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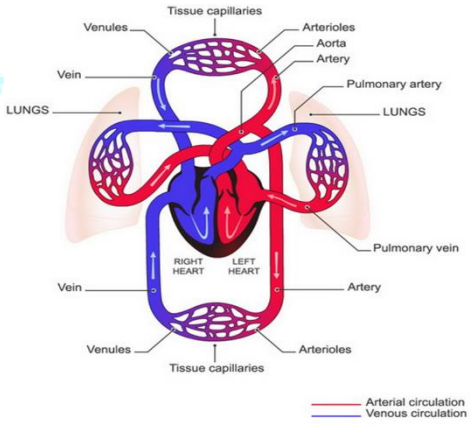
PRIMARY SIX SCIENCE BOOKLET

HOME STUDY MATERIAL FOR 2024

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THEME : THE WORLD OF LIVING THINGS
TOPIC : CLASSIFICATION OF ANIMALS

Living things

- Living things are things that have life.

Examples of living things;

- Trees
- Insects
- An ostrich
- Human beings
- Worms etc.

Characteristics of living things

a) Living things respire.
b) Living things feed.
c) Living things respond to stimuli.
d) Living things grow.
e) Living things reproduce.
f) Living things excrete.
g) Living things move

Reasons for classifying living things

- Makes it easy for us to identify them.
- Makes it easy to name them.

Note: Living things are classified into five groups called **kingdoms**

- Animals kingdom
- Plant kingdom
- Fungi kingdom
- Monera kingdom
- protoctista kingdom

1. Animal kingdom

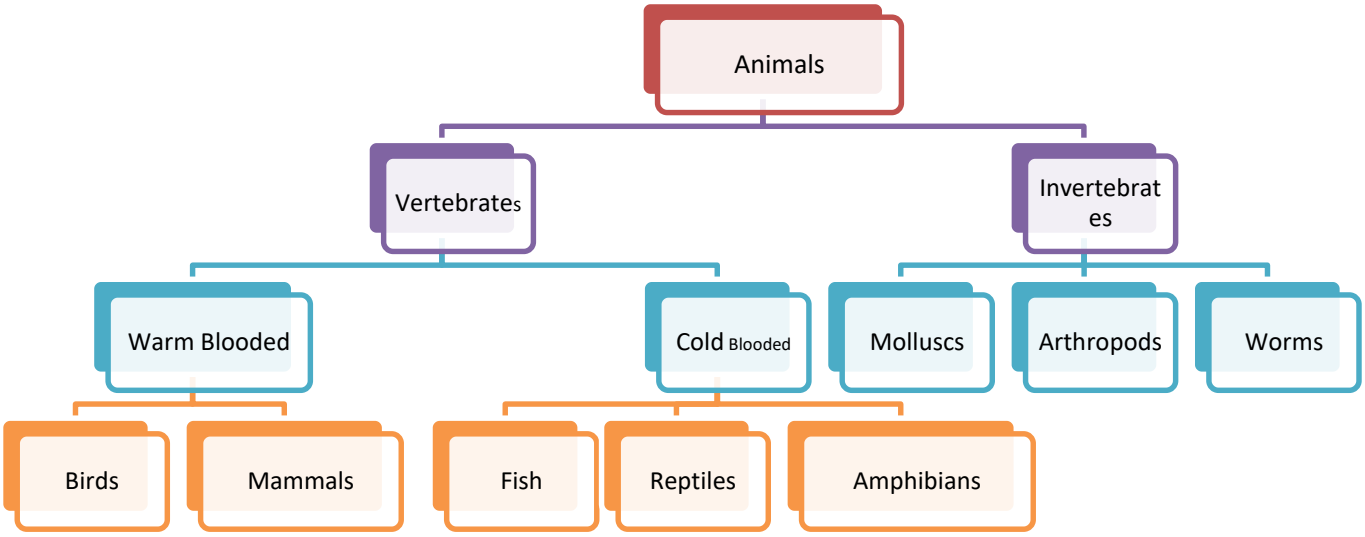
Characteristics of animals

- Animals are multicellular
- Animals cannot make their own food because they do not have chlorophyll
- They feed on other living things like plants and other animals
- Animal cells do not have cell walls but have a cell membrane
- Animals have natural defensive mechanisms against enemies
- Animals vary greatly in size, shape, way of moving, method of food capture and habitat

Differences between plants and animals

Plants	Animals
o Make their own food	Don't make food
o Store waste products as harmless substances in certain cells	Remove wastes from their bodies by their special excretory organs
o Are fixed on the ground and unable to move about	Most move freely from one place to another
o Contain chlorophyll	Don't have chlorophyll
o Are branched	Their bodies are compact and not branched
o Growth occurs only at the tips of roots and shoots	Growth occurs equally on all parts of the body
o Don't have sense organs	Most animals have sense organs
o React slowly to stimuli	React quickly to external stimuli
o Continue growing throughout their life	Stop growing long before their death

Classification of animals



Vertebrates:

- Vertebrates are animals with backbones.

Characteristics of vertebrates

- They have an Endo (internal) skeleton.
- Their backbone is made up of many small bones called vertebrae.
- They have pairs of limbs or fins for movement.
- They have a large brain protected by the skull (cranium).
- They have red blood.
- They have water proof skins.

Groups of vertebrates

Vertebrates are classified into five groups;

- Mammals
- Birds
- Reptiles
- Fish
- Amphibians

Note:

Vertebrates are also grouped into two;

- Warm blooded (homoeothermic or homeothermic)
- Cold blooded (poikilothermic)

Warm blooded

- Mammals
- Birds

Cold blooded

- Fish
- Reptiles
- Amphibians

Warm blooded vertebrates:

- These are vertebrates that have a constant body temperature. They include Mammals and Birds.

1. Mammals

- Mammals are animals that feed their young on milk produced by their mammary glands.

Characteristics of mammals

- They are warm blooded (homoiothermic) i.e. keep their body temperature constant.
- Their bodies are covered with hair or fur.
- All mammals care for their young ones.
- They produce living young ones except the egg laying mammals.
- They feed their young ones on milk from their mammary glands.
- They breathe through lungs.
- They have well developed ear lobes (pinnae).
- Their hearts are divided into four chambers.
- They undergo internal fertilization.
- They have teeth which differ in shape and function.

Groups of mammals

- Primates (flexibly fingered mammals)
- Cetaceans (sea mammals)
- Carnivores (flesh eating mammals)
- Ungulates (hoofed mammals)
- Rodents (gnawing mammals)
- Marsupials (pouched mammals)
- Insectivores (insect eating mammals)
- Chiroptera (flying mammals)
- Monotremes (egg laying mammals)

A. Primates

- Primates are flexible fingered mammals.
- Primates have enlarged fore brain and well developed cerebral activities.

Characteristics of primates

- They have enlarged fore brain.
- They have well developed cerebral activities e.g. intelligence and memory
- They are omnivorous i.e. they eat meat as well as vegetables.
- They have five fingers on each hand and five toes on each foot.
- They have four types of teeth i.e. Incisors, canines, premolars and molars.
- They use front limbs for holding and hind limbs for walking.
- They have 32 teeth.

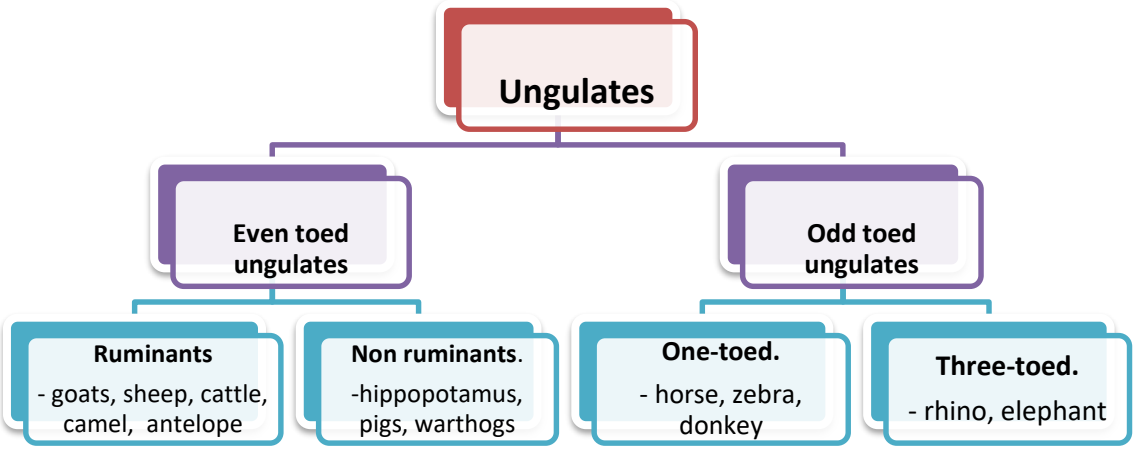
Examples of primates

- Man
- Apes
- Gorilla
- Baboon
- Monkey
- Bush baby
- Chimpanzee

B. Ungulates (hoofed mammals)

All hoofed mammals feed on vegetables so they are herbivorous mammals

Classification of ungulates



- **Even toed ungulates** are hoofed mammals with two toes on each foot.
- **Odd toed ungulates** are hoofed mammals with one or three toes on each foot.
- **Ruminants** are animals that chew their cud and have four stomach chambers.
  Ruminants do not have canines and incisors but they have horns to protect themselves.
- **Non-ruminants** are animals that do not chew cud.
  Non-ruminants have almost complete dentition and some have well developed canines which they use as weapons of defence and offence.

C. Carnivores (flesh eating mammals)

- They are mammals which feed on flesh (meat). They are also called **predators**.

