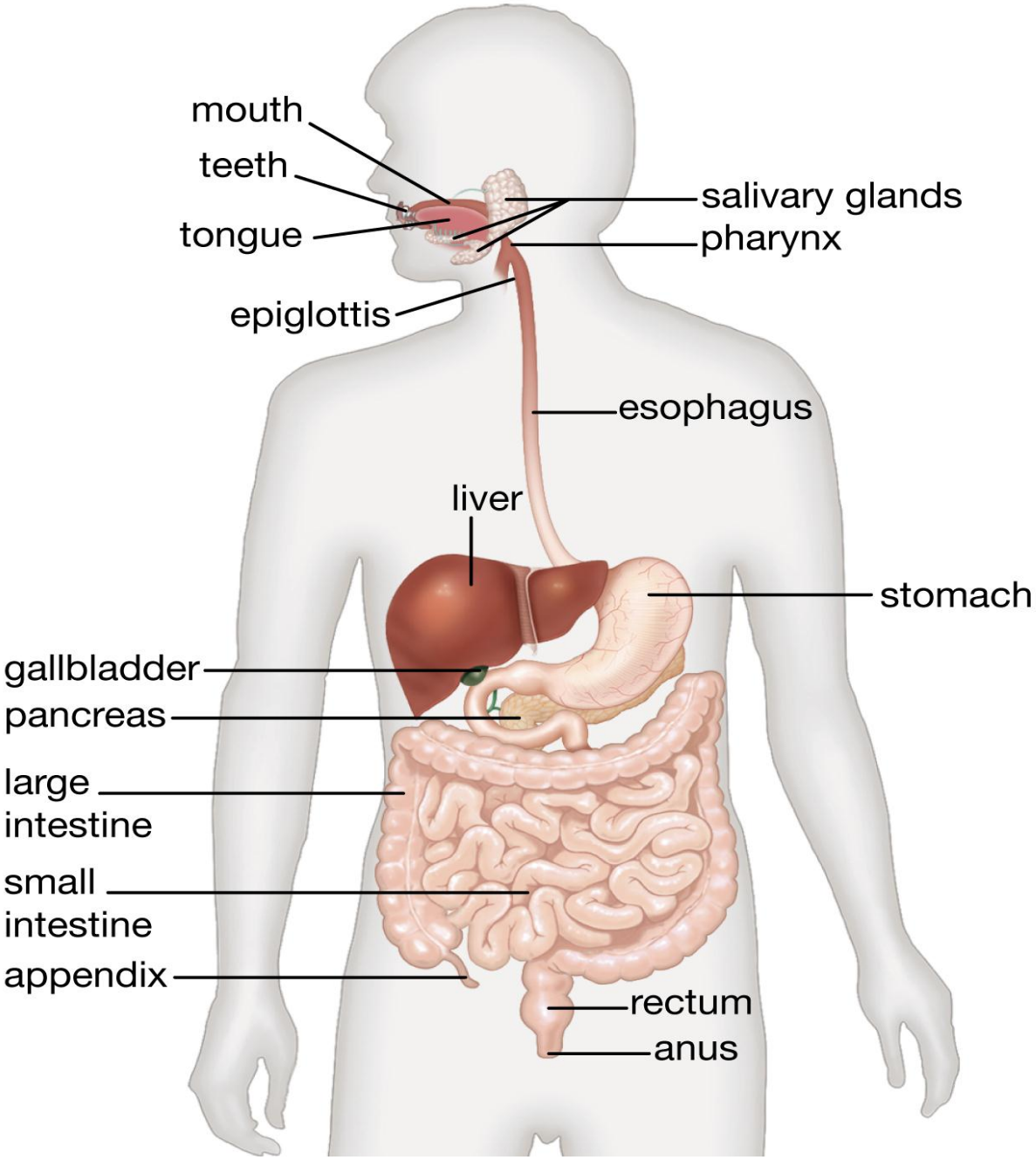
- Heart attack
- Diabetes
- High blood pressure
- Stroke in the brain
- Heart disease
- Breathing problems

PREVENTION AND CONTROL OF OBESITY

The problem of obesity can be solved by:

- Avoid overfeeding
- Regular physical exercises which helps to control weight and reduce weight in obese persons.
- Feed on the diet with more vegetable and less starch

CHAPTER 6- HUMAN DIGESTIVE SYSTEM



WHAT IS DIGESTION?

It refers to the process of breaking down of large food particles into smaller particles that can be absorbed into the blood stream.

EXPLAIN THE TWO TYPES OF DIGESTION.

1. **PHYSICAL DIGESTION**

It involves the breaking of large particles to small food particles by the action of the teeth and the muscular action of the stomach walls.

2. CHEMICAL DIGESTION

It involves the breaking down of large food particles into smaller food particles that can easily absorbed into the blood stream by the use of enzymes.

THE PROCESS OF DIGESTION IN THE MOUTH

PHYSICAL/MECHANICAL DIGESTION IN THE MOUTH

The chewing action of the teeth (mastication) begins the physical or mechanical digestion of food particles in the mouth.

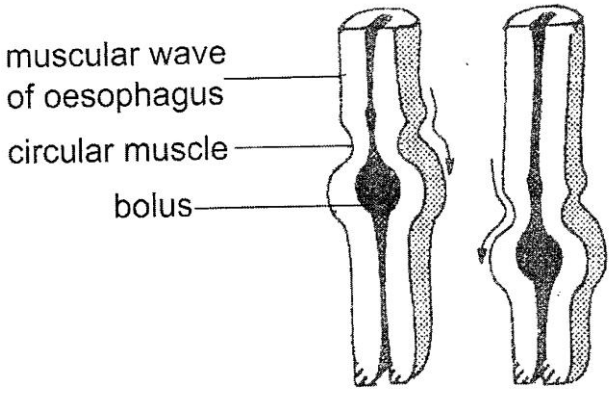
It increases the surface area of food for digestive enzymes to work on and makes swallowing easier.

CHEMICAL DIGESTION IN THE MOUTH

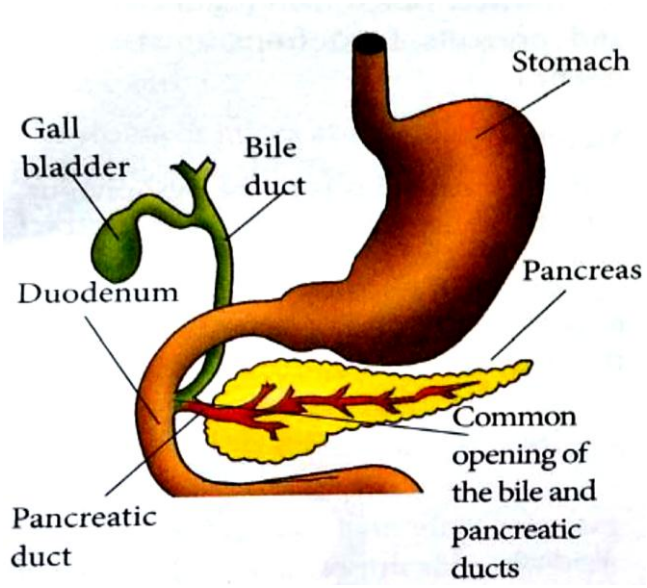
- The chemical digestion of carbohydrates begins in the mouth.
- The mouth contains **salivary glands** that produce digestive juice known as **saliva.**
- Saliva acts on **carbohydrates.**
- Saliva contains digestive enzymes known as **salivary amylase (Ptyalin).**
- **Salivary amylase (ptyalin)** acts on **carbohydrates** and breaks them down to **maltose**. In other words, salivary amylase breaks **starch** to **maltose**.
- A part from salivary amylase, saliva also contains, mucin, salts and water.
- **Mucin** moistens, softens, and lubricates food and this makes dry food easy to swallow.
- Salts provides alkaline pH optimum for the action of salivary amylase.
- Water moistens and softens the food for easy chewing and swallowing.

THE PERISTALYSIS PROCESS IN THE OESOPHAGUS

Peristalsis is the means by which food and fluids are moved along a muscular tube from the mouth to the stomach by alternate contractions of circular and longitudinal muscles



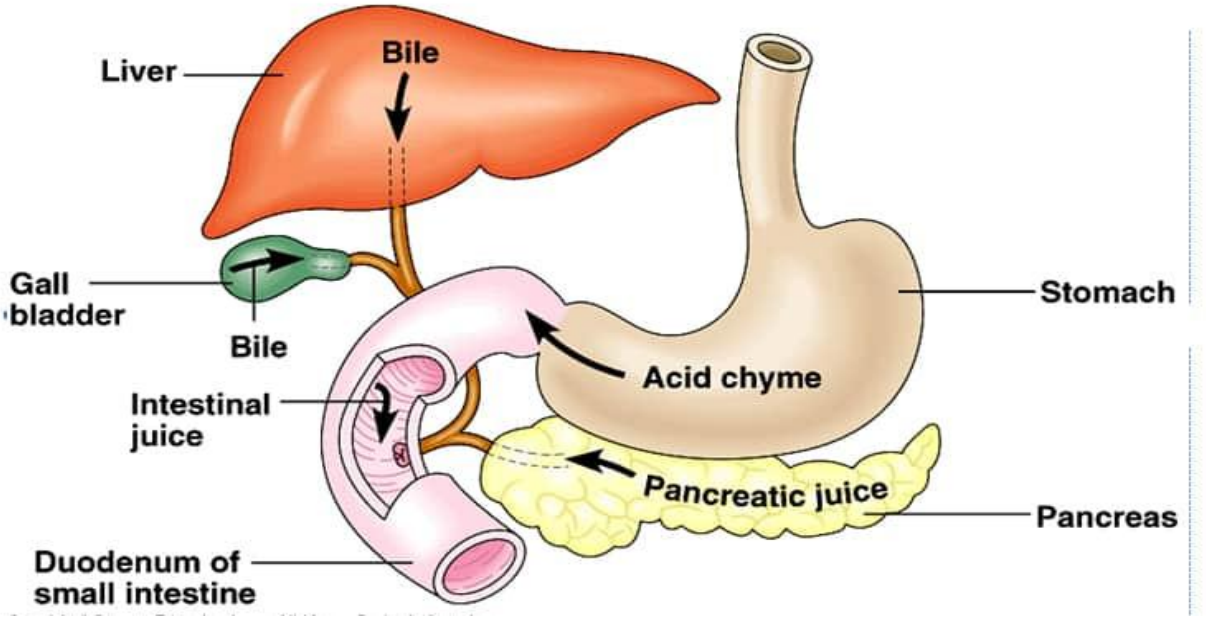
CHEMICAL DIGESTION IN THE STOMACH



The gastric glands	The stomach contains gastric glands
Function	Gastric glands produce digestive juice known as gastric juice. Gastric juice acts on proteins
Secretion	This is process of producing useful substances in the body. Three substances that secreted in the stomach are enzymes pepsin and renin, hydrochloric acid and mucus.
Enzymes	Gastric juice contains two digestive enzymes a. **Pepsin-** this enzyme breaks down proteins to peptides b. **Renin-** this enzyme breaks milk protein casein to caseinogen so that milk protein can easily be digested by pepsin to peptides. The chemical digestion of proteins begins in the stomach of the human digestive system.
Hydrochloric acid	The functions of hydrochloric acid include a. It provides acidic medium for the action of enzyme pepsin. b. It kills bacteria that come in with the food. c. It activates pepsinogen into pepsin d. Dissolves bones brought to the stomach

Mucus	a. It lubricates the food b. It protects the stomach walls from being eaten by pepsin or eaten by hydrochloric acid.

THE FUNCTION OF THE LIVER



THE LIVER HAS THE FOLLOWING FUNCTIONS

a. Produces bile.

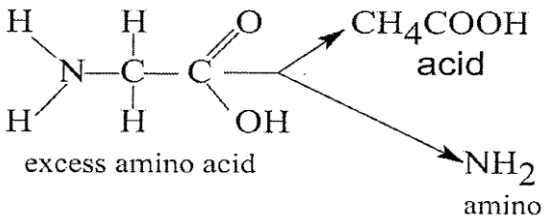
The function of bile is

- ✓ To ***emulsify fats*** in the duodenum in order to increase the surface area for lipase enzyme to act on it.

  Emulsification is the process that involves the breaking down of large fat particles into small droplets that can easily be digested by enzymes.
- ✓ **It contains sodium bicarbonate salts** that change acidic chime to alkaline suitable for the enzymes from the pancreas**.**

b. It stores Iron

c. It de-aminates excess amino acids to form urea.



d. It stores excess glucose in the form of glycogen with the aid of insulin hormone.

e. It detoxifies harmful bacteria.