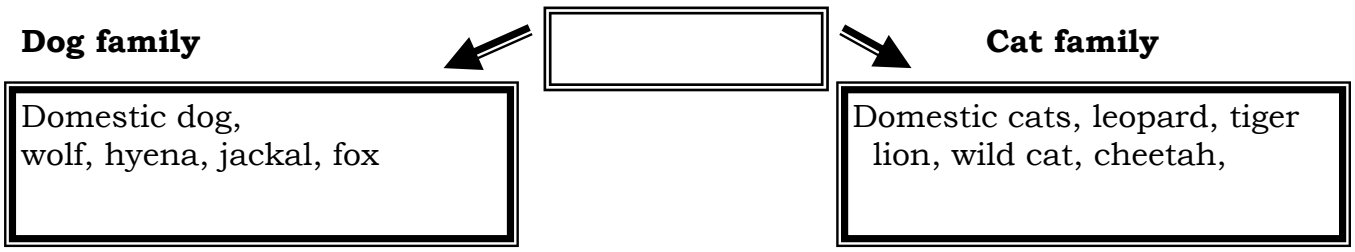
Characteristics of carnivores

- They have well-developed canines for tearing flesh of their prey.
- They have sharp claws for holding, killing and tearing their prey.
- They have good speed in running.
- They have a very good sense of smell.
- They have good eye sight.
- They have soft pads in their feet so they can run after their prey without making noise.

NB: Carnivores are sub divided into two groups namely;

- Cat family
- Dog family

Classification of carnivores



Note:

- Some carnivores are scavengers e.g. the hyena and jackals.

- Scavenger animals are animals that feed on ……

D. Rodents (gnawing mammals)

- Have well developed incisors to chew and bite powerfully and rapidly.
- They don't have canine.
- Their incisors grow continuously.
- Most rodents are vegetarians.
- They have strong claws for digging the ground.

Examples of rodents

- Rats
- Porcupines
- Guinea pigs
- Squirrels
- Mice

NB. Porcupines have spines for protection.

E. Insectivores (insect eating mammals)

These are mammals which feed on insects.

Characteristics of insect eating mammals

- They have strong claws for digging the ground.
- They mostly hunt at night and sleep during day (nocturnal)

Examples of insect eating mammals

- hedgehog,
- tiny insect eater

NB A hedge hog has spines on its body for protection and when threatened it rolls itself up into a ball.

F. Chiroptera (flying mammals)

They have a fold skin attached to the fore limbs which act as wings.

Characteristics of flying mammals

- Their fore limbs are modified into wings.
- They are nocturnal.
- They find their food at night using echoes.
- They produce live young ones and feed them on milk from mammary glands.

NB: Bats are the major examples of flying mammals.

Types of bats

a) **Fruit eating bats: -** eat a variety of fruits from trees so they help in dispersing seeds and pollinating flowers.
b) **Insect eating bats: -** they eat insects that may be harmful to man
c) **Blood sucking bats (vampire bats):-** they are large and suck blood from animals like horses, cows, buffaloes, etc..

G. Marsupials (pouched mammals)

- Marsupials are mammals with a pouch or pocket on their abdomen in which mammary glands are found.

Characteristic of pouched mammals:

- They have a pouch or pocket on their abdomen inside which mammary glands are found.

NB: Marsupials are found in Australia and South America

Example of pouched mammals:

- Kangaroo
- Wallabies
- Koala bear

H. Monotremes (Egg laying mammals)

- These are mammals which lay eggs but feed their young ones on milk produced by their mammary glands.

Note:

- They are regarded as the most primitive mammals because;
- They have characteristics of reptiles, birds and mammals.
- They lay eggs and have beaks similar to those of birds.

Examples of egg laying mammals:

- Duck billed platypus
- Spiny ant eater(echidna)

I. Cetaceans (sea mammals)

- Cetaceans are mammals that live in the sea and oceans.
- They have a layer of fats called **blubber** which keep them warm in water.

Characteristics of cetaceans

- They live in seas.
- They breathe by means of lungs, they don't have gills.
- Have a high level of intelligence next to primates.

Examples include;

- Whales
- Dolphins
- Seals

Importance of mammals to man.

- Some ungulates and rodents are a source of food to man
- Some mammals such as horses, donkeys, camels and oxen can be used for transport.
- Some mammals provide raw materials such as hides and skins, horns and tusks for industries.
- Oxen are used to plough land for man.
- They are tourist attractions

- Some mammals such as cats and dogs are kept as pets by man.
- Some mammals can be used to reduce or kill pests on a farm.
- Some mammals like cows, goats can be used for social functions like dowry.

Dangers of mammals

- Some mammals are crop pests.
- Some mammals like dogs, cats are diseases vectors.
- Some mammals can kill people

2. Birds

Characteristics of birds.

- Have streamlined bodies.
- Their bodies are covered with feathers and moult them every year.
- Have scales on their legs.
- They are warm blooded (homoiothermic).
- They breathe by means of lungs
- Their front limbs are modified as wings.
- They reproduce by laying eggs with hard shells which are fertilized internally.
- They have four chambered hearts.
- They take care of their young ones.
- Most birds can fly except a few which are flightless.

Groups of birds

- Swimming birds
- Climbing birds
- Birds of prey
- Perching birds
- Scratching birds
- Wading birds
- Scavenger birds
- Flightless bird

A. Birds of prey

- These are birds which hunt, kill and feed on flesh of small animals like rats, fish, mice, lizards, chicken, geckoes.

Characteristics of birds of prey:

- They have strong eye sight to spot their prey even at a distance.
- They have strong, sharp, hooked beaks for tearing the flesh of their prey.
- They have strong, sharp curved claws (talons) for gripping and killing their prey.

Examples of birds of prey:

- hawks,
- eagles,
- secretary birds
- owls,
- kites
- falcons

Structure of the beak and feet

B. Perching birds

- Have three toes pointing forward one back ward which helps them to grasp twigs and small branches.

Types of perching birds

1. Seed eaters

Have short strong conical beaks suitable for breaking seeds.

Examples include;

- pigeons,
- doves,
- weaverbirds,

Structure of beak and feet

2. Insect eaters

They have short narrow beaks for picking up the insects from the bark of trees.

Examples include;

- Sparrows
- Robins
- Bee eaters
- Swallows
- Swifts

NB: swallows and swifts have short wide open beaks to catch insects even when flying.

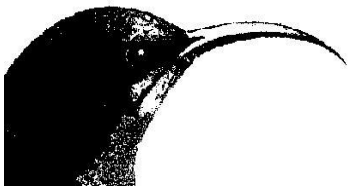
Structure of beak and feet

3. Nectar suckers

They have thin long slender slightly curved beaks so that they can suck nectar from flowers.

Examples include; sun bird or humming bird.

Structure of beak



4. Fruit eaters

They feed on fruits of different trees. It has a long stout beak for collecting fruits. Example; a horn bill

C. Scratching birds

- They feed on seeds and insects they find by scratching the ground.
- They have short strong firm pointed beaks for picking food.
- They have strong feet with thick toes and blunt nails for scratching the ground.
- Their bodies are heavy and their wings are weak because they have bone marrow.

Examples of scratching birds

- Domestic fowls e.g.
  - ✓ Chicken,
  - ✓ Turkey,
  - ✓ Guinea fowl.

Structure of beak

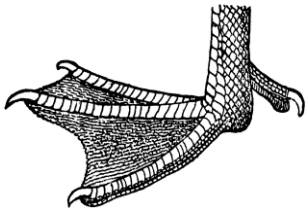
D. Swimming birds

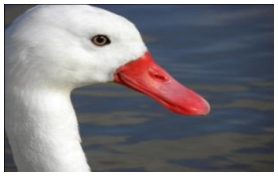
- They have webbed feet which act like paddles in water to help them to swim and move fast.
- They have broad breast bone to float on water.
- They have flat beaks with small cross plates on the margins to help them to sieve food from mud.
- Their skin has many oil glands which produce oil to keep them warm.
- They feed on fish, frogs, toads and worms.

Examples of swimming birds

- Ducks
- Pelicans
- Sea gulls
- Geese
- Swans
- King fisher

Structure of beak and feet





E. Wading birds

- They live along river banks
- They have long thin legs with half webbed toes widely spread out which prevent them from sinking in mud
- They have long necks and sharp beaks to catch small animals like frogs in water

Examples of wading birds

- flamingoes
- herons
- ibis
- crested crane
-

Structure of beak and feet

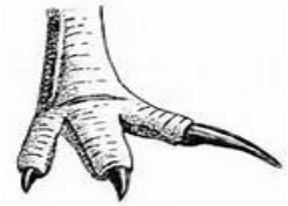
F. Flightless birds or walking birds

- They are unable to fly but can run very fast
- They have weak and small wings compared to their body size.

Examples of flightless birds

- Ostrich
- Penguin
- Kiwi
- Emu

Foot of an ostrich



NB: An ostrich is the largest and fastest flightless bird.

G. Climbing birds

- They are able to climb or walk on tree trunks.
- They have two toes pointing forward and two toes pointing back ward.
- They have short, curved and strong beaks

Examples

1. A parrot has a short strong and curved beak which is used for holding and cracking seeds.

Structure of beak and feet

2. **Wood pecker**
    - It gets insects from holes and cracks in the bark of trees with its long pointed beak.

H. Scavenger birds

- They feed on flesh of animals killed by other animals .
- Have strong curved beaks to enable them tear flesh.

NB: They help to clean the environment by eating flesh of dead animals that would be a source of germs.

Examples of scavenger birds

- vultures,
- crows,
- marabou storks

Structure of beak and feet

Ways in which birds are adapted to flying

- They are streamlined to reduce friction in air.
- They have hollow bones which help to reduce weight.
- Their front limbs are modified into wings.
- They have a nictitating membrane which cover the eyes and protect them against moving air during flight.
- They have flight feathers.
- They have no pinnae to obstruct the flow of air.
- They have hollow air sacs from the lungs.

Importance of birds

- They are a source of food to man and animals.
- Their feathers can be used for decoration on hats, hand bags.
- Their bones can be used for making glue.
- Some birds are kept as pets.
- Birds are a source of income to farmers.
- Some birds like sun bird help in pollination.
- Some bird like vultures, crows and marabou storks clean our environment
- Some can be used for cultural practices like paying dowry.

Dangers of birds

- Many birds destroy crops.
- Some birds cause accidents on run ways at airports.
- They make a lot of noise especially weaver birds
- They keep vectors like fleas and mites.
- Some birds of prey such as kites and eagles kill and eat the chicks of domestic birds.