FUNCTIONS OF THE GALL BLADDER AND BILE DUCT

Gall bladder

It stores bile produced in the liver

Bile duct

It transport bile from the gall bladder to the duodenum

FUNCTIONS OF PANCREAS

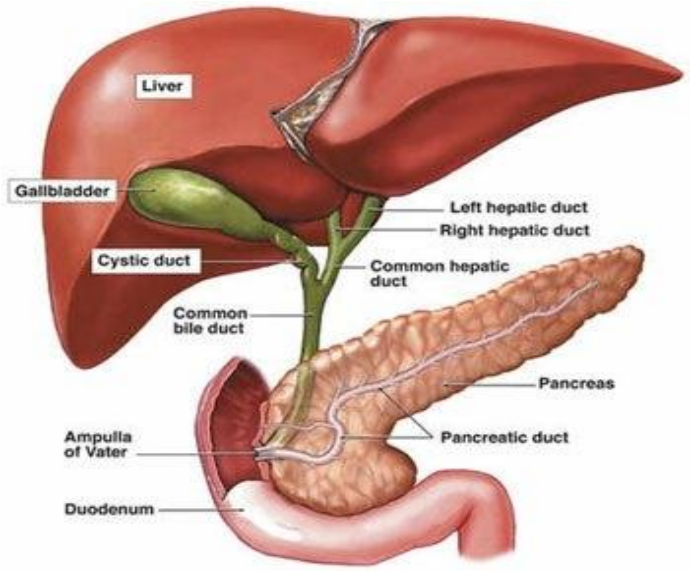
a. It produces digestive juice called pancreatic juice –This is the digestive function of pancreas. Pancreas produces **three enzymes** that are contained **in pancreatic juice** namely

- ✓ **Pancreatic amylase**- that converts **uncooked starch/carbohydrates** to maltose
- ✓ **Trypsin**- that converts **proteins** to **peptides**
- ✓ **Lipase**- that converts **fats/lipids** to **fatty acids and glycerol**.

b. It produces insulin hormone to control the amount of sugar level in the blood.

c. It produces sodium bicarbonate salts that reduces acidic chime from the stomach to alkaline condition for enzymes from the pancreas.

THE FUNCTION OF PANCREATIC DUCT



It is the passage of enzymes and sodium bicarbonate slats from the pancreas to the duodenum.

THE FUNCTION OF THE DUODENUM

It is the site for chemical digestion of starch, lipids and proteins.

THE FUNCTION OF THE SMALL INTESTINE (ILEUM)

1. It produces a digestive juice known as **intestinal juice.**

The intestinal juice contains the following actions

a. Sucrose- It breaks down sucrose to glucose and fructose

b. Maltase- It breaks down maltose to glucose
c. Lactase- It breaks down lactose to glucose
d. **Peptidase-** It breaks down peptides to amino acids
e. Lipase- It breaks down lipids to fatty acids and glycerol.
2. It site of food absorption into the blood stream

THE END-PRODUCTS OF THE CHEMICAL DIGESTION

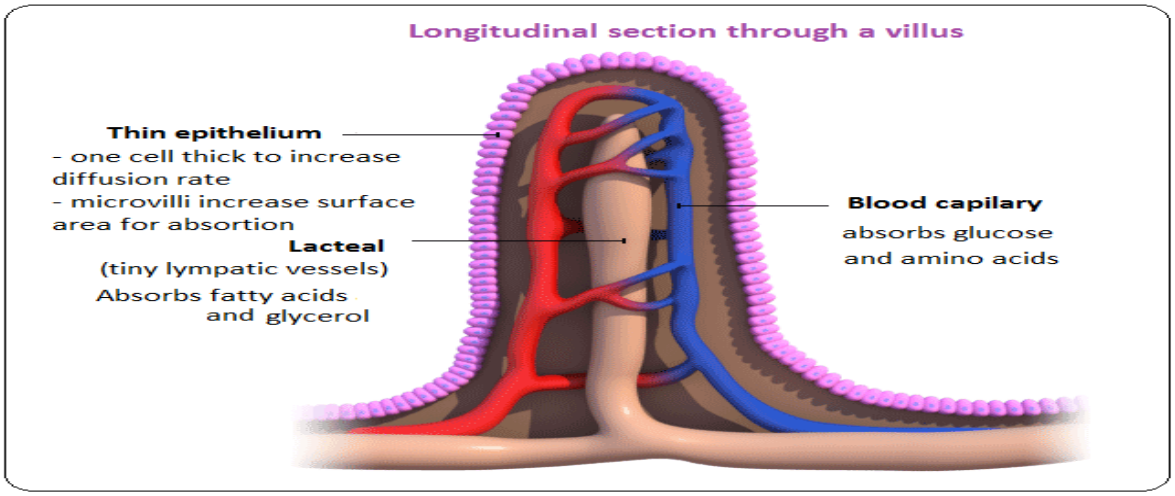
The following are the end-products of the chemical digestion	
Food substance	**End-product of the chemical digestion**
Carbohydrates	glucose
Proteins	Amino acids
Lipids/fats	Fatty acids and glycerol

ADAPTATIONS OF THE SMALL INTESTINE FOR FOOD ABSORPTION

Features	**Importance**
It is long	It increases the surface area on which the end-products of the digestion are absorbed
It contains villi	They increase the surface area for absorption into the blood stream
The thin epithelium of the villi	It provides a shorter distance through which nutrients pass into the blood stream and lacteal.
It contains network of blood capillaries	They pick up digested food particles away from the small intestine into blood stream.
Mitochondria in the small intestine	Sites of respiration to release energy used to transport food nutrients by active transport.

FUNCTION OF THE VILLUS

This is where food is absorbed into the blood stream



The is adapted for food absorption because it

a. Is well supplied with blood capillaries that absorb glucose and amino acids and transport them away into the blood stream
b. Contains lacteal that absorb fatty acids and glycerol and transport them away from the small intestine into the blood stream
c. Has thin epithelium- that provides a shorter distance through nutrients pass into the blood stream and lacteal.

The particles of digested food substances move into the blood capillaries and lacteal by either **diffusion** or **active transport**(the process that requires expenditure of energy)

THE FUNCTION OF HEPATIC PORTAL VEIN

It transports digested food particles such as amino acids and glucose from the small intestine to the liver.

WHAT HAPPENS TO THE EXCESS AMINO ACIDS AND EXCESS GLUCOSE IN THE LIVER?

a. The excess glucose is converted into glycogen for storage in the liver with the aid of insulin hormone.
b. Excess amino acids are de-aminated in the liver to produce urea. The amino group combines with carbon dioxide to produce urea while the acidic group is turned into carbohydrates to provide energy for the living cells.

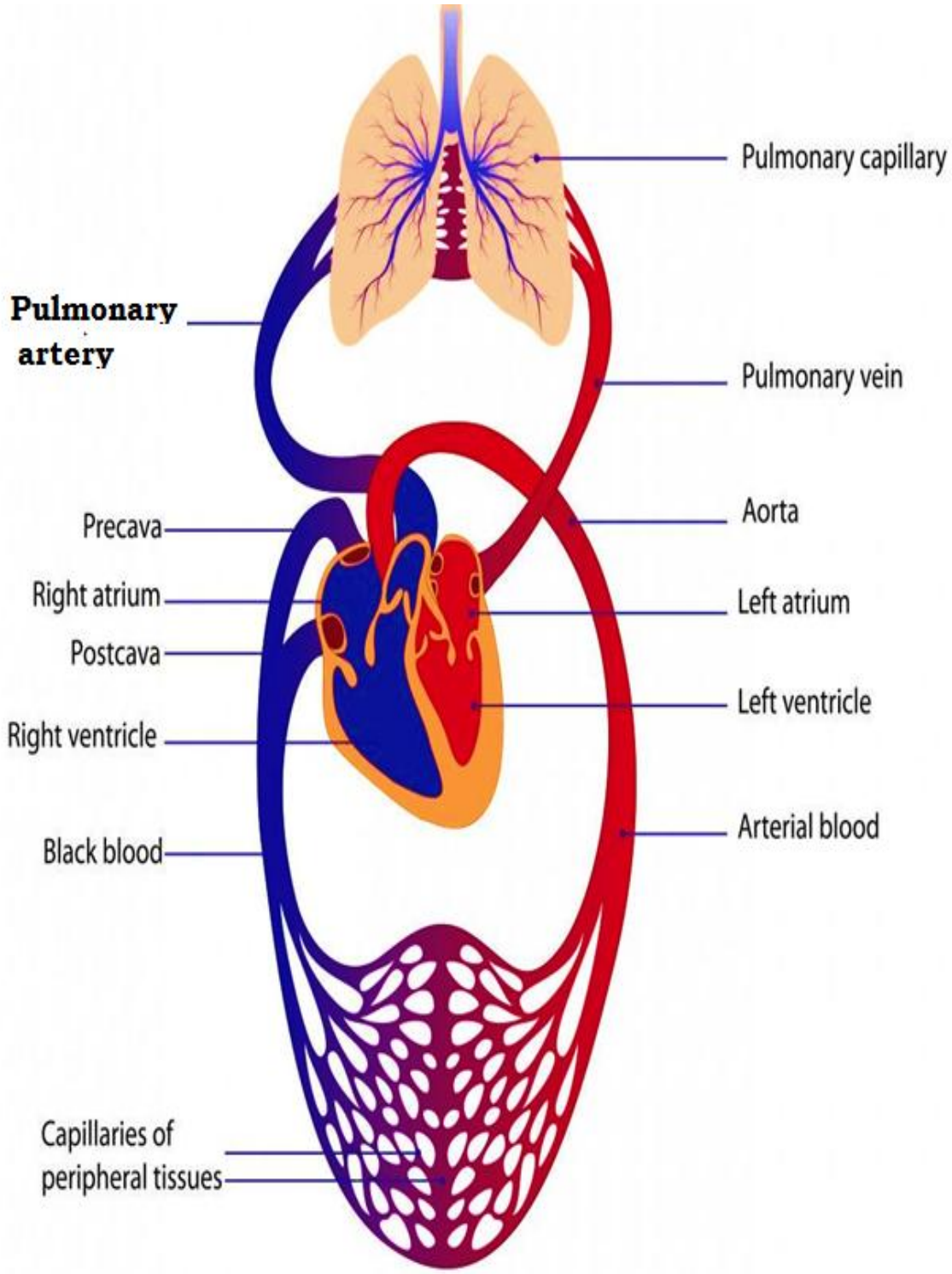
THE FUNCTION OF THE LARGE INTESTINE

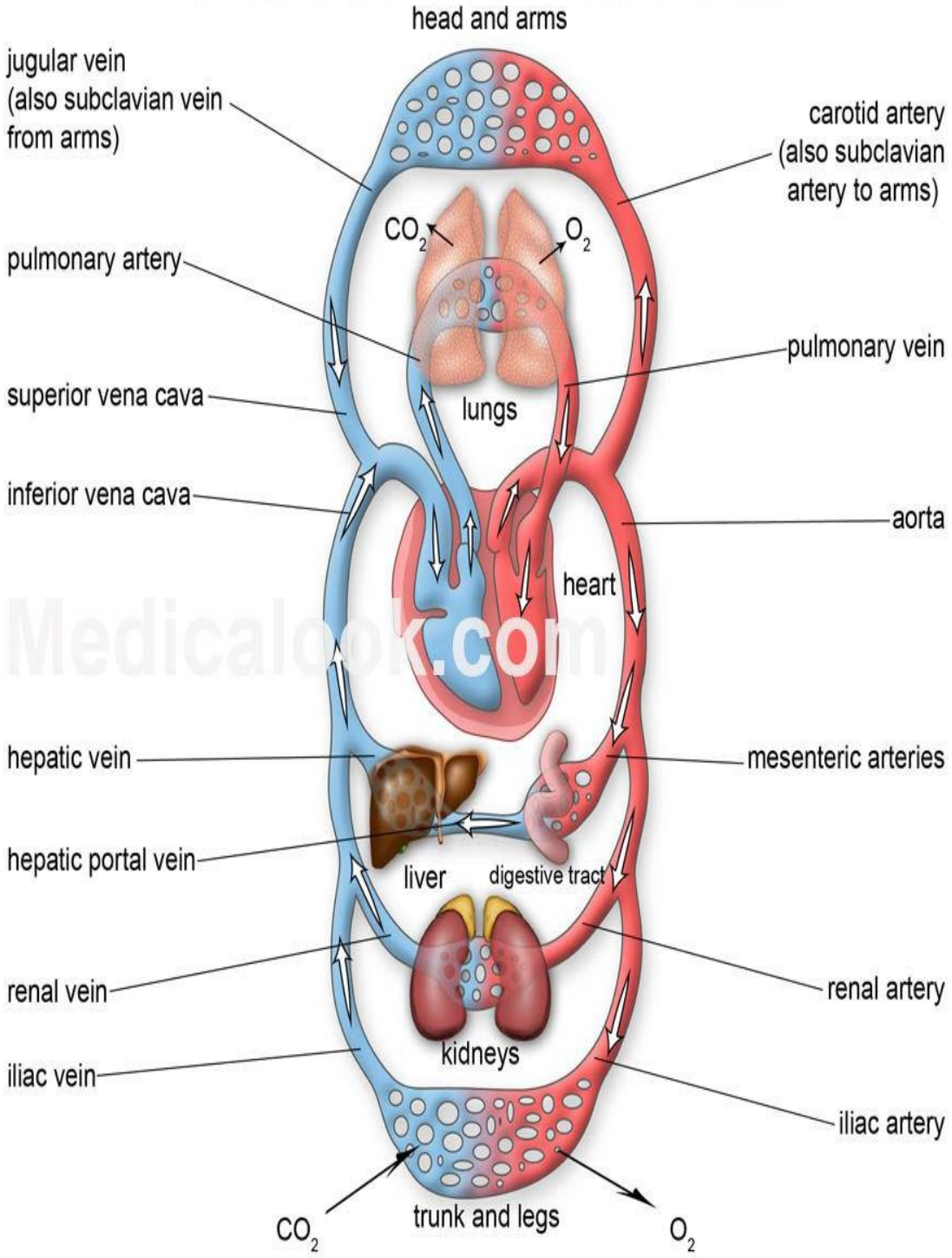
It is where water is absorbed into the blood stream.