The cold blooded Vertebrates

- These are vertebrates whose body temperature changes according to the environment.

Groups of cold blooded animals

- Reptiles
- Amphibians
- Fish

1. Reptiles

These are cold blooded vertebrates that undergo internal fertilization and move by crawling

Common characteristics of reptiles

- They all move by crawling along the ground
- Their bodies are covered with scales
- Most reptiles have four limbs except for snakes which are limbless.
- Their eggs undergo internal fertilization.
- They breathe by means of lungs.
- They have three chambered hearts
- They reproduce by laying eggs except for a few snakes.
- They are poikilothermic (cold blooded)
- They do not take care of their young ones
- They have a set of teeth of the same kind

Classification of reptiles

Reptiles are divided into the following groups

- Snakes
- Lizards
- Turtles and tortoises
- Crocodiles and alligators

a) Snakes

Characteristics of snakes

- They have no limbs.
- They are carnivorous animals.
- Their eyes have no eyelids but are protected by an immovable transparent membrane.
- They have a forked tongue which acts as a sense organ for smell, touch and taste.
- They shed their skin after a certain period.
- They have a large number of ribs and vertebrae.
- They move by slithering.
- Snakes bite to paralyse their prey in order to swallow them and bite people when they are disturbed so they do it to defend themselves.

Groups of snakes

- Poisonous snakes
- Non-poisonous snakes
- Constrictors

i.Poisonous snakes.

- Have a pair of long hollow teeth called fangs connected to poison glands.

- When the snake bites poison or venom is injected into the bitten animal.
- They kill their prey before swallowing it whole.

N.B Snake venom can be used to make anti-venoms.

Examples of poisonous snakes

1. **Cobras e.g**. spitting cobra can and black cobra
2. **Vipers e.g.** horn viper, Gabon viper. These bear live young ones.
3. **Mambas e.g**. black mamba, green mamba.
4. **The adder family e.g**. Puff adder

First aid for snake bites

- Stop movement of the casualty.
- Identify the fang marks on the bitten part.
- If the casualty was bitten by a poisonous snake, slightly tie above the bitten part.
- Take the casualty to the nearest health center.

ii. Non-poisonous snakes

- They don't have fangs but have solid teeth facing backward to prevent their prey from escaping
- They swallow their prey whole live e.g. frogs, lizards, birds, toads, geckoes, etc

Examples include;

- house snakes,
- grass snakes,
- tree snakes

iii. **Constrictors**.

- They kill their prey by squeezing and suffocating them
- They lick their prey to make it slippery and smooth when swallowing.
- They eat big wild birds and small mammals like antelopes, wild pigs, goats, young buffaloes, calves, etc

Examples include;

- Python,
- Boas
- Anaconda.

Importance of snakes to man

- They provide skin that can be used for making drums, shoes, belts, hand bags.
- They attract tourists through which a country earns income.
- They eat pests and vectors which would attack man and his crops.
- They can be eaten as food.
- They can be used as a source of medicine e.g. anti-venom of snake bites.

c. Lizards

- Most lizards have four limbs which end in clawed toes.
- Their tongues are fleshy.
- They have movable eyelids.
- Their heads are flat and triangular.

N.B Most lizards are harmless except the Gila monster which has fangs.

Examples of lizards;

1. **Geckoes**
    - These are small and yellowish-brown.
    - They have short and broad tongues.
    - They can cast off their tails and develop new ones.
    - They feed on small insects and worms.
    - They lay eggs in cracks and holes in buildings where they mainly live.
    - They have suction pads on their feet which enable them **to move upside down on ceilings.**
    - They are useful because they feed on mosquitoes and other harmful insects.
2. **Agama lizards** – Are usually found in rocky places.
3. **Monitor lizard** – it is a large lizard. It eats eggs, birds, rats and mice. It has a strong tail which it uses to hit its enemies when attacked.
4. **Chameleon**
    - They have large heads and protruding eyes.
    - Their feet and tails are well developed for catching and gripping small twigs and branches of trees.
    - They have long sticky tongues used to catch insects.
    - They camouflage for protection and trapping insects for their food.

NB: Chameleons feed on insect vectors that are harmful to man. E.g. mosquitoes, houseflies, etc.

d)Tortoises and turtles

- Have shells on their bodies for protection.
- Tortoises are land animals that feed on grass and insects.
- Have four limbs that end in clawed toes.
- Have sharp cutting edges in their jaws instead of teeth.
- They reproduce by laying eggs which are fertilized internally.
- Turtles are similar to tortoises but live in water and come on land only to lay eggs in sand. The limbs of turtles are modified into flippers for swimming.
- Terrapins are a kind of turtles that **live in fresh water**.

a) Crocodiles and alligators

- They are found mostly in rivers and lakes of Africa.
- They have a long powerful tail which helps them in swimming and attacking
- They have long strong jaws
- The female lays hard-shelled eggs and covers them in sand or mud.
- They are covered with tough leathery scales.
- Alligators are similar to crocodiles but they are found in America.

Uses of crocodiles and alligators to man

- Man can kill them to get skins for making shoes, bags and belts.
- They attract tourists who in turn contribute to the country's income.
- Man can eat their meat

Importance of reptiles to man

- They skins are used to make leather products e.g. Bags, Shoes, Belts etc.

- Reptiles are tourist attraction.
- Snake venom is used to make **anti venom**
- Some reptiles are source of food in some countries.
- Reptile feed on insect vectors.

e. <u>Amphibians</u>

These are cold blooded vertebrates that move by leaping

Characteristics of amphibians:

- They live both in water and on land.
- They are poikilothermic
- Have two pairs of limbs (hind limbs are webbed to enable them to swim).
- Adults breathe by means of lungs but young ones breathe by means of gills.
- Their eggs undergo external fertilization.
- They have eardrums under the skin on the head but they do not have external ears.
- Their teeth are all alike.
- Frogs and toads don't have tails while newts and salamanders have tails in the adult stage.

Examples of amphibians

- Frogs
- Toads
- Newts
- Salamander

Differences between frogs and toads

Frog	**Toad**
❖ Their tadpoles are brown ❖ Their skin is moist, smooth, slippery and blackish ❖ Live mostly in water during adult stage ❖ Have teeth in the upper jaw ❖ Have fully webbed hind feet ❖ Lay eggs in big mass spawns ❖ Have no poison glands ❖ Can breathe through their moist skin because it is moist	❖ Their tadpoles are black ❖ Their skin is dry, rough, warty and brownish ❖ Live mostly on land during adult stage ❖ Have no teeth ❖ Have half webbed hind feet. ❖ Lay eggs in ribbon-like spawns ❖ Have poison glands ❖ Cannot breathe through the skin because it is dry

Structure of a frog and toad

Functions of the parts

Mouth – for feeding

Nostrils – sense organ for smell

Eyes – sense organ for sight

External eardrum – for hearing

Poison gland – produce poisonous substance that prevents other animals from eating a toad

Strong hind legs – enable a toad hop to escape from enemies

Webbed feet – enable a toad to swim in water.

Feeding, life history, respiration and adaptation of frogs

Feeding in frogs / toads

- Adult frogs and toads are carnivores. They feed on worms, beetles, cockroaches and other insects.

Life cycle (metamorphosis) of a frog / toad

- During rains the male and female form a pair in water
- The males make noises (croaks) to attract females.
- The male climbs the female's back
- The female lays eggs as the male sheds sperms over them and get fertilized externally.
- After about 2 weeks the eggs hatch into young ones called tadpoles

Respiration in a toad/ frog

i)a frog can breathe through lungs, the moist skin and lining of the mouth cavity. When under water, it breathes through the moist skin only.

ii) A toad can breathe through lining of the mouth and lungs only

Differences between a tadpole and an adult frog / toad

Tadpole	Adult
- It has gills for breathing.	- Has no gills and uses lungs and its moist skin for breathing. The skin is moist to dissolve oxygen so that it can be taken in.
- Has a tail for swimming	-Has no tail and uses its webbed feet for swimming

Ways in which a frog is adapted to living in water

- Has a streamlined body that enables it to move easily in water.
- Have strong hind legs with fully webbed feet so it can swim rapidly.
- Can stay under water for sometime because they can take in oxygen from water through their moist skin.
- The eyes and nostrils are arranged in such a way that they can float on water and its body is hidden from its enemies.
- They can hibernate during dry season i.e. rest or sleep.

Importance of amphibians

- They feed on harmful insects such as houseflies, mosquitoes, cockroaches, etc that spread diseases.

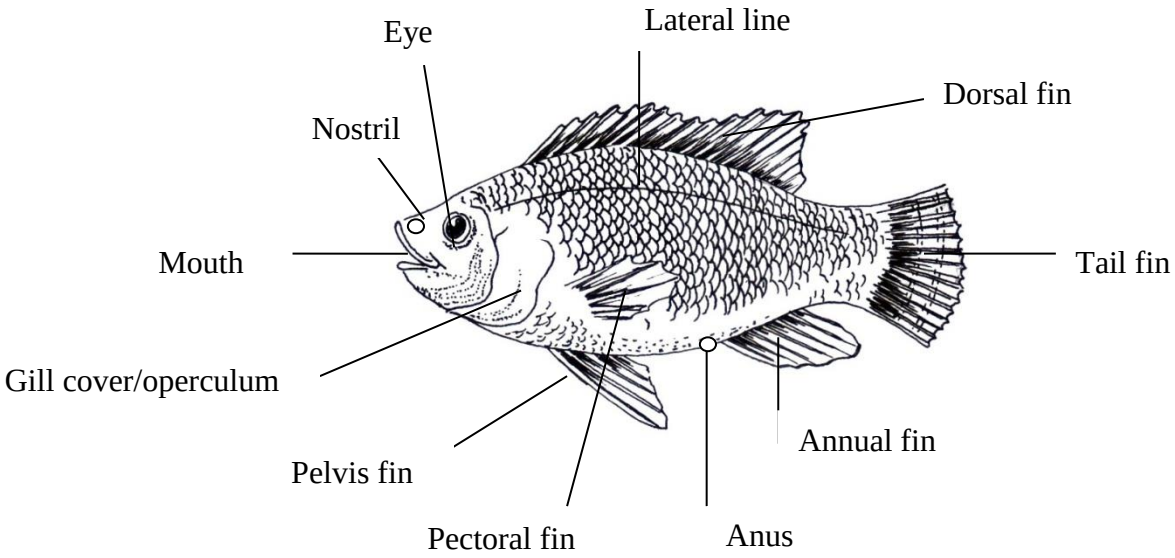
f. Fish

Characteristics of Fish

- They are poikilothermic animals.
- They live in water.

- They have fins used for swimming / moving in water.
- Their eggs undergo external fertilization.
- They have streamlined bodies to reduce friction while swimming.
- Some fishes' bodies are covered with scales.
- Have nostrils used for smelling and tasting.

External features of fish



Functions of the parts

The mouth– helps fish to take in food and water for breathing.
Nostrils – used for smelling food
Scales – bony plates covering and protecting the skin. Some fishes do not have scales. Their bodies are covered with slippery jelly which helps them to escape from their enemies.
Gill cover or operculum – covers and protects the gills
Lateral line – it enables the fish to pick sound waves in water
Fins – make fish stable and control the direction in water during movement
The median fins – these include caudal fin, dorsal fin and ventral / anal fin. They prevent fish from rolling in water.
The dorsal fin may also be used for protection.
The tail / caudal fin can also be used to control turning of fish (acts as steering wheel) and increasing speed.
Paired fins – They include pectoral and pelvic fins. They enable the fish to swim upwards and down wards. They also act as brakes for slowing down speed and balancing in water.
Anus – used for passing out excreta.
Gills – used for breathing

Classification of Fish

Types of Fish

- Bony fish
- Cartilaginous fish
- Lung fish

Bony fish

01Their skeletons are made of bones

- Their eyes have no eyelids.
- Their bodies are covered with scales that overlap.
- Their gills are covered by a bony structure called operculum.
- They have a swim bladder which prevents them from sinking (keeps them buoyant)

Examples of bony fish;

- Nile perch
- Tilapia
- Salmon
- Pike

Cartilaginous fish

- Their skeleton is made of cartilage.
- The mouth is situated on the underside of the head.
- They have tough and spiny scales.
- They have no gill cover but have gill slits on the surface of the body
- They have no swim bladder.

Examples of cartilaginous fish;

- Dog fish
- Skates
- Rays
- Shark

Lung fish

- ❖ They breathe by means of gills in water and by the swim bladder when the gills can't supply enough oxygen.
- ❖ They have long and thin pelvic and pectoral fins.
- ❖ They live in dirty pools, swamps or rivers that dry up during the dry season.
- ❖ They hibernate during the dry season.

Examples of lung fish;

- Common lung fish,
- Dipon

Reproduction in fish

The female lays eggs in shallow water and the male sheds sperms over them. The eggs hatch out by the heat from the sun. Young fish are called fry or fingerings. Most fish don't care for their young ones except tilapia.

How fish protect themselves against enemies

- By use of scales on their bodies, dorsal fins and teeth.
- Some fish have electric organs which give out high voltage electricity to shock the enemy.
- Some change their colour to hide from their enemies.
- Some fish inject poison into their enemies using spines on their fins.
- Fish have slippery bodies that enable them slip away from their enemies.

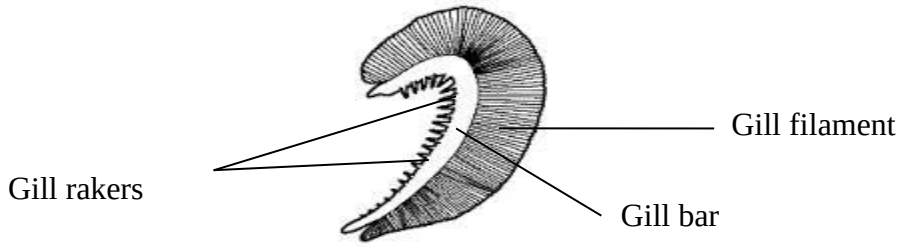
Breathing, feeding habits, adaptations and importance of fish.

Breathing in fish

- Fish breathe in dissolved oxygen in water. Water containing oxygen moves through the mouth and over the gills which absorb oxygen in water.
- Gill rakers trap any solid particles or dirt so that they do not damage the gills.

- Gill filaments absorb oxygen from water.

Structure of a gill



NB: Why does a fish keep its mouth open when swimming?

- To let in water containing dissolved oxygen.

Feeding in fish

- Fish feed on water plants and small animals like worms, insects and smaller fish.
- They capture their food with teeth and pass it down the gullet without chewing.
- Fish have different feeding habits; some are predators, grazers, strainers, suckers or parasites.
    a) **Predators** – these feed on flesh or living prey e.g. Nile perch
    b) **Grazers** – they feed on water plants and some water animals e.g. labeo
    c) **Strainers** – swim with their mouth open and take in a lot of water with microscopic algae which the body sieves and digests e.g. tilapia
    d) **Parasites** – they hold on to their host and make holes on the host's body and suck body fluids.

Ways how fish are adapted to living in water.

- Have streamlined bodies to reduce viscosity (friction in liquids).
- Have gills for breathing in water.
- Scales and colour provide them with protection.
- Have fins that enable them to move in water and stop them from rolling.
- Have swim bladders that control the depth at which they swim in water.
- Have lateral lines that help them to sense any danger in water.
- Some are slippery to help them to slip from their enemies.

Importance of fish

- They are eaten as food. They are a good source of proteins.
- Their bones are used in the manufacture of glue.
- They are source of employment.

NB: Difference between the breathing in fish and tadpole.

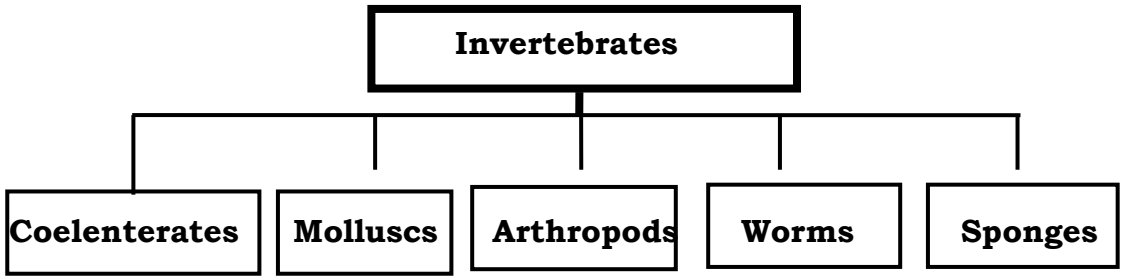
- A tadpole uses external gills while a fish uses internal gills

Invertebrates

- Invertebrates are animals without back bones.

Characteristics of Invertebrates

- They do not have a back bone.



Group of invertebrates

- Worms
- Echinoderms
- Coelenterates
- Molluscs
- Arthropods
- Sponges

1) Arthropods

- Arthropods are invertebrates with segmented bodies and jointed legs.

Characteristics of arthropods

- They all have segmented bodies.
- They all have Exo skeleton.
- They have jointed legs.

NB. The Exo skeleton prevents growth in size. Arthropods shed their Exo skeleton through the process known as moulting.

Classes of arthropods

- Crustaceans
- Insects
- Arachnids
- Myriapods

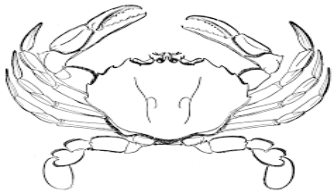
Crustaceans

- They have two body parts i.e. Cephalothorax and abdomen.
- Have two pairs of antennae.
- Mainly live in water.
- They have ten legs.

Examples include;

- crab
- lobster
- cray fish
- shrimps
- prawns
- sand hoppers

Structure of a crab



Myriapods

- There are two groups of myriapods namely; chilopoda and diplopoda.

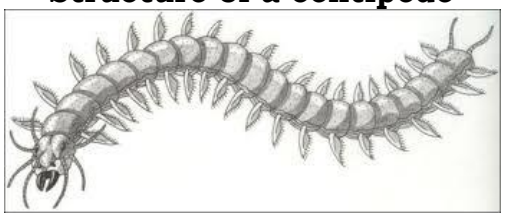
a) Chilopoda (chilopodes)

- Have one pair of jointed legs attached to each segment
- They have a pair of antennae
- The front pair of legs is modified to form poison claws which they use to paralyse their prey by biting.
- They feed on small insects (they are carnivorous animals)

Example of chilopodes

Centipede

Structure of a centipede



b) Diplopoda (diplopodes)

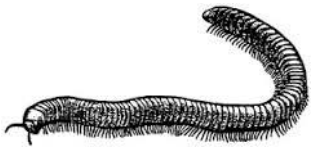
- Have two pairs of jointed legs on each segment.
- They protect themselves by curling up and produce a fluid with a bad smell.
- They herbivores

N.B These help in aerating the soil

Examples of diplopodes

- Millipede

Structure of a millipede



c) Arachnids

- Have only two body divisions (cephalothorax and abdomen).
- They breathe by means of book lungs.
- Have four pairs of legs.