CHAPTER 7- HUMAN CIRCULATORY SYSTEM

COMPONENTS OF THE CIRCULATORY SYSTEM

Human circulatory system consists of three main parts and these include the heart, the blood and the blood vessels.



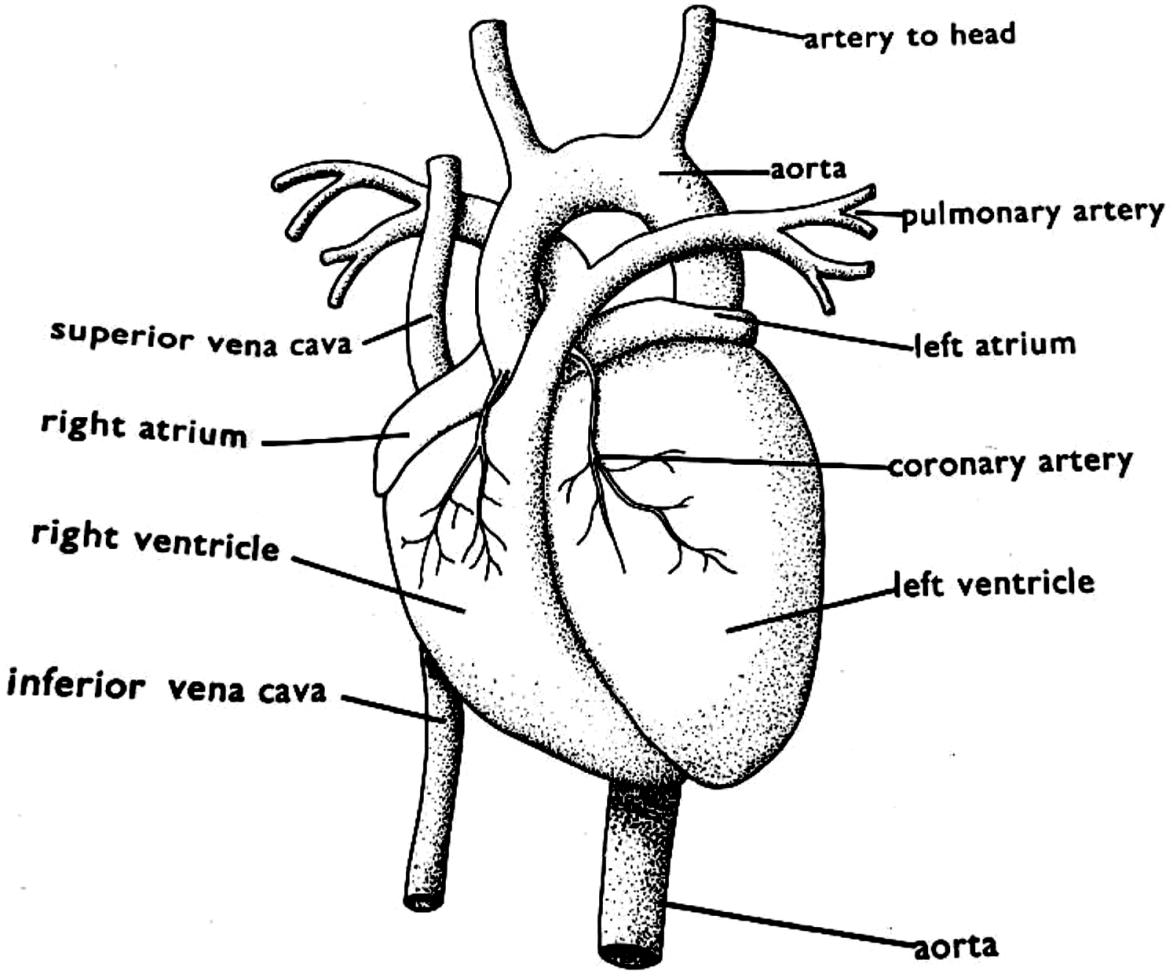


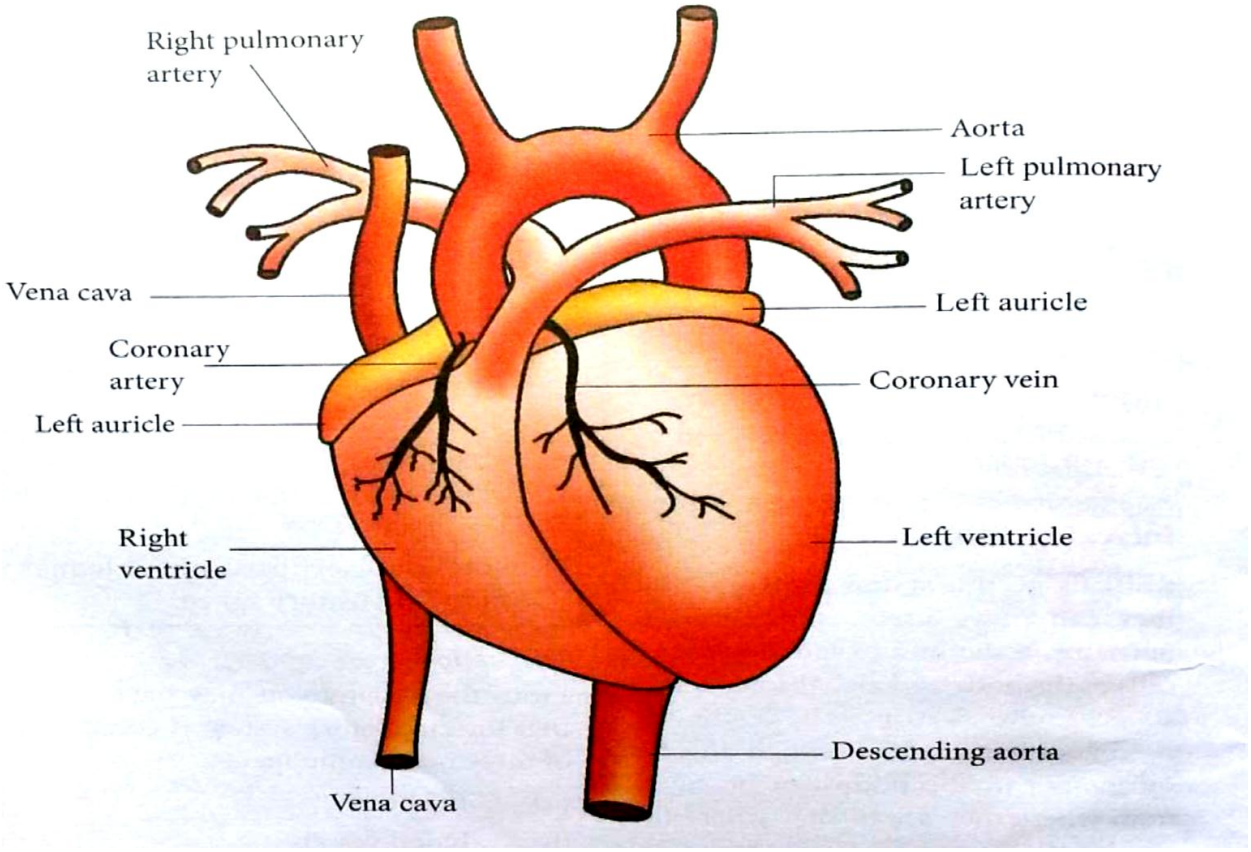
THE FUNCTIONS OF THE CIRCULATORY SYSTEM

- It transport substances
- It transport oxygen from the lungs to all parts of the body where it used in respiration process
- It transports carbon dioxide from the body tissues to the lungs for excretion.

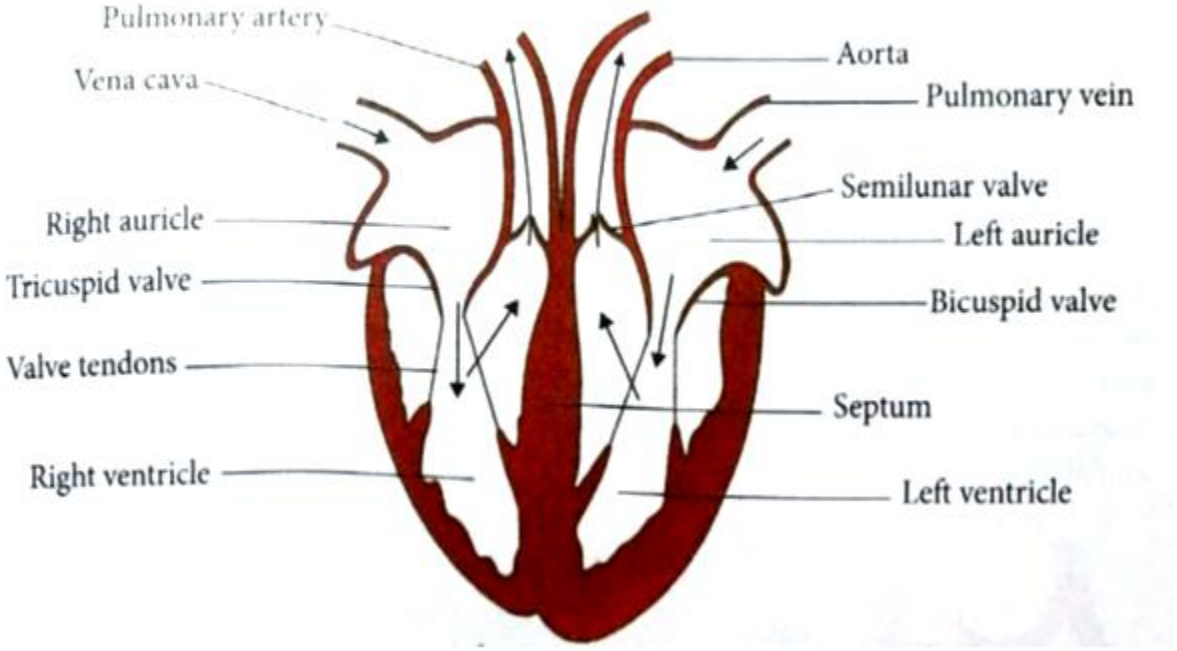
- It transports food nutrients from the alimentary canal to the liver and then to the parts of the body.
- It transports nitrogenous wares such as urea from the liver to the kidney for excretion in form of urine.
- It transports hormones from the endocrine glands to the target organs.
- It transport white blood cells and antibodies to the site of infection.
- It distributes heat evenly around the body from the muscles and the liver
- It provides defence mechanism through white blood cells and antibodies that destroy disease causing microbes that have entered the body.
- It helps in the formation of clots on damaged tissues at cut surface. Platelets produce substances that change fibrinogen to fibrin that forms a network of fibres. The fibers trap blood cells thereby stopping bleeding and prevent entry of germs.

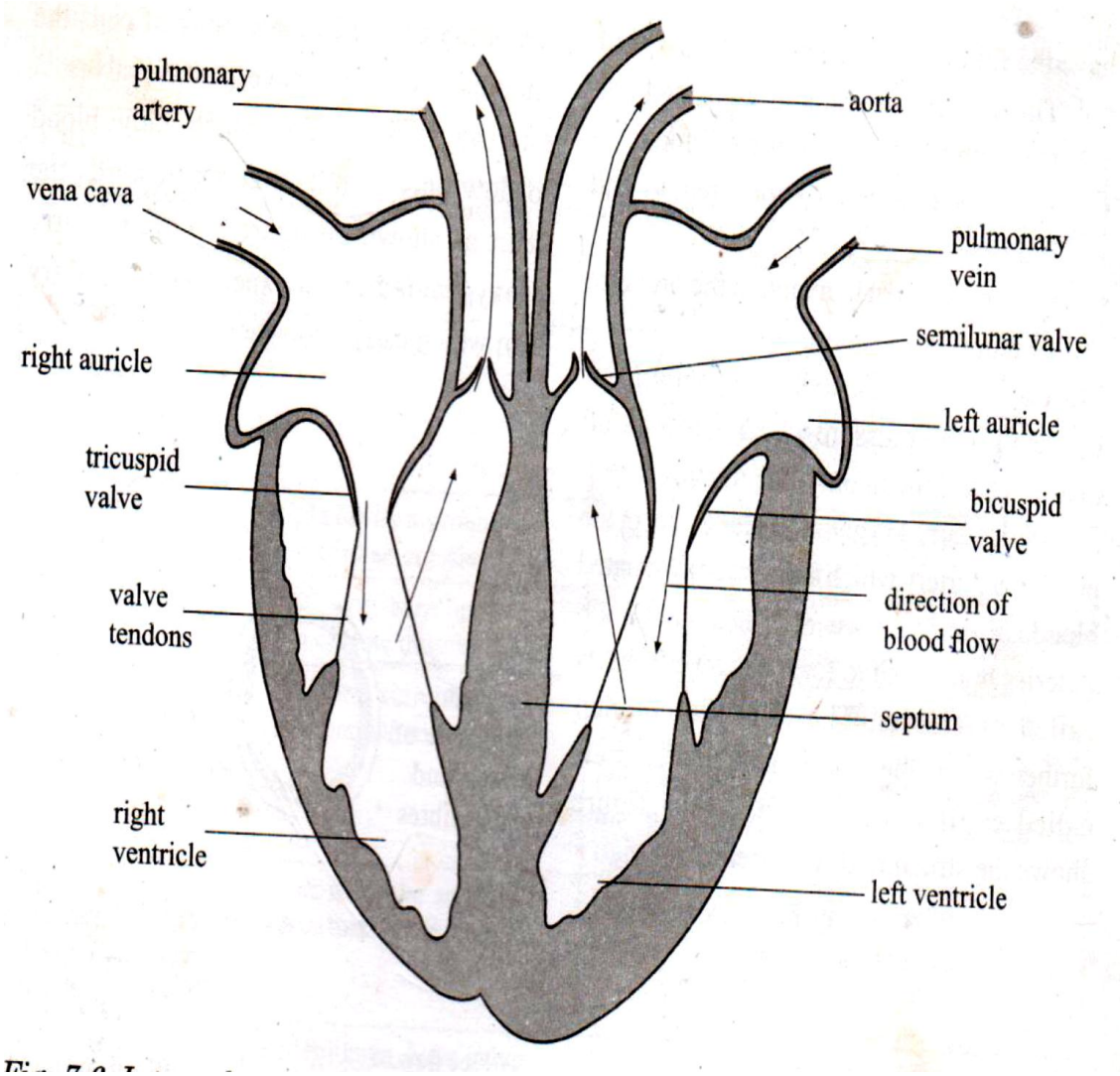
THE PARTS OF THE HUMAN HEART





The heart is divided into two sides, **the left** and **the right side** which are completely separated by a wall called **septum**.