Examples include;

- Scorpions,
- Spiders,
- Mites,
- Ticks

NB. Spiders have special organs at the end of the abdomen called spinnerets used to spin silk to make cob webs. The cob webs are used to trap insects (prey). They breathe through book lungs on their abdomen. **Scorpions** protect themselves by stinging. They don't lay eggs but give birth to live larvae (young ones).

d) Insects

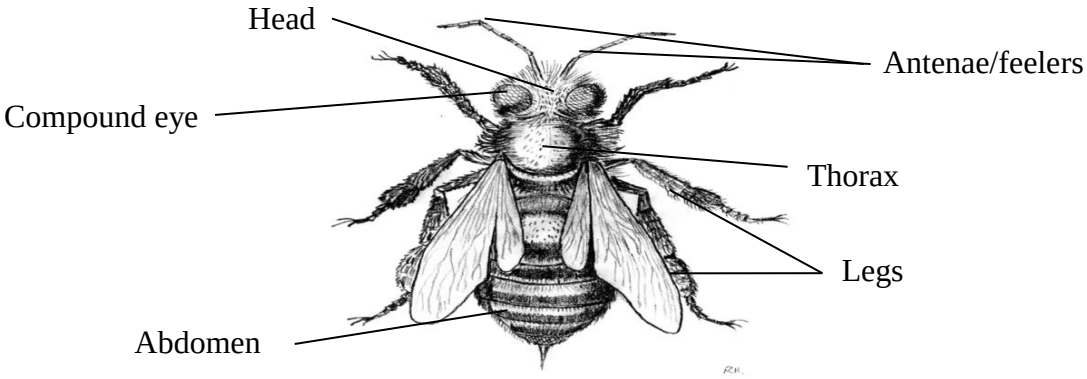
- Is the largest and widest spread group among arthropods.

Characteristics of insects

- They have three pairs of jointed legs attached to the thorax.

- The bodies of insects are divided into three divisions i.e. head, thorax and abdomen.
- They have a pair of compound eyes.

Structure of an insect



Head

- Has a pair of antennae / feelers used as sense organ for touch, smell, detecting sound and temperature change.

  Mouth parts i.e. proboscis used for sucking fluids e.g. mosquitoes, houseflies, bees, tsetse flies others have mandibles used for chewing e.g. grasshoppers, locusts, cockroaches, beetles, etc…

N.B The head performs sensory functions

Thorax

- It has halteres / balancers used for balancing during flight.
- The thorax has legs which have suction pads which help an insect to move on the walls and ceilings without falling

Abdomen

- It has breathing holes called spiracles.
- The abdomen has reproductive, digestive and respiratory organs.

N.B The abdomen performs digestive, reproductive and excretory functions.

Metamorphosis in insects

- Metamorphosis is the change in stages of growth of an organism. The life cycle of an insect is called metamorphosis.

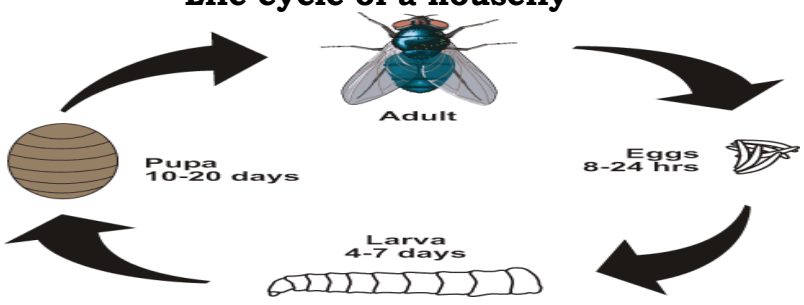
Types of metamorphosis

a) Complete metamorphosis

This is the life cycle of some insects in which they go through four stages of development i.e. eggs, larva, pupa and adult.

Examples of insects which go through complete metamorphosis include; houseflies, mosquitoes, butterflies, moths, bees, beetles

Life cycle of a housefly



- An adult house fly lays eggs in dead decaying matter.
- The eggs hatch into larva (maggot) after one day
- The maggots feed on decaying food or flesh.

Dangers of houseflies / economic importance of houseflies

- They carry germs on their hairy bodies which cause diseases like diarrhea, dysentery, cholera, typhoid, trachoma, etc.
- The larvae of houseflies help to reduce the volume of faeces in latrines.

Mosquitoes

Types of mosquitoes

a) Anopheles mosquito

- Female anopheles mosquito spreads a germ in the protozoan group called **plasmodium**
- The germ causes malaria
- Male anopheles mosquito don't bite human beings, they instead feed on nectar and juice of plants.
- The female anopheles mosquito lays eggs in stagnant water.

Why does a female anopheles mosquito suck blood?

- To obtain iron and protein which help its eggs to develop?

b) Culex mosquito

- It spreads a worm called filaria which causes elephantiasis (filariasis). The disease makes the legs to grow big like those of an elephant.

c) Aedes or tiger mosquito

- Spreads the virus that causes either yellow fever or dengue fever in human beings.

Differences between anopheles mosquito and other types of mosquitoes

Anopheles mosquitoes

- Lay eggs singly with an air float
- Flies only at night
- The body of an adult lies in a sloppy position while at rest and wings spotted.
- Larva lies parallel to the water surface when breathing

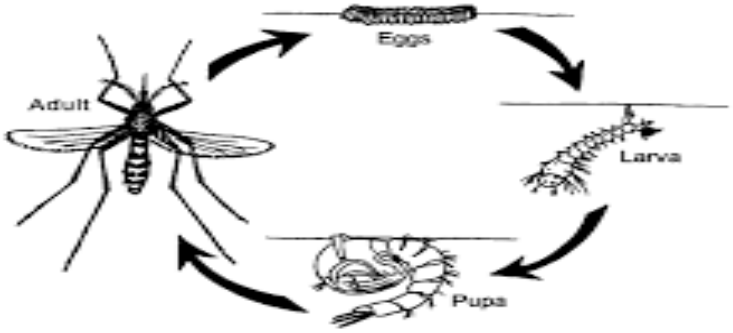
Culex mosquito

- Lays eggs in a raft (many together)
- Flies during the day and night
- Adult lies horizontally while at rest
- Larva lies at an angle to water surface when breathing

Aedes or tiger mosquito

- Lays eggs singly
- Flies during the day only
- Adult lies horizontally while at rest
- The body has white and black spots
- Larva lies at an angle to the water surface when breathing
- The larva of a mosquito breathes through breathing tubes called **siphon** and the pupa uses breathing **trumpet**
- The larva of a mosquito is called a **wriggler** while that of a butterfly is called a **caterpillar**, and the pupa is **chrysalis**

Life Cycle of the Mosquito



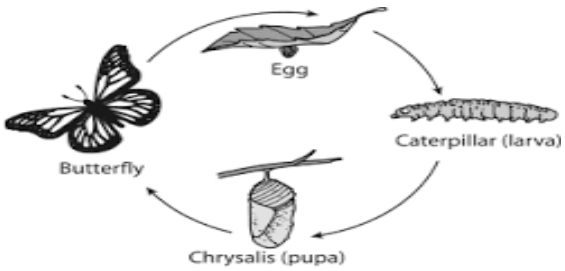
Differences between moths and butterflies

Moths	Butterflies
They have stout bodies	Have small slender bodies
Mostly move during nights	Move during day time
Rest with their wings wide open	Rest with their wings folded at the back
They have dull colours	Have brightly coloured wings
Have triangular wings	Have rectangular wings
Have smooth bodies	Have hairy bodies
Have hairy feelers	Have feelers with knobs

Life cycle of a butterfly

- The eggs are laid on plant leaves.
- The larva (caterpillar) is very destructive because it feeds on plant leaves.
- The pupa (chrysalis) does not feed. It rests in a cocoon.

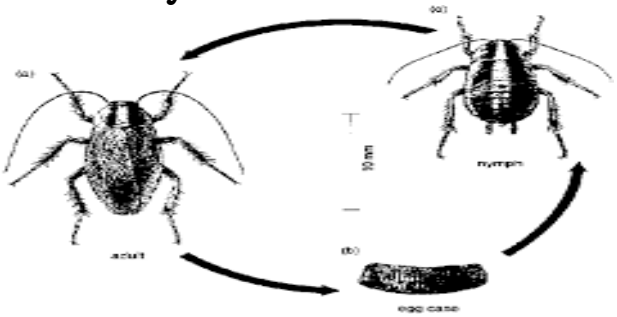
Illustration



Incomplete metamorphosis

- This is a life cycle which involves three stages i.e. eggs, nymph and adult
- Examples of insects that undergo incomplete metamorphosis include; grasshoppers, locusts, cockroaches, crickets, termites

Life cycle of a cockroach



Dangers of different insects

a) **Cockroaches**
- Destroy clothes, books, food
- They transmit diseases like typhoid fever, diarrhea, polio.

b) **Mosquitoes**
- Spreads germs that cause diseases such as malaria, elephantiasis, dengue fever, yellow fever

c) **Tsetse flies**
- Spreads germs that cause Nagana to animals and sleeping sickness to human beings

d) **Honey bees**
- They sting

e) **Termites**
- Destroy crops
- Damage buildings and other structures.

f) **Grass hoppers**
- Damage crop leaves

g) **Butterfly and moth**
- During the larva stage caterpillars destroy crops and plants

Importance of different insects

a) **Honey bee**
- Help in pollination
- We get honey and bee wax from them

b) **termites**
- Break down plant materials and form soil

c) **Grasshoppers**
- They are eaten as food.

d) **Butterflies and moths**
- Help in pollination
- Silk worm produces silk used for making cloth

e) **House flies**
- During the larva stage reduces the volume of faeces in latrines.

Molluscs

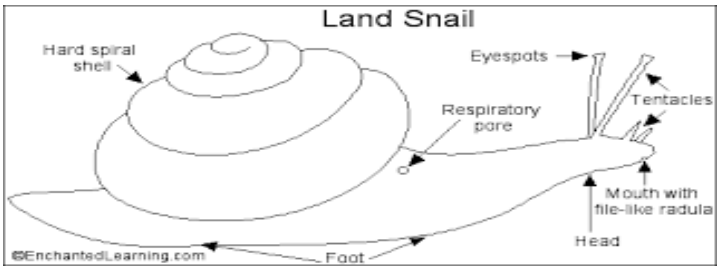
Characteristics
- Have soft unsegmented bodies.
- Their body is surrounded by a glue-like substance called mantle.
- Some are covered in a shell e.g. snails while others are not.
- Some live in seas while others live in fresh water.

- Some have gills for breathing while land molluscs have simple lungs.

Examples include;

- snails
- slugs
- squid
- octopus
- oysters

Structures of a snail



Functions of different parts of a snail.

Shell: - For protection

Tentacles: - For sense of smell and touch

2) Worms

- They are long, thin, soft bodied animals. They live in moist environments e.g. inside other animals. They breathe through their moist skin.

Types of worms

a) Segmented worms (annelids)
b) Round worms (nematodes)
c) Flat worms (platy helminthes)

- Segmented worms/ annelids

- These are worms whose bodies are divided into segments as rings. They live in water and soil.

Examples of worms;

- Earth worms,
- Leeches,
- Bristle worms.

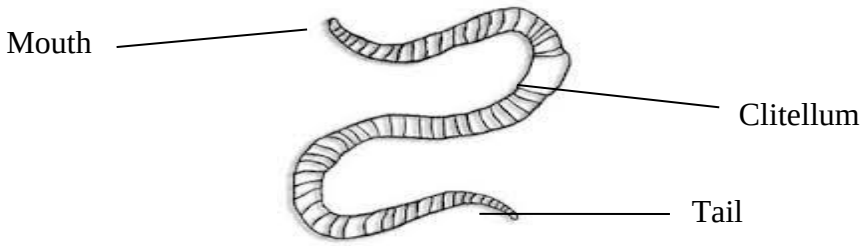
Earth worms

- Live in the soil and eats decayed vegetation. It is a hermaphrodite i.e. has both male and female reproductive organs. Breathe through its moist skin.

Importance of earth worms

- They aerate the soil by making tunnels in soil where air and water occupy.
- They help in the formation of humus.

Structure of an earthworm



Flat worms

- They have flattened and segmented bodies. Most of them are parasites. They are hermaphrodites.

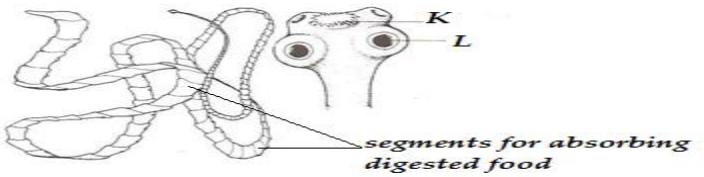
Examples include;

- tape worms
- blood flukes,
- Liver flukes and.

a)**Tape worms**

- They are intestinal parasites which feed on digested food.
- They enter our body when we eat under cooked meat or fish.
- Their eggs are passed out in human faeces, they may be eaten by grazing animals. When the eggs hatch they turn into embryos which later form cysts that are kept in animal flesh.

Structure of a tape worm



b) Blood flukes or bilharzias worm.

- Lives in the veins of the bladder, large intestines or small intestines of human beings
- It has suckers to hold to the sides of the blood vessel

Feeding

Feeds by sucking blood from the walls of the body organs where it is found.

Reproduction

Reproduce by laying eggs.

c) Liver flukes

- They live in the liver or bile duct.

Round worms (nematodes)

- They have long round bodies that look like threads.
- They have cylindrical bodies and pointed ends at both ends.
- Some are parasites in man, animals and plants.

Examples of round worms

- Hook worms,
- pin worms,
- askaris (common round worm),
- thread worm

Askaris

- Are not very dangerous but suck digested food from the alimentary canal.
- They can be got by eating contaminated food.

Hook worms

- Are small intestinal round worms.
- They have tiny hook like structures which they use to feed from the walls of the intestines.
- They suck blood from the intestinal walls
- The young worms (larvae) enter the body by penetrating through the bare skin.
- They go to the lungs through the blood streams and cause dry cough.
- The infected person coughs up the worms and swallows them

N.B Hook worms lead to anaemia in a host

Thread worms

- They look like pieces of thread.
- They can be got through eating dirty food and licking dirty fingernails.

SOUND ENERGY

Sound

- **Sound** is the form of energy produced by vibrating objects.

Vibration

- Is the repeated to and fro movement of an object.

Sources of sound:-

- These are things that vibrate and produce sound.

Natural sources of sound:-

- These are things that vibrate and produce sound on their own.

Examples of natural sources of sound include;

- Crying baby
- Talking man,
- animals,
- thunder,
- storms,
- Waterfalls, etc.

Artificial sources of sound:-

- These are people made sources and include; radios, bells, gun, flute, cars, musical instruments like guitars, harps, tube fiddles, drums, etc

How sound is produced

- Sound is produced by vibrations of different objects or substances. This can be liquids, gases or solids.

How sound is produced by living things

- All mammals produce sound by vibrations of vocal cords.
- Birds make sound by vibration in the rings of cartilage in the trachea.
- Insects produce sound while flying by vibrations of the wings.
- Grass hoppers and crickets produce sound by rubbing their hind legs against their wings to produce sound.

Properties of sound

- Sound travels by means of sound waves in all directions from the source.
- Sound requires a medium or material in order to travel. That is why it is not travel through a vacuum.
- Sound can be reflected
- Sound can be defracted

- Sound can be stored and produced.

Speed of sound in the three states of matter.

a) Solids (iron) – 1500 m/sec.
b) Liquids (water) – 1484 m/sec.
c) Gases air) – 330 m/sec.

Factors that affect speed of sound

- **Temperature** – At night when the temperature is low, the sound waves travel very near the ground level. This is why we hear clearly and easily at night than during day.
- **Heat** – The heat of the day makes sound waves rise high making it difficult to hear.
- **Wind** – wind carries sound farther if it is blowing in the same direction. If it blows against it the sound is obstructed.
- **Altitude** – Sound waves move easily along a lower altitude than climbing or going downhill or mountain.

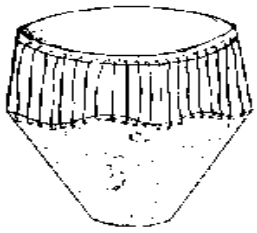
Pitch, volume and frequency of sound

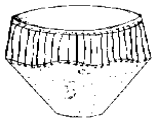
1. **Pitch** is the highness or lowness of sound.

Factors that affect or determine the pitch of sound

a) **The size of the vibrating surface** – the smaller the surface the higher the pitch.

Illustration



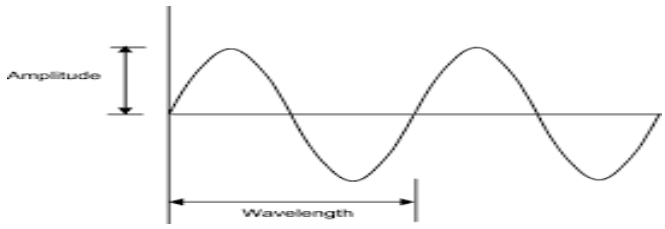


b) **Tension (tightness or looseness) in the vibrating surface** – the tighter the object the higher the pitch and vice versa
c) **Frequency of the vibration** – quick vibrations produce high frequency and therefore produce high pitch of sound and low vibration produce low frequency and therefore produce low pitch.
d) **Thickness or thinness of the vibrating object –** Thick objects produce low pitch while thin objects produce high pitch**.**
e) **Temperature** – When the temperature is high, the pitch is also high and when it is low the pitch is also low. The pitch of sound increases with temperature.

2. Volume of sound

- Volume is the loudness or softness of sound
- Volume depends on the amplitude
- Amplitude is the width of vibrations.

Diagram showing amplitude



3. Frequency

- This is the number of vibrations per second.
- Frequency can determine the pitch of sound. Quick vibrations produce high frequency and low vibrations produce low frequency.

Types of sound

a) Music
b) Noise

Music

- This is organized sound with rhythm.
- Music is pleasant to hear.
- Music is produced by regular vibrations.

Noise

- This is disorganized sound
- Noise is unpleasant to hear.
- Noise is produced by irregular vibrations.

Musical instruments

- These are instruments which produce sound.

Groups of musical instruments

a) String instruments: - these produce sound by vibration of the strings when plucked e.g. violin, tube fiddle, guitar, etc..
b) Wind instruments: - these produce sound by vibration of air blown in them e.g. flute, trumpet, pine pipes, a bottle, saxophone, horn, etc..
c) Percussion instruments: - these produce sound by vibration of the surface when hit e.g. xylophones, bells, shakers, rattles, etc..

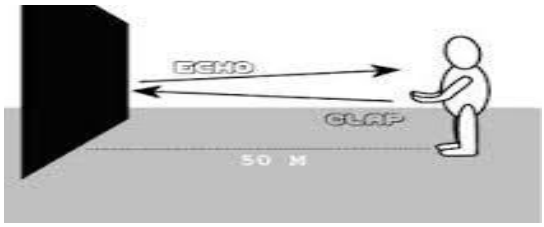
NB:

- A drum is played by hitting it and the skin vibrates,

Echoes / reflection of sound

- An **echo** is a reflected sound we hear.
- When sound strikes a hard surface such as tall buildings, cliffs, walls, mountains, etc it is bounced.

Illustration



- Smooth hard surfaces produce the best echoes while soft rough surfaces absorb sound.

Uses of echoes

- Bats use echoes to locate food and find their way by dodging obstacles.
- Pilots use echoes sounding from hills and mountains to avoid accidents by not crashing into hills and mountains.
- Sailors use echoes to find the depth of the water
- Doctors use echoes to find the condition of different parts of the body.
- Whales use echoes to know if there is an obstacle in front.

Dangers of echoes

- Echoes cause unnecessary noise in music rooms and cinema halls.
- Echoes cause fear.

How to control echoes in theatres

- Covering walls with thick curtains and soft boards
- Covering the floors of theatres with woolen carpets
- Putting cushioned seats in theatres.

Calculating distance and time using speed of sound.

Example 1

A man heard a gunshot after four seconds. How far is he from the firing spot?

Distance = ?

Speed of sound = 330 m/sec.
Time = 4 sec.
D = S x T
D = 330 m/s x 4 s
D = (330 x 4) m
D = 1320 m

Therefore the man is 1320 m from the firing spot.

Example II

It takes three seconds for a man to hear the echo of his clap. How far is he from the cliff that reflected the sound?

Speed of sound = 330 m/sec
Time taken = 3 sec
Distance = ?
D = S x T/2
D = 330 m/s x 3/2 s
D = 990/2
D = 495 m

Example III

Amooti was standing across the valley, which was 660 metres from the cliff. If he shouts, how long will it take to hear the echo?