- The **function of the septum** is to prevent blood on the right side from mixing with that on the left side.
- The human heart has four main chambers with the upper chambers called the atria and the lower chambers called the ventricles.
- The atria or auricles are thin walled because they just receive blood from all parts of the body and pump it to the ventricles.
- Whereas the ventricles are thick walled because they pump the blood out the heart to all parts of the body.
- The four chambers of the heart include

a. RIGHT ATRIUM/AURICLE

- The right atrium receives blood from all parts of the body through **vena cava** which is deoxygenated blood to the heart.

- Vena cava is the largest vein and transport the deoxygenated blood from the parts of the body to the right atrium.
- The ***tricuspid valves*** found between the right atrium and right ventricle prevents the blood from slipping back to the right auricles/atrium.

b. LEFT ATRIUM/AURICLE

- **I**t receives oxygenated blood from the lungs to the heart via pulmonary vein**.**
- The pulmonary vein transports oxygenated blood from the lungs to the right auricle of the heart.
- The ***bicuspid valve*** found between the left atrium and left ventricle prevents the blood from going back to the left atrium.

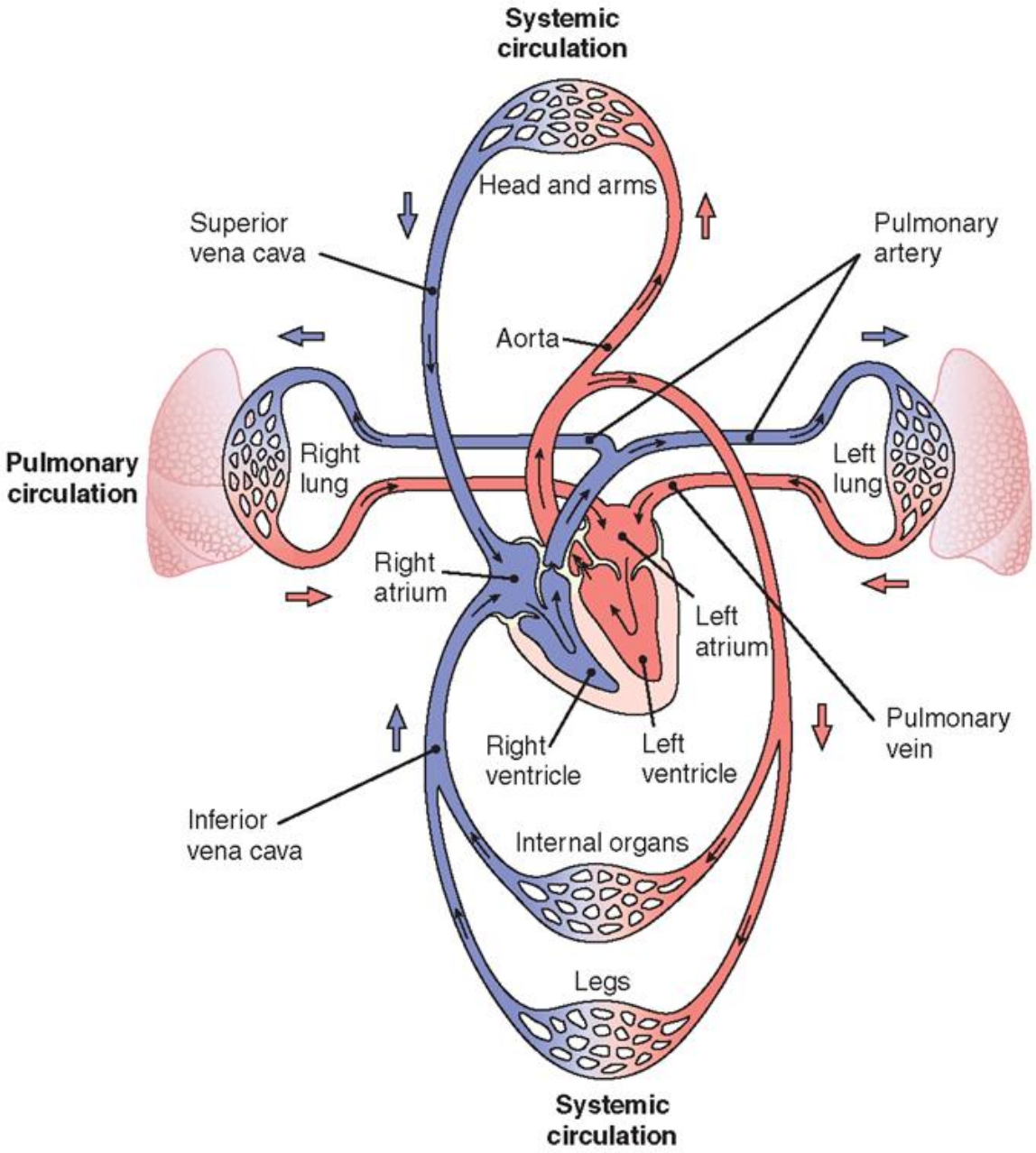
c. RIGHT VENTRICLE

- It pumps the deoxygenated blood that it received from the right atrium to the lungs via pulmonary artery.
- Pulmonary artery transports deoxygenated blood from the right ventricle to the lungs.
- The muscles of the right ventricles are thicker than the muscles of the right atrium because they pump the blood to the lungs.
- The function of the **semi lunar valves** found between the right ventricle and the pulmonary artery is to prevent the blood from going back to the right ventricle.

d. LEFT VENTRICLE

- **I**t receives oxygenated blood from the left atrium and pumps it to all parts of the body through aorta.
- Aorta is the largest artery in the body and transport oxygenated blood from the left ventricle to all parts of the body.
- The function of the semilunar valves found between the left ventricle and the aorta is to prevent the blood flowing back from the aorta to the left ventricle.
- The muscles of the left ventricles are thicker than the muscles of the right ventricles because the left ventricle pumps the blood to all parts of the body while the right

BLOOD CIRCULATION



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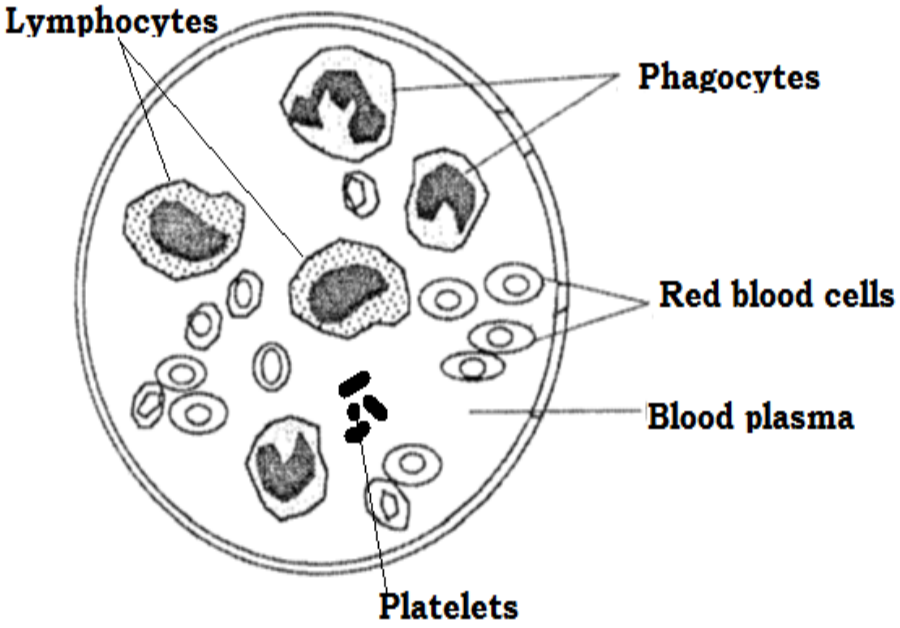
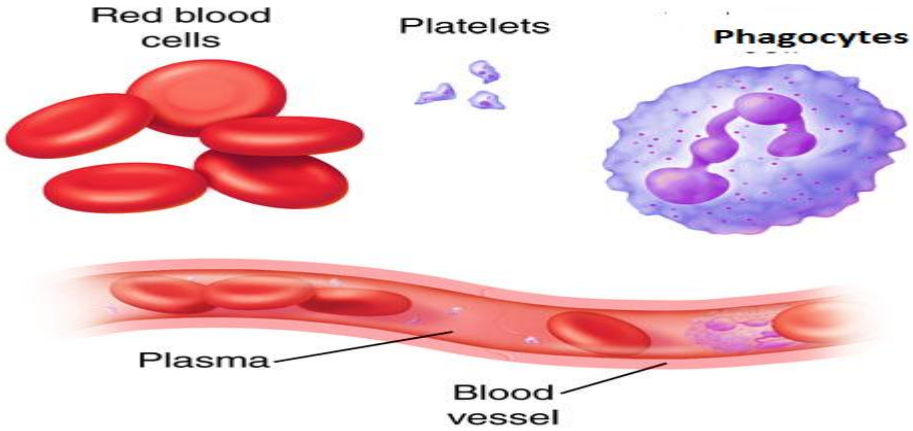
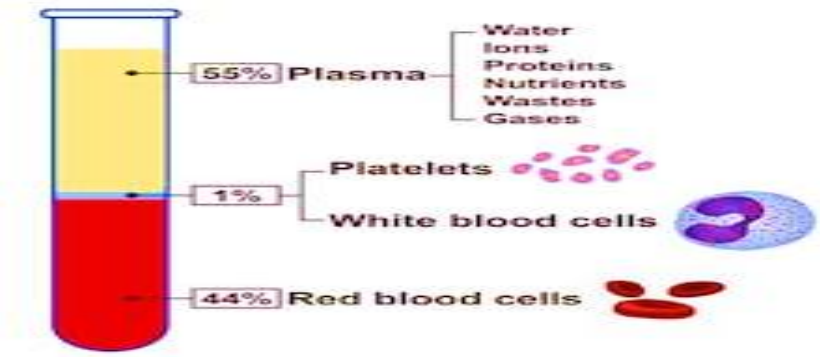
It pumps the blood to all parts of the body through the arteries. This ensures that blood transports substances to all tissues and at the same time it removes waste substances from all the tissues.

COMPOSITION OF BLOOD

- It is made of 55% of blood plasma and 45% blood cells.
- The solid part of the blood consists of red blood cells and white blood cells. It also contains fragments of large cells called platelets.







The following are the five components of blood

1. BLOOD PLASMA

- Blood is the liquid part of the blood.
- It consists of 90% water and 10% different molecules that dissolve in water.
- The following are the substances that dissolve in blood plasma

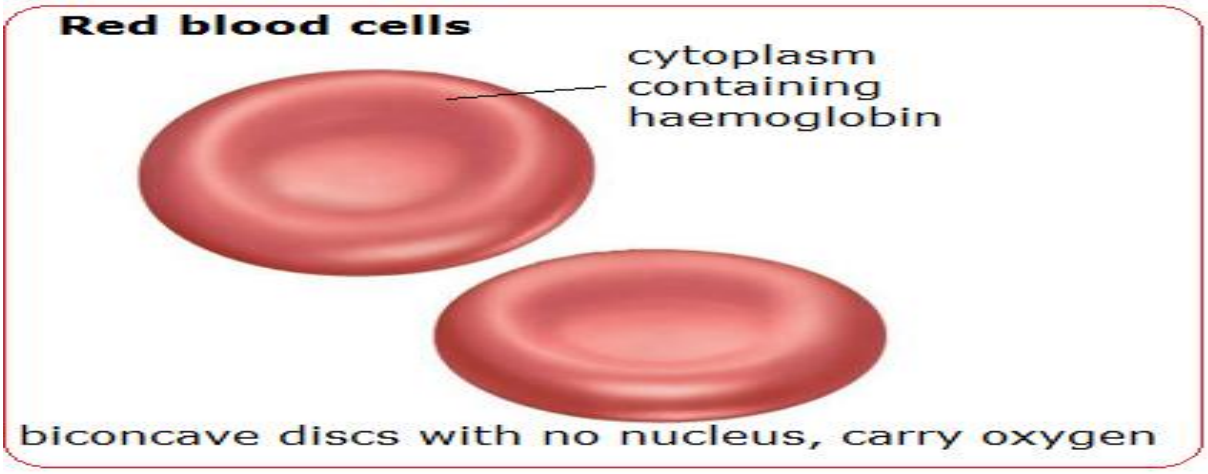
a. food substances such as glucose, amino acids and fatty acids and glycerol
b. vitamins and mineral salts from digestion
c. waste substances like carbon dioxide and urea
d. hormones like adrenaline and insulin hormones
e. enzymes and antibodies proteins such as albumin, fibrinogen, globulins.