D = 660 m
S = 330 m/s
T = ?
T = D/ S
T = 660/ 330 x 2
T = 2 x 2
T = 4 sec

Example IV

Okello was standing 165 metres away from his father who called him by clapping. How long did it take Okello to hear the clapping?

T = ?
D = 165 m

S = 330 m/s
T = D/S
T = 165/330
T = 0.5 sec

Ways of storing sound

- Recording sound.
- Writing in notation form.

Devices used to store sound

- Video compact discs
- Digital Video Discs (DVDs),
- Audio compact discs (CDs),
- Computer diskettes
- Compact Cassette tapes,
- Video compact tapes

Reasons for storing sound

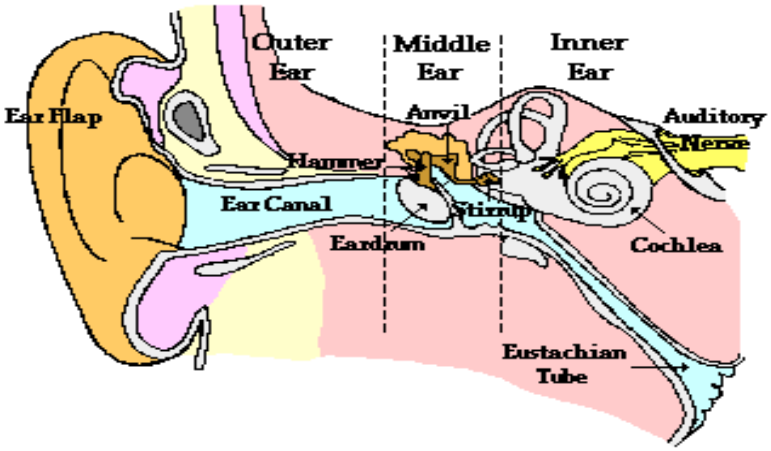
- For future use
- To get evidence

Reproducing stored sound

Sound can be reproduced by playing the recorded sound using; radio cassettes, video compact disc player, digital video disc player, computer monitors, video decks and reciting the notation

The human mammalian /ear

Structure of the mammalian ear



The ear is divided into three parts i.e.

a) The outer ear,
b) middle ear
c) the inner ear

The outer ear

Pinna – collects sound waves from the environment and sends it to the auditory canal

Auditory canal – directs sound waves to the ear drum making it to vibrate

The middle ear

Ear drum - made of a thin membrane, it vibrates when sound waves hit / strike it and transmit the sound waves to the middle ear.

Ossicles – a chain of three small bones i.e. hammer, anvil, stirrup (HAS) or malleus, incus, stapes (MIS). They amplify or increase the strength of sound vibrations and transmit them to the oval window.

Oval window – passage of sound vibrations from the ossicles to the inner ear.

Eustachian tube – balances air pressure on either side of the ear drum.

The inner ear

Semi-circular canals – determine balance and posture of the body.

Cochlea – convert the sound vibrations into nerve impulses.

Fluids found in the cochlea:

- Perilymph
- Endolymph

Auditory nerve – conducts sound impulses to the brain for interpretation.

Hearing process, caring for the ear and ear defects

Hearing process

- The pinna collects the sound waves from the environment
- It directs the sound waves to into the auditory canal
- The sound waves make the ear drum to vibrate.
- The ear drum passes on the waves to the ossicles in the middle ear making them to vibrate
- The ossicles amplify the vibrations to make them stronger.
- The sound vibrations move into the inner ear.
- The cochlea in the inner ear changes the sound vibrations into nerve signals or messages ready to be interpreted by the brain.
- The auditory nerve picks up the nerve signals from the cochlea and takes them to the brain.
- The brain interprets the nerve signals. This enables us to hear and understand the message.

Problems that affect the ear (ear defects)

a) **Deafness**

- This is a condition whereby a person is not able to hear at all or cannot hear properly. The kind of deafness in which a person cannot hear at all is called **complete or permanent deafness** and the kind of deafness where a person hears but not well is called **partial deafness.**

Causes of deafness

- Damage to the ear drum caused by accidents or exposure to loud noise
- Hardening of the ear drum.
- Blockage of the ear due to too much wax or foreign body such as beans in the ear.
- Damage to the part of the brain responsible for hearing
- Accidents that can cause damage to the ear drum
- Pushing objects into the ear
- Motor accidents affecting the head
- Being exposed to very loud noise produced by big guns and bombs

- Getting heavy blows or slaps on the ear
- Pouring dangerous liquids like paraffin into the ear.

b) Discharging ears

- ❖ This is a condition in which a person has pus coming out of the ear. It can result due to poor personal hygiene.

c) Ringing ears

- ❖ This is caused by chronic irritation or inflammation of the middle ear.

Diseases of the ear

Cancer of the ear

- Cancers of the ear usually occur on the skin of the outer ear. Cancers of the ear can develop inside the ear too,

Type of ear cancer

Cancer of the outer ear

Symptoms:

- Swelling or lump in the neck.
- Cause: Long periods of time in the sun
- Treatment for people with small cancers of the skin of the ear includes surgery to remove the affected area.

Cancer of the Auditory Canal

Symptoms:

- Discharge from the ear canal, often tinged with blood
- Hearing loss
- Sometimes facial paralysis on the side of the affected ear
- Earache
- Cause: Unknown—but may be more common in adults with long history of outer ear infections.
- Treatment for people with cancer of the auditory cancel includes surgery to remove parts of the middle ear.

Cancer of the Middle Ear

Symptoms:

- Discharge from ear for long period of time
- Recent blood stained discharge
- Hearing loss
- Sometimes facial paralysis

Cause: Unknown—but may be more common in adults with history of discharge from ears for long periods of time.

Otosclerosis

- Otosclerosis is the buildup of bone-like tissue in the middle ear that prevents the ossicles, from working properly.
- Scientists aren't sure about the exact cause but there is some research suggesting a relationship between otosclerosis and the hormonal changes associated with pregnancy and also with viruses.

- Treatment for people who are diagnosed with otosclerosis depends on the extent of hearing loss and may include surgery to replace some or all of the ossicles with artificial ones

Otitis

- This is an inflammation of the ear caused by either bacteria or virus.
- It attacks the outer, middle and inner parts of the ear.
- It si common in children.

Care for the ear

- Wash the ear daily with clean water and soap to remove dust.
- Never use sharp objects to clean the ear because they can pierce and damage the ear drum
- In case of ear problems contact a qualified medical personnel

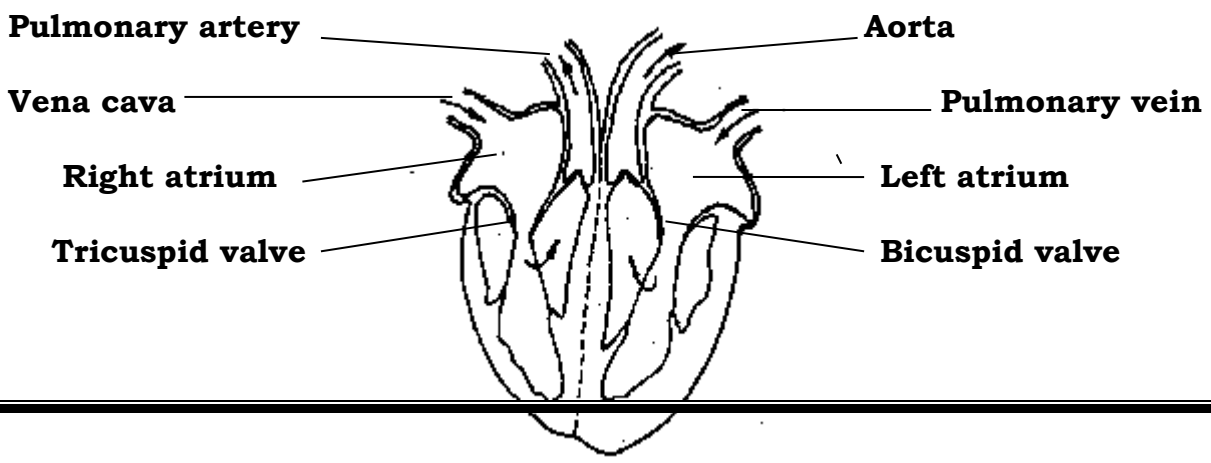
THE CIRCULATORY SYSTEM

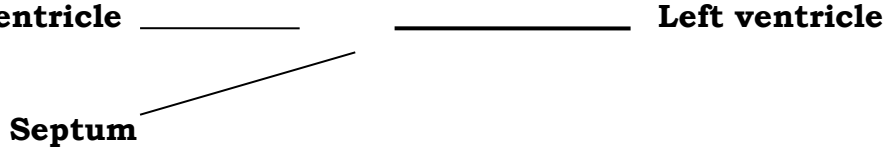
1. The circulatory system is a group of organs responsible for movement or flow of blood in the body.
2. Blood circulation is the movement of blood around the body.
3. The circulatory system has three main components namely;
    - The heart
    - Blood
    - Blood vessels

THE HEART

- The heart is a muscular organ which pumps blood around the body
- The heart is located in the chest cavity between the lungs
- It is protected by the rib cage
- It is made up of thick muscles called cardiac muscles which are involuntary.
- It is covered by a transparent sac known as pericardium.
- It is divided into two parts by a thick wall called septum.
    - ✓ The right side deals with de-oxygenated blood.
    - ✓ The left side deals with oxygenated blood.
- ➢ The heart is further divided into four chambers i.e.
    - ✓ The upper chambers referred to as auricles/atria (the right and left auricles)
    - ✓ The lower chambers referred to as ventricles (the right and left ventricles)

THE STRUCTURE OF THE HEART





FUNCTIONS OF THE PARTS

1. Vena cava – It carries deoxygenated blood from all the parts of the body to the heart.
2. Pulmonary artery- It carries deoxygenated blood from the heart to the lungs to pick oxygen.
3. Pulmonary vein – It carries oxygenated blood from the lungs to the heart.
4. Aorta – It carries oxygenated blood from the heart to all body parts.
5. Valves – They prevent the back flow of blood.
6. Septum – It is a thick muscle which divides the heart into two parts.
   The septum prevents de oxygenated blood from mixing with oxygenated blood.
7. The left ventricle-Pumps oxygenated blood to all body parts
8. The right ventricle-Pumps de-oxygenated blood to the lungs

How the heart works

- The heart receives blood from all parts of the body through the vena-cava.
- When blood from the vena cava reaches the right atrium of the heart, it is pumped to the lungs through the pulmonary artery.

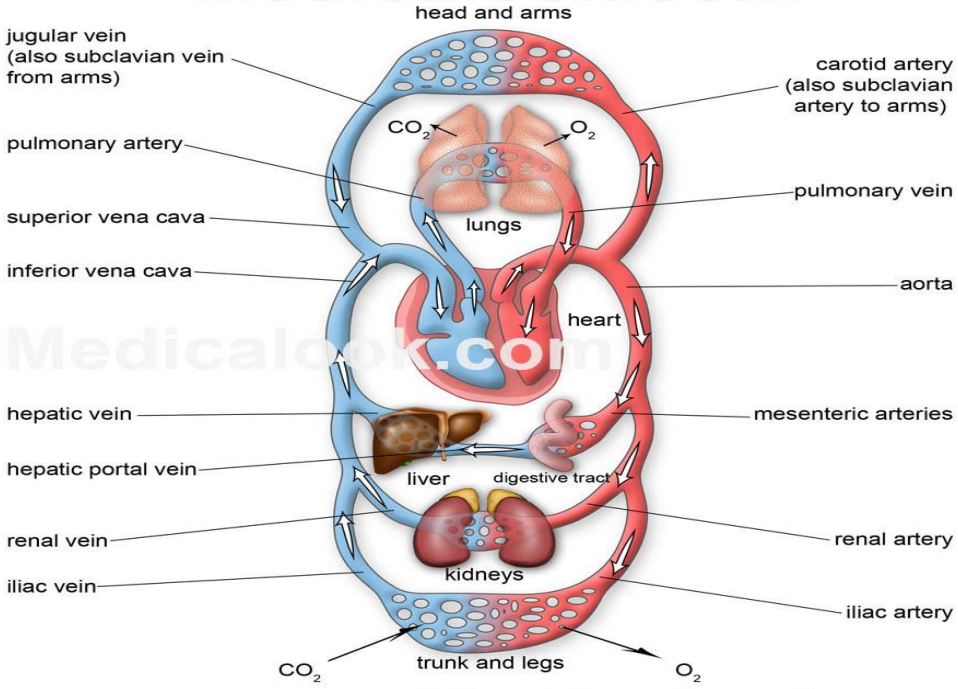
NB: Blood goes to the lungs to release carbon dioxide and pick oxygen.

- From the lungs, blood is carried to the left atrium through the pulmonary vein and then pumped to all body parts through the aorta.
- The left side of the heart has thicker muscles because it pumps blood with pressure to all body parts.

Note

- The normal heart beat of a person is 72 times per minute, but can go beyond if there is fear or excitement.
- The circulation of blood all around the body was first discovered by Sir William Harvey (1578 - 1637) English physician.
- The instrument used by doctors to detect heart beat is called a **stethoscope**.

A diagram showing the circulation of blood in the body:



Organs related to the circulatory system

1. **Heart** – Pumps blood to all body parts.
2. **Lungs** – It is where blood picks oxygen and gets rid of carbon dioxide.
3. **Kidney** – It is where blood is filtered.
4. **Small intestine** – Blood picks digested food to be supplied to body parts.
5. **Liver** – Regulates amount of sugar in blood.
   Detoxifies blood

BLOOD (Blood composition)

It is a red liquid that flow s through vessels to all body parts.
Blood is composed of the following components

- White blood cells
- Red blood cells
- Blood plasma
- Platelets

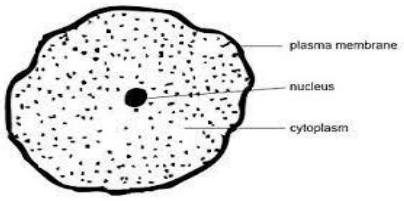
a) White blood cells solid part of blood

- ❖ They are made in the bone marrow of long bones, lymph nodes and the spleen.
- ❖ They are solid part of blood.
- ❖ They have nuclei
- ❖ They don`t have defined (regular) shape
- ❖ The main function of white blood cells is to defend the body by fighting disease causing germs in the body.

Qn. How do white blood cells fight disease causing germs?

- By engulfing and digesting the germs before they multiply.
- By producing anti-bodies against germs.

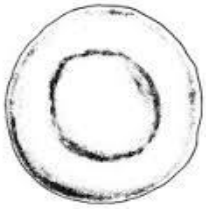
Simple diagrams of white blood cells



b) Red blood cells(Erythrocytes)

- They are made in the red bone marrow of the short bones
- They are disc shaped.
- They have a red pigment or substances called haemoglobin (this is protein with iron)
- Haemglobin gives blood the red colour and helps to absorb oxygen in blood.
- The main function of the red blood cells is to carry or transport oxygen around the body.

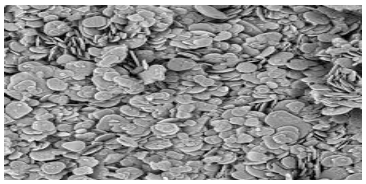
Diagrams showing red blood cells



Platelets

- They are made in the red bone marrow.
- They are responsible for blood clotting by creating a fibre around the cut to prevent further loss of blood.

Diagram showing the platelets



Plasma

- Plasma is the liquid part of blood.

Functions of plasma

- It transports digested food
- It transports carbon dioxide and waste products from cells to excretory organs.
- It transports anti-bodies
- It transports heat in the body.
- It transports hormones in solutions.

Components of plasma

- Digested food
- Antibodies
- Hormones
- Urea
- Carbon dioxide

Function of blood

- It carries oxygen and digested food to all body parts.
- It transports waste products from all parts of the body to excretory organs.
- It transports carbon dioxide from the body tissues to the lungs.
- It defends the body against diseases (it transports white blood cells (phagocytes) to places where there are disease causing germs.
- It distributes heat all parts of the body. (maintain body heat temperature)
- It carries hormones which help the body to work properly

Qn why does a dead body feel cold when touched?

BLOOD GROUPS

- There four blood groups namely
  - ✓ Blood group A
  - ✓ Blood group B
  - ✓ Blood group AB
  - ✓ Blood group O

Note:

- Blood is grouped according to the clotting agent A and B
- A person who gives blood is called a donor.
- A person who receives blood is called receiver or recipient.

Receiver (Recipient)	Donor
Blood group	**Blood group**
A	A, O
B	B, O
AB	AB, A, B, O
O	O

Note:

- A person with blood group AB is called a universal recipient.

Why?

- Because he or she receives blood from all blood groups.
- A person with blood group O is called a universal donor.

Why?

- Because he or she gives blood to all blood groups

NB:

- Because of HIV/AIDS, all blood must be screened before it is donated.

Blood transfusion

- Blood transfusion is the transfer of screened blood from one person to another as long as the blood groups agree.
- A person may run short of blood due to an accident or an operation, so should undergo blood transfusion.

Blood vessels

- These are tubes which carry blood around the body.
- There are three blood vessels namely

- ✓ Arteries
- ✓ Veins
- ✓ Capillaries

Arteries

- These are blood vessels which transport blood away from the heart to all body parts.
- They have thick walls to withstand the pressure at which blood pumped
- They have narrow lumen
- They are elastic and have pulse.

Note

- Pulse is the rhythmic flow of blood in the artery.
- The aorta is the main artery which transports oxygenated blood from the left ventricle to the whole body.

Qn. How are arteries adapted to their function?

- They have thick walls to withstand the high pressure at which blood flows.

Veins

- Veins carry blood towards the heart.
- They have thin walls (thin walled vessels)
- They have wide lumen (blood passage)
- They have valves to prevent the back flow of blood.
- They carry blood with low pressure.
- Blood in the veins contains less oxygen and more carbon dioxide.
- The biggest vein in the body is the vena cava.

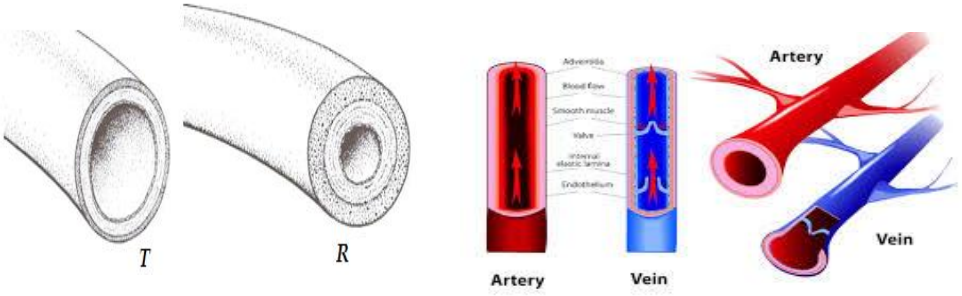
Qn. How are veins adapted to their function?

- They have valves to prevent the back flow of blood.

Note

- All veins carry de-oxygenated blood apart from the pulmonary vein.

Structure showing artery and a vein:

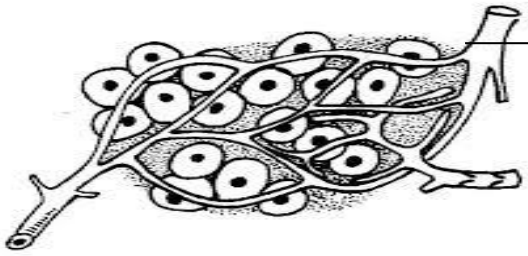


Capillaries

- These are the tiniest and smallest blood vessels found in every living tissue of our bodies.
- They connect arteries to veins.
- Capillaries are more than veins in our bodies