FUNCTIONS OF THE BLOOD PLASMA

a. it transports carbon dioxide from the body tissues to the lungs for excretion in the form of hydrogen carbonate ions
b. It transport waste matters produced in the body tissues to the excretory organs.
c. It transports hormones from the endocrine glands to the target organs.
d. It transports antibodies from where they are produced to the site of infection.
e. It transports nutrients from the small intestine to the liver either for storage or for further transport to the cells in the body.

2. RED BLOOD CELLS

- They are biconcave disc in shape- The advantageous of this shape to red blood cells is it provides a large surface area for trapping adequate oxygen.
- They do not contain nucleus
- They have a ref pigment known as haemoglobin.
- They are very many in number.
- The red blood cells are made in the red bone marrow of the bones of the sternum and ribs.
- The diagram below shows red blood cells



- The diagram below shows the red blood cell

The two factors the number of red blood cells in the body and these include

a. **Altitude-** The higher the altitude the more will be

b. **The state of health of a person**. People with severe anaemia or malaria have fewer red blood cells.

THE FUNCTION OF THE RED BLOOD CELLS

1. it transports oxygen in the form of oxyhaemoglobin from the lungs to the body tissues

Adaptations of red blood cells in transporting oxygen

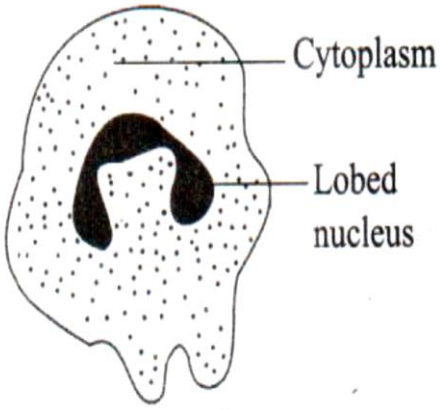
a. It contains haemoglobin that has affinity for oxygen and combines oxygen with haemoglobin to form oxyhaemoglobin. The formation of oxyhaemoglobin occurs in the lungs under low oxygen concentration in the lungs.

$$\text{Haemoglobin} + \text{oxygen} \underset{\text{tissues}}{\overset{\text{lungs}}{\rightleftharpoons}} \text{Oxyhaemoglobin}$$

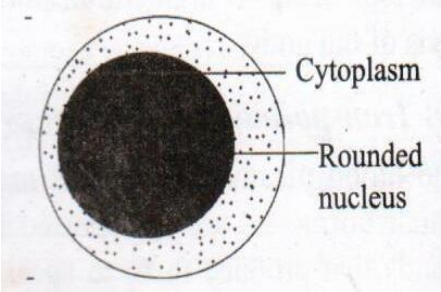
b. They are numerous hence increasing the surface area for trapping oxygen
c. They are small and flexible which enable to easily squeeze along the smallest capillaries.
d. It contains antigens A and B on its surface areas.

3. WHITE BLOOD CELLS

- They are used in fighting against infection
- They are larger in size as compared to red blood cells
- They lack hemoglobin
- They have nucleus
- They are made in the bone marrow inside bones, spleen and lymph glands**.**
- They are two types of white blood cells, **the phagocytes** and **lymphocytes.**
- The phagocytes have lobed nucleus. The diagram below shows the phagocyte



- The lymphocytes have spherical nucleus. The diagram below shows lymphocytes.



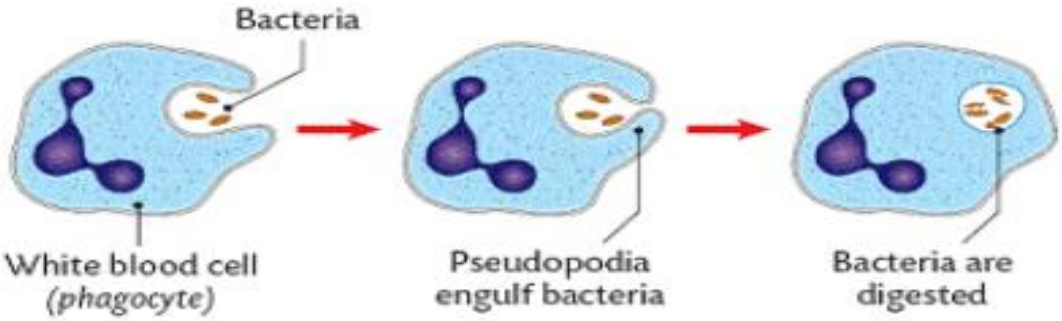
Examples of phagocytes include neutrophil eosinophil and basophil where as examples of lymphocytes include

T-lymphocytes – T- cells attack viruses

B-lymphocytes- Produce antibodies which combine with germs which are then engulfed by phagocytes

HOW DO PHAGOCYTES DIFFER FROM LYMPHOCYTES IN TERMS OF THEIR FUNCTION?

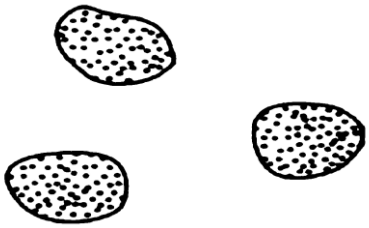
Phagocytes fight against infection by engulfing disease causing microbes such as bacteria



Lymphocytes fight against infection by releasing antibodies which combine with germs which are then engulfed by phagocytes.

4. PLATELETS

Platelets are also known as thrombocytes. They do not have nucleus.



It is used for blood clotting the site of the wound.

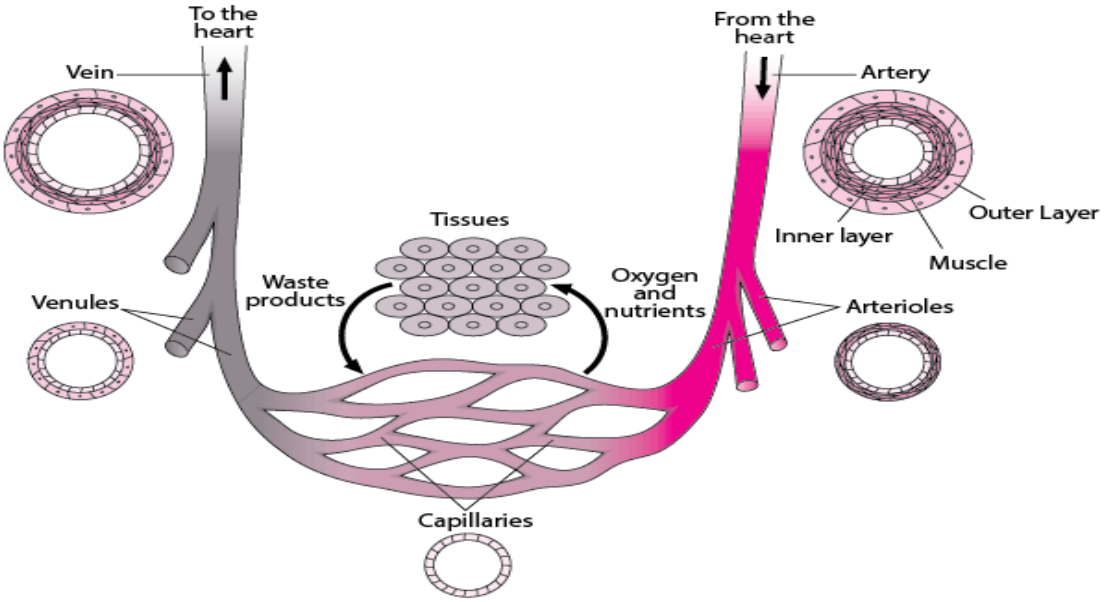
5. BLOOD SERUM

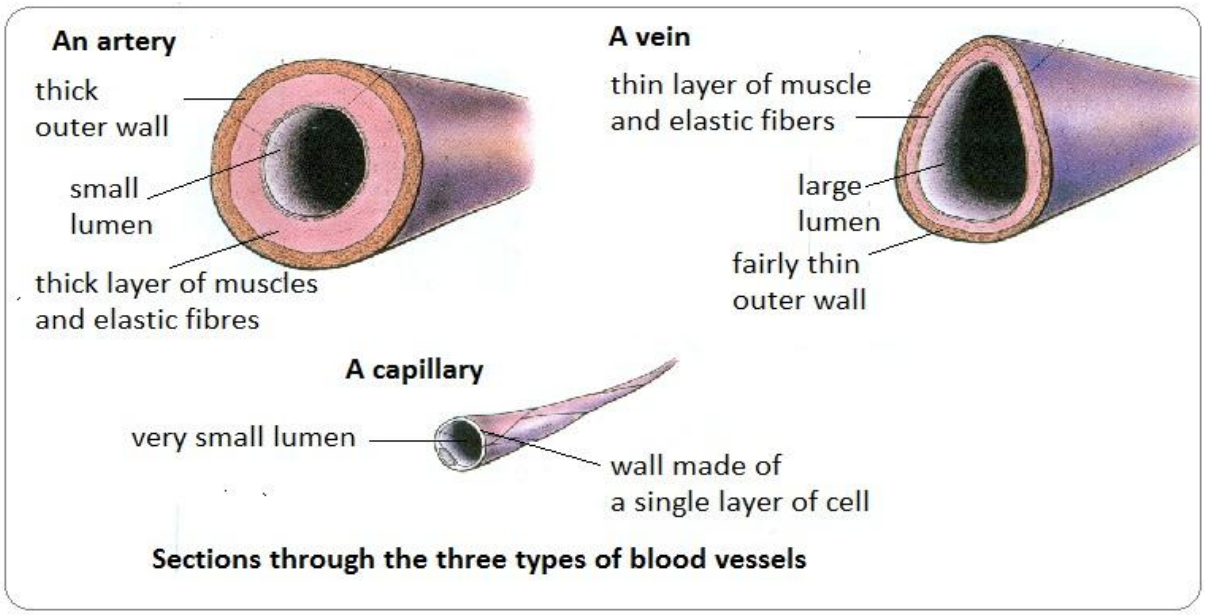
- It is the blood plasma without fibrinogen.
- It is used for testing blood groups at the hospital.

CHAPTER 8- BLOOD CIRCULATORY SYSTEM

The Blood Vessels

- These are the passage of the blood.
- There are three main types of blood vessels: Arteries, Veins and Capillaries

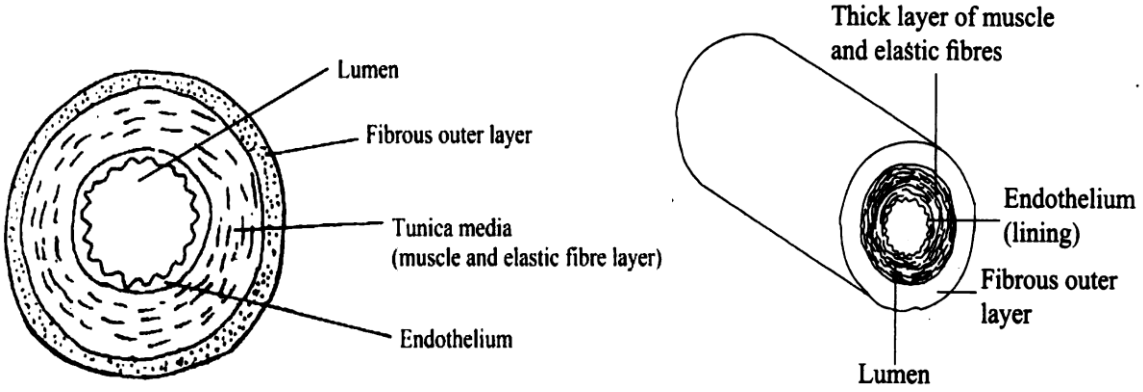




1. Arteries

- These are blood vessels that carry blood away from the heart.

- Arteries branch to form a network of smaller arteries called **arterioles**.
- The diagram below shows the transverse section of an artery

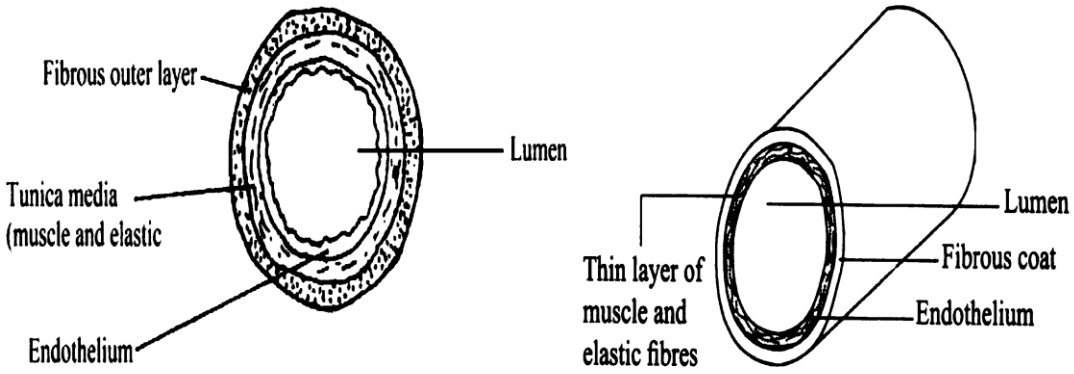


CHARACTERISTICS OF ARTERIES

- They have thick muscular wall to withstand and maintain higher pressure of blood flowing through them.
- They have an outer fibrous coat for strength and protection.
- They have a thick layer of muscle and elastic fibres which contract and relax to adjust their diameter as the blood flow through them.
- They have narrow lumens to maintain higher pressure of blood inside them.
- They have no valves.
- Blood flows in arteries with high pressure because of the force exerted by the pumping action of the heart.
- They carry oxygenated blood, except the pulmonary artery.

2. VEINS

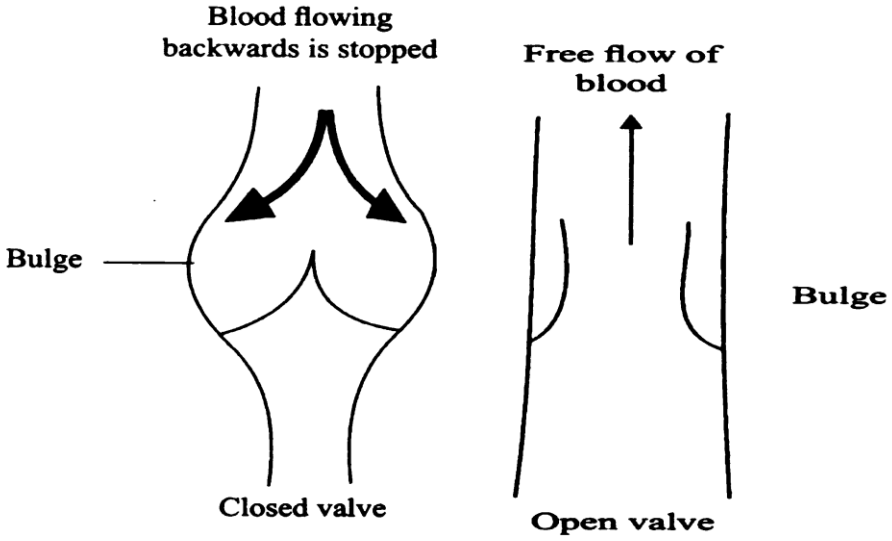
- These are blood vessels that carry blood towards the heart.
- Veins branch into **venules**.
- Transverse section through a vein



CHARACTERISTICS OF VEINS

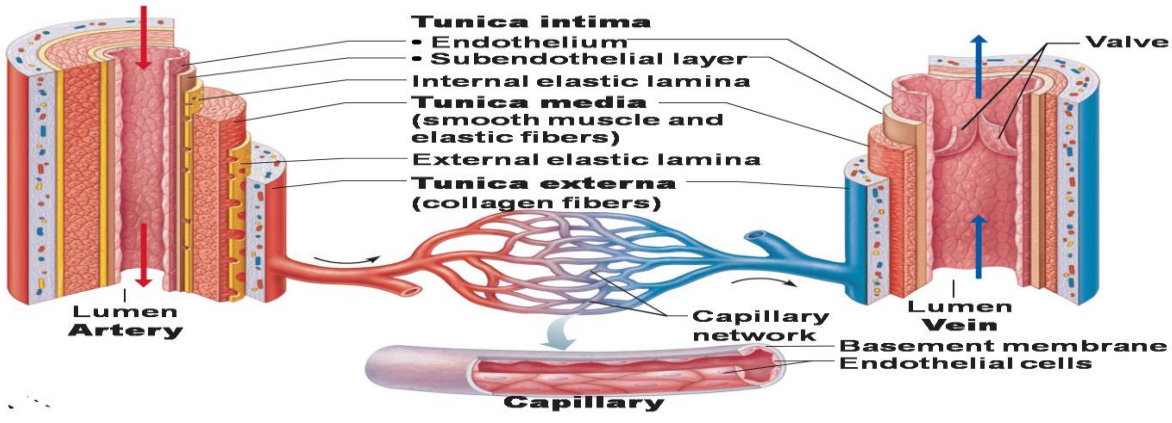
- They have thin walls.

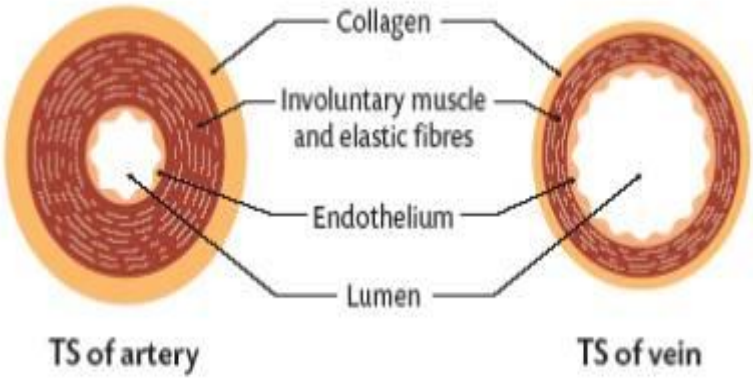
- They have wide lumens. The wide lumen reduces resistance to the flow of blood. The wide lumen provides more space to the flow of blood.
- They have valves at intervals. The valves help to prevent the backflow of blood. The diagram below shows how the valves work.



- Blood is also kept moving in the veins by the contraction of muscles around them. When the skeletal muscles contract during movement, they squeeze the veins. This help to push blood back to the heart.
- Blood flows in the veins with low pressure since the pumping effect of the heart is not felt.
- They carry **deoxygenated blood**, except the **pulmonary vein**.

THE STRUCTURAL DIFFERENCES BETWEEN THE VEINS AND ARTERIES



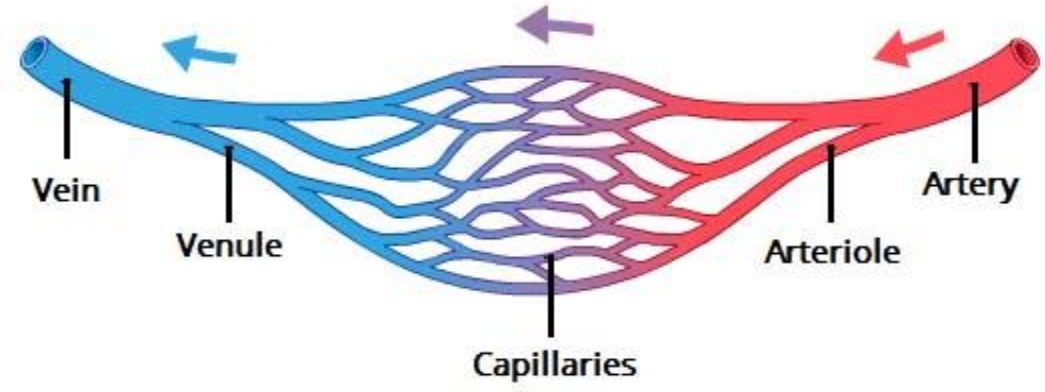


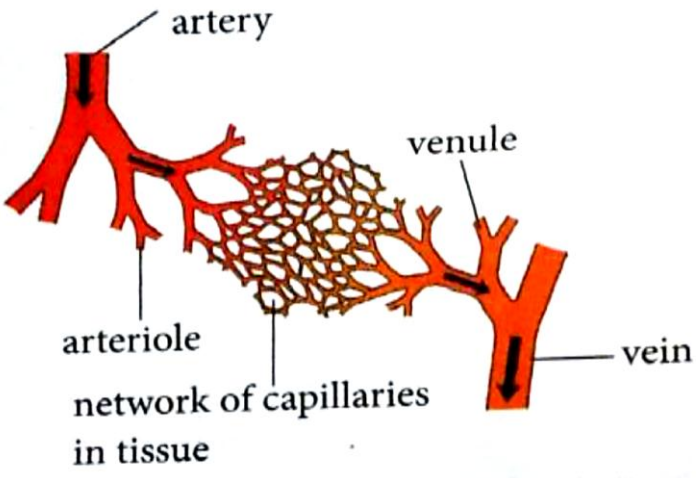
- Veins have wide lumen while arteries have narrow lumen
- The veins have valves to prevent the back flow of blood while arteries do not have valves
- The arteries have thick muscular walls veins have thin walls

3. CAPILLARIES

These are network of blood vessels which link the arterial and venous systems.

CHARACTERISTICS OF CAPILLARIES





- Their walls are one cell thick. This enables useful substances such as oxygen and glucose, and wastes such as carbon dioxide to diffuse through them easily. Therefore, capillaries are places of exchange of substances in the blood.
- They have the narrowest lumens. This ensures that blood moves slowly through them, giving more time for exchange of substances.
- They have no elastic tissue or smooth muscles. This ensures efficient diffusion of materials and also enables the capillaries to penetrate between individual cells.
- They form a dense network. This creates a large surface area over which exchange of substances takes place.
- They transport blood from arterioles to the venules.

FUNCTIONS OF CAPILLARIES

They supply the body cells with their requirements, and take away waste products.

ANAEMIA

Anaemia is a disease that develops when the body does not have enough healthy red blood cells leading into reduced haemoglobin level,

In other words, anemia is a condition whereby the blood does not contain enough healthy red blood cells which results to less oxygen being transported to the tissues.

CAUSES OF ANAEMIA

a. Heavy or excessive bleeding due to injuries and accidents
b. Heavy bleeding in adult females due to menstruation
c. Diseases which lead to reduced blood production. Such diseases include malaria that attack red blood cells, leukemia- cancer of blood and diseases of the liver and kidney.
d. Infection by worms such as hookworms and bilharzia worms
e. Poor nutrition- taking food that does not rich in iron and vitamin C and proteins.
f. Hereditary diseases such as sickle cell anaemia.

SIGNS AND SYMPTOMS OF ANEMIA

a. The person feels tired and fatigued even after slight activity
b. The face looks pale
c. The patient may experience mild headaches and may sometimes feel fainting.
d. Body weakness
e. Shortness of breath

WAYS OF PREVENTING ANAEMIA

a. Eating balanced diet
b. Prevention of worm infestation
c. Prevention of malaria infection by sleeping under treated mosquito nets
d. Use of pesticides to kill mosquitoes in homes and water bodies.
e. Cutting tall grass around homes.

TREATMENT OF ANAEMIA

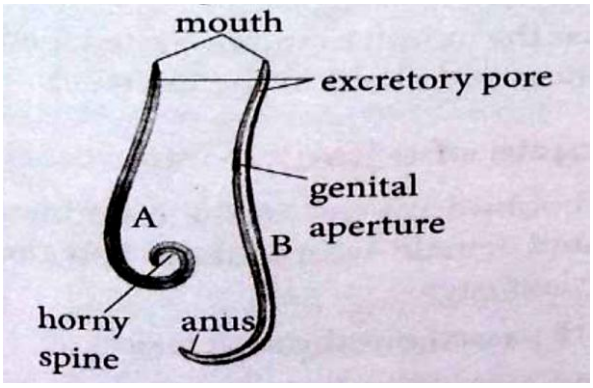
a. Giving the patient mineral supplements such as iron tablets and folic acid tablets.
b. Having blood transfusion

CHAPTER 9- WORM INFECTION

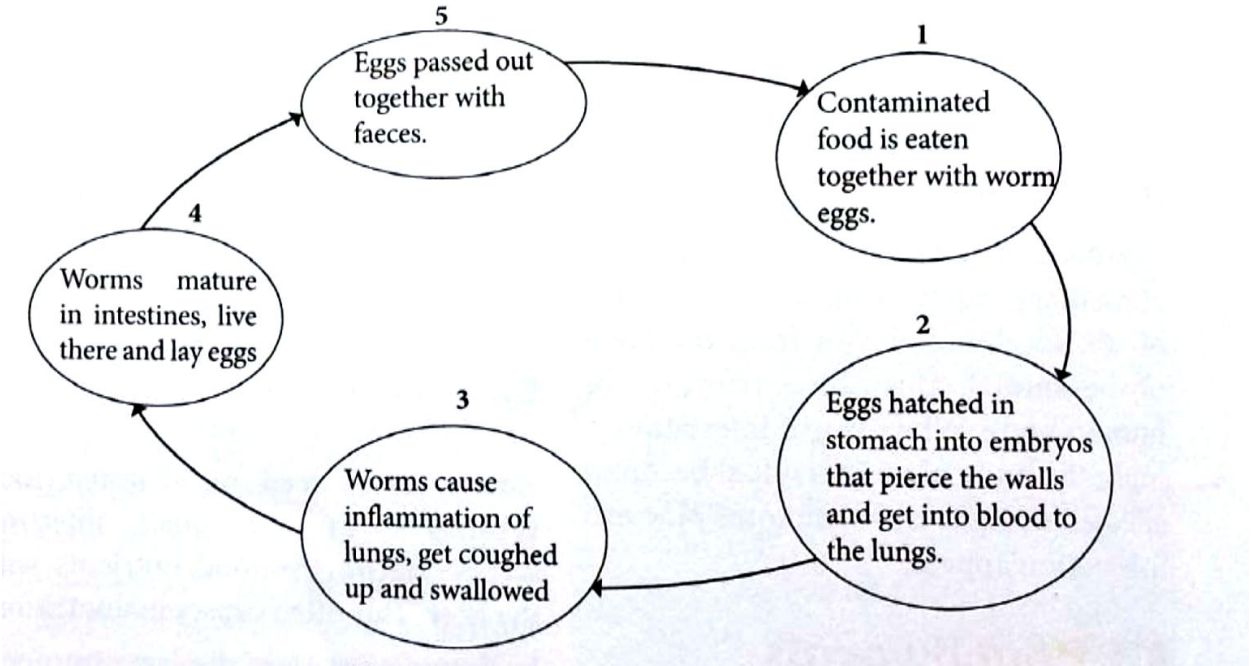
Parasitic worms which infect humans include round worms, hookworms, tapeworms, threadworms, bilharzia worms and filarial worms.

ROUNDWORMS (*Ascaris lumricoides*)

- Roundworms mainly live in the small intestine where they feed on the food that has been digested by the host.
- A roundworm grow up to 30 cm in length and is white or pink in colour.
- One person may be infested with many roundworms at a time.



LIFE CYCLE AND TRANSMISSION OF ROUNDWORMS



- The eggs of roundworms are passed out with the faeces of infected person. If this person handles food with dirty hands, the food becomes contaminated.
- The eggs may be swallowed by another person eating raw food such as vegetables or fruits.

- In digestive tract the eggs hatch into larvae, which in turn pass through the wall of intestine into bloodstream and travels to the lungs.
- The larvae take about ten days to grow in the lungs, before they are coughed up from the lungs and swallowed back into the intestine, where they mature into adults. They then produce eggs which are passed out in faeces. This process is illustrated in the lifecycle of roundworm

SIGNS AND SYMPTOMS OF ROUNDWORM INFECTION

- Loss of appetite
- General weakness
- Dullness
- Damage of the lungs by the larvae of the worms
- Malnutrition
- Stunted growth in children
- Nausea
- Vomiting worms
- Abdominal discomfort
- Obstruction of the intestine

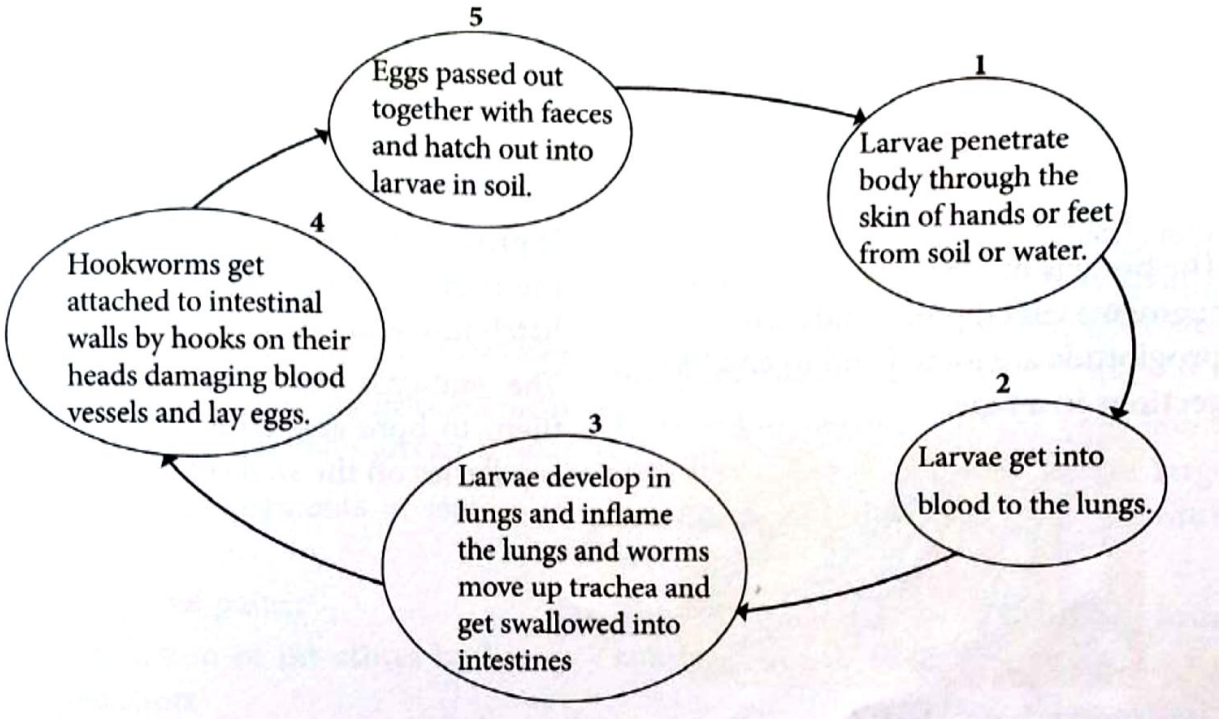
WAYS OF PREVENTING AND CONTROLLING ROUNDWORM

- Roundworm infection can be effectively prevented and controlled by breaking the life cycle.
- The life cycle of roundworms can be broken in the following ways:
- At the egg stage:
  - ✓ Wash vegetables and fruits before eating.
  - ✓ Cook vegetables to destroy eggs.
  - ✓ Wash hands before handling food
  - ✓ Always use proper toilet.
- At larva and adult stages, take appropriate drugs to kill larva and adult roundworms in the body.

HOOKWORM INFECTION

Hookworms live in intestines. They attach themselves to the intestinal lining and suck blood. Adult hookworms are 1 cm long and red in colour.

LIFE CYCLE OF THE HOOK WORM



- The eggs of the worm come out with faeces and hatch into larvae which can live in water or damp soil.
- If they come in contact with bare skin, the larvae burrow and bore through the flesh and make their way via the bloodstream to the lungs. From there they are coughed up into the mouth and swallowed.
- Once in the intestines, they can feed and lay eggs which are passed out in faeces.

SIGNS AND SYMPTOMS OF HOOKWORM INFECTION

- Abdominal pain
- Weakness
- Fatigue
- Weight loss
- Anaemia
- Diarrhoea
- Itching of the skin at the site of penetration
- Difficulty in breathing
- Coughing, sore throat and blood in the sputum during the passage of the immature worms to the lungs.

WAYS OF PREVENTING AND CONTROLLING HOOKWORM INFECTION

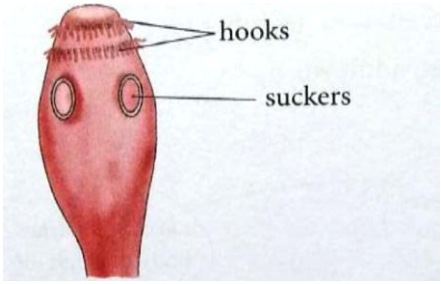
- Disinfect latrine floors
- Wearing shoes
- Proper disposal of faeces.
- Deworming using drugs

TAPEWORM INFECTION

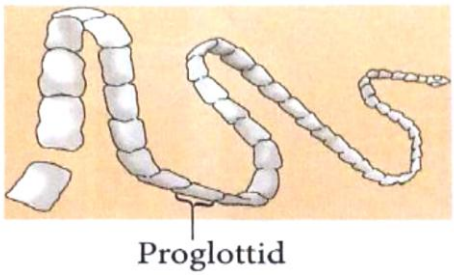
Tapeworm infest human beings and also animals such as pigs, cattle and fish.

THE STRUCTURE OF TAPEWORM

- Tapeworm have flat, tape- like bodies which can reach a length of 3.5 cm.
- At one end of the long body is a small head called **scolex**.



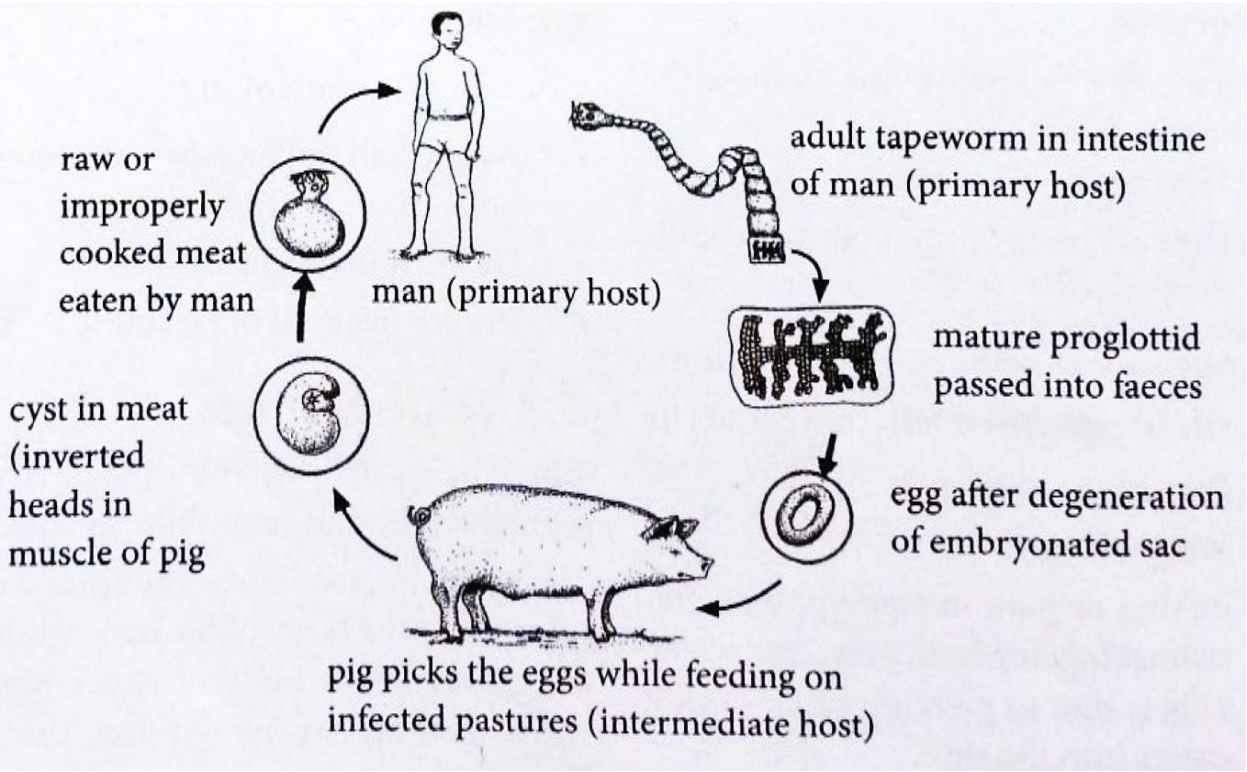
- The body consists of numerous flat segments called **proglottides** which bud off from the narrow region behind the scolex.



- The tapeworm has four evenly spaced suckers on the head and some of them have a ring of hooks.
- Tapeworms live in small intestine and are attached by hooks or suckers to its lining.
- Tapeworms feeds by absorbing partly digested food of its host through the whole surface of its body. Its long and flattened shape provide a large absorptive area.

- The parasite is not digested by the host's digestive enzymes because it secretes a substance which neutralise them. Besides, the parasite is not easily passed out because it is firmly anchored by scolex to the walls of intestine.
- A large tape worm may block the intestine completely.
- Tapeworm also produces waste substances which are absorbed by the victim and over time make him ill.

LIFE CYCLE OF TAPEWORM



- Tapeworms spread when eating not well cooked meat or eating contaminated food or drinking contaminated water with tapeworm eggs.
- Inadequately cooked flesh of a cow, sheep or pig is eaten by human being. This may contain the larva of a tapeworm.
- In the human intestine, the larvae develop into adult tapeworms and attach themselves to the wall of the alimentary canal by hooks.
- Mature segments full of tapeworm eggs break off from the end of tapeworm.
- Mature segments pass out in faeces.
- Cattle, sheep or pigs may eat grass contaminated with human faeces.

- In the intestines the eggs hatch into larvae which burrow through the wall of the gut and lay dominant in muscle.
- If the animals is slaughtered for meat and eaten, the cycle start again.

SIGNS AND SYMPTOMS OF TAPEWORM INFECTION

- Anaemia
- Abdominal pain
- Presence of segments of worms in faeces
- Diarrhoea
- Loss of body weight
- Obstruction of intestine by large tapeworm

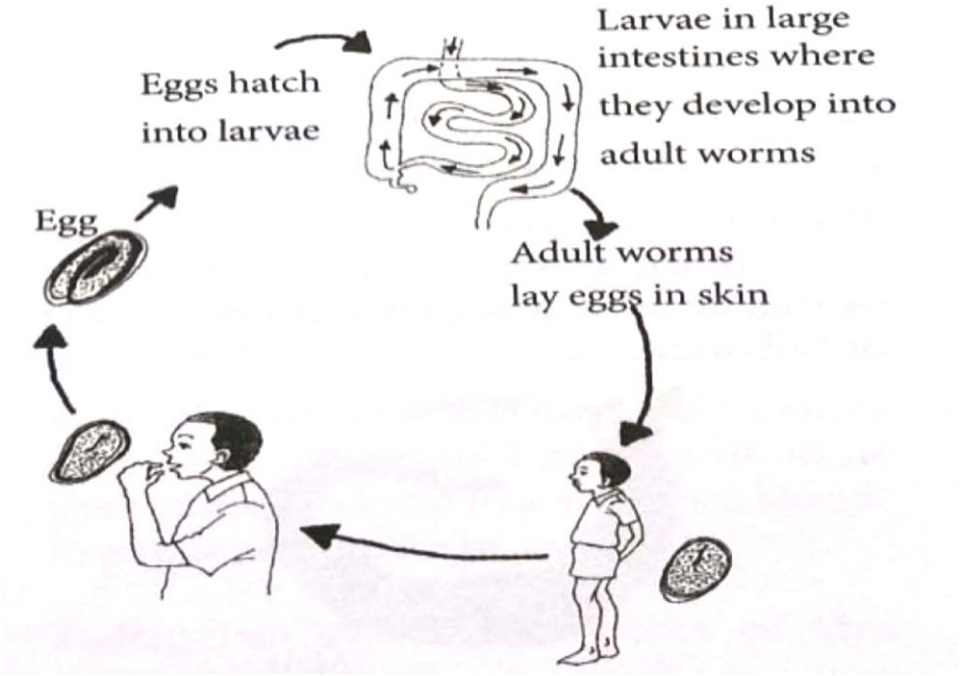
WAYS OF PREVENTING AND CONTROLLING TAPEWORMS

- Cook the meat and fish thoroughly to kill the larvae.
- Proper disposal of faeces by use of toilets and pit latrines to prevent spread of worms
- Drinking boiled or treated water to kill the eggs
- Livestock should be given anti-worm drugs to kill the worms

THREADWORM INFECTION

- Threadworms, also called pin worms, mainly infect young children, although adults occasionally do not get infected.
- Threadworms are white and about 1 cm long.

LIFE CYCLE OF THREADWORMS



- The worm lives in the large intestines. The female lay eggs which are passed out through faeces.
- Eggs are swallowed through contaminated food or water.
- The eggs also attach onto the fingers as children scratch the anus due to itching. They then swallow the eggs as they feed using unwashed hands.
- In the alimentary canal, the eggs hatch into larvae. Larvae migrates to the large intestine and develops into an adult worms.
- The worm feeds by absorbing food substances in the large intestine.

MODE OF TRANSMISSION

- Through contaminated food.
- Through contaminated water

SIGN AND SYMPTOMS OF THREADWORM

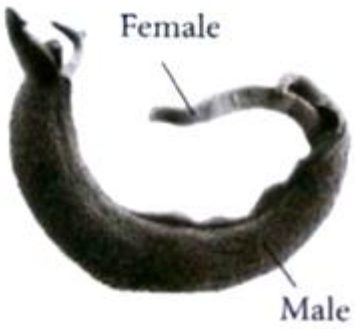
- Itching of the anus
- Presence of worms in faeces
- Small wounds around the anus
- Swelling around the anus in heavy infestation. This because the female threadworms lay eggs around the anus.

WAYS OF PREVENTING AND CONTROLLING THREADWORM INFECTION

- Washing hands with soap and water before eating.
- Proper disposal of faeces
- Deworming using drugs.

BILHARZIA WORMS

- Bilharzia is a disease resulting from parasitic flat worms called bilharzia worms which live inside the body of infected people.
- The disease is also called **schistosomiasis**.



Shistosoma

THE STRUCTURE OF BILHARZIA WORMS

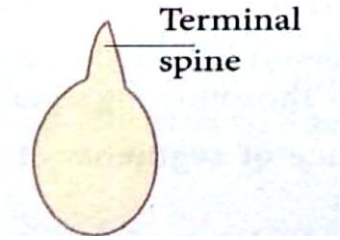
1. Bilharzia worms (flukes) are flat and about 1-2 cm long.
2. The male worm has a groove in which the female fluke lives.

3. The adult female and male flukes are always together. In this position the eggs laid by the female can easily be fertilized by the male.
4. Bilharzia worms live in the blood vessels in the bladder and intestines.
5. The worms feed on human blood.

TYPES OF BILHARZIASIS/SCHISTOSOMIASIS

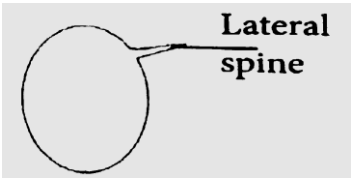
1. URINARY BILHARZIA

2. It affects urinary bladder of infected person.
3. It is caused by **Schistosom haematobium**, a parasite which lives in water snails of **Bulinus spp** which lays eggs with a terminal spine.

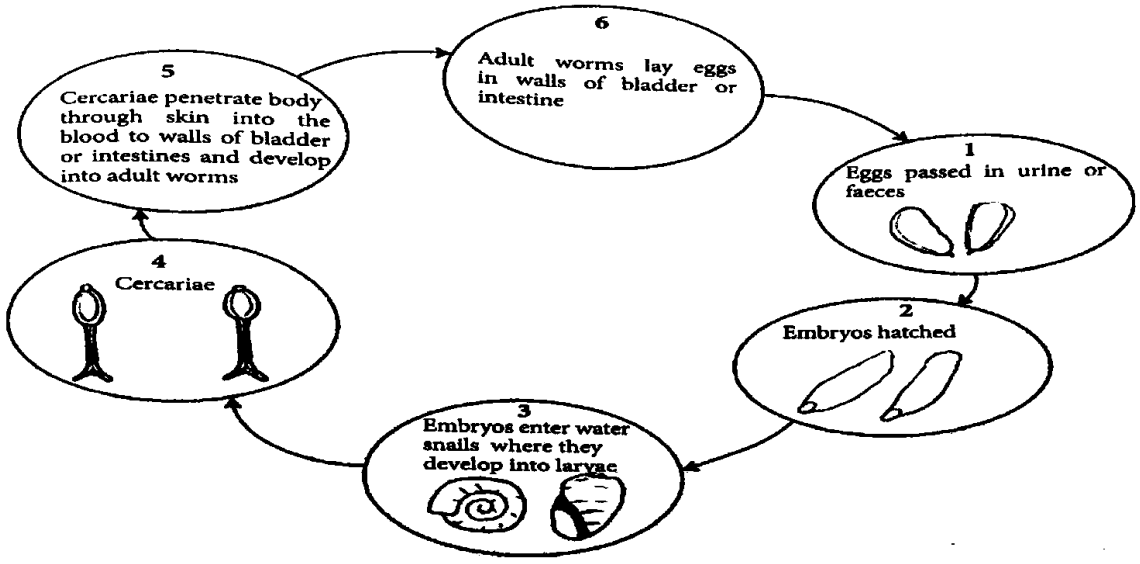


2. INTESTINAL BILHARZIA

- It affects the large intestines of an infected person.
- It is caused by **Schistosoma mansoni**
- The parasite lives in water snails of **Biomphalaria spp** which lays eggs with lateral spine.



LIFE CYCLE AND MODE OF TRANSMISSION OF BILHARZIA



- Eggs in urine or faeces from an infected person may get into water in rivers.

- In water, these eggs hatch out into embryos and then enter some types of water snail.
- The embryos use the snails as hosts to feed on and they reproduce, giving rise to many more embryos. The embryos reproduce asexually, and develop into different type of embryo called **cercariae**.
- Cercariae emerge from these snails to enter second host. The forked tail helps the cercariae to swim in search of new host. If they fail to find new host within 1-2 days, these cercariae die.
- When the new host is found, the cercariae attach to the host's skin with their suckers. This new host is either human or another animal. With the help of digestive juice from digestive gland, the cercariae burrow through the skin of the host to enter its blood stream. Itching occurs at point where the cercariae enter the skin.
- Once in the blood stream, the cercariae feed on blood and grow in size.
- From blood stream the cercariae move to the blood vessels near intestines or bladder. Here they settle down and mature through several stages into adult male and female flukes.
- The adult female fluke lives in the groove of the adult male fluke. The female lays thousands of eggs which get fertilized by the male fluke.
- When the host visit the toilet, the eggs get passed out. Often blood can be seen in urine or faeces, depending on which part is infected.
- If these eggs get passed out into fresh river water, the life cycle start all over again.

ADAPTIVE CHARACTERISTICS OF BILHARZIAL PARASITE- SCHISTOSOMA

1. The eggs have a hook-like structure or spines which have raptures the wall of the intestines or bladder.
2. The Schistosoma produces large members of eggs to ensure its survival.
3. The larvae have tail for swimming in water in search for a host.
4. The larvae have a sucker that is used for attachment on the human skin.

SIGNS AND SYMPTOMS OF BILHARZIA

1. **Cough or skin rashes for few days**. This is due to the presence of cercariae (young bilharzia worms) in blood stream. The body fights the cercariae that have entered the blood stream causing a cough or skin rash.
2. **Anaemia.** Cercariae feed on the blood.
3. **Abdominal pain**. The adult female flukes produce thousands of eggs which have sharp spines. The spine are used to cut through walls of the intestines and other tissues.
4. **Pain when urinating**- This is due to presence of cuts in urethra.

5. **Blood in urine and faeces**. The blood that come out of the cuts in the walls can be seen in urine and faeces, depending on an area where the tissue is cut.
6. **Cancer**. This is due to the damage of the intestine and the bladder
7. **Fever**

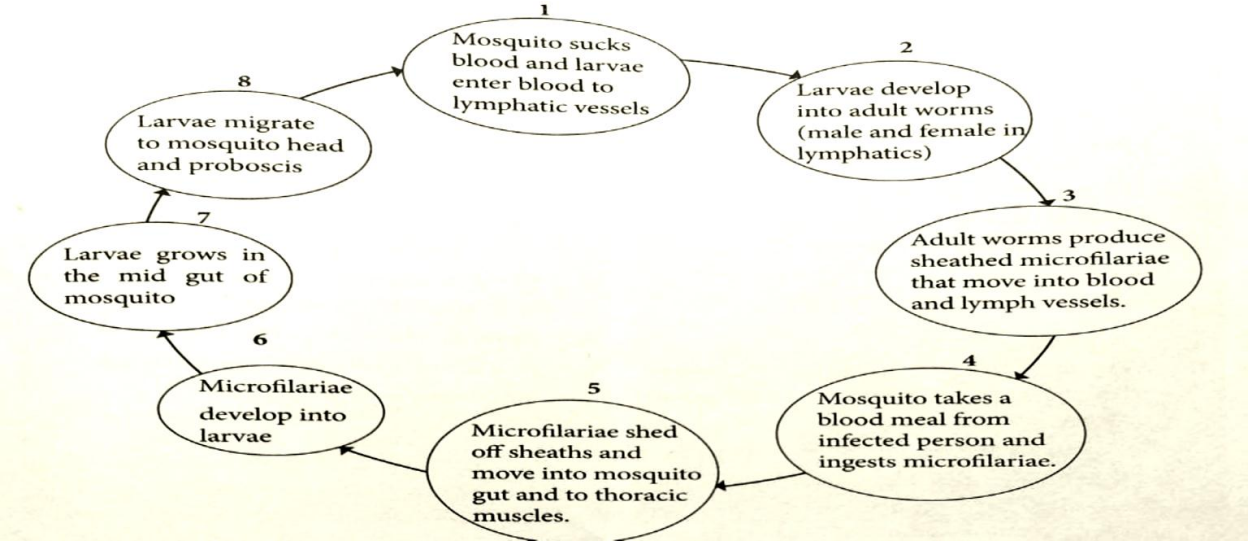
WAYS OF PREVENTING AND CONTROLLING BILHARZIA

1. Proper disposal of urine and human excreta. This prevents the eggs from reaching fresh water.
2. Treating drinking water and washing water. Filtration followed by chlorination kills the larvae. Boiling also destroys larvae in water.
3. Destruction of water snails that serve as intermediate hosts by use of appropriate chemicals in water.
4. Wear protective clothes, e.g. boots when working in rice fields to prevent the larvae from reaching the skin.
5. Effective health education. People living infected areas should be educated always to use latrines. Children should be warned about the hazards of playing in snail infested water and be taught about need for hygiene behaviour. This is necessary since they often play in and out of water, exposing themselves to the risk of infection.
6. Early medical treatment to reduce the number of infected people in the area.
7. Clearing vegetation in ditches which are the feed of water snails.

FILARIAL WORMS (*WUCHERERIA BANCROFTI*)

Wuchereria bancrofti is a parasitic worm which causes elephantiasis.

LIFE CYCLE OF FILARIAL WORMS



Filarial worms produce young ones in lymph nodes, and the larvae migrate to bloodstream where they are sucked by mosquitoes. When these mosquitoes bite a person, the filarial worms are injected into the victim's bloodstream and enter the lymphatic system where they mature.

SIGNS AND SYMPTOMS OF FILARIAL WORMS ON THE HOST

The following are the signs and symptoms of filarial worms on the host:

- Fever
- Pain in the testicles
- Pain above the testicles
- Enlarged groin
- Blocked lymph vessels
- Massive swollen legs, genitalia and breast
- White urinary discharge
- Swollen liver
- Swollen spleen.

PREVENTION AND CONTROL OF FILARIAL WORMS

They can be controlled and prevented in the following ways:

- Spray rooms and houses with insecticides such as doom to kill mosquitoes which are vectors of filarial worms.
- Spray oil on stagnant water that cannot be drained. This prevents the larvae from breathing and so kills them by suffocation.
- Drain all stagnant water which are breeding areas of mosquitoes to reduce population of mosquitoes.
- Cut grass or vegetation short around homes which harbour adult mosquitoes.
- Breeding fish or ducks in slow running water to feed on mosquito larvae or pupae to reduce population of mosquitoes.
- Sleep under treated mosquito nets to avoid contracting filarial worms through mosquito bites.
- Administer medicine to kill microscopic worms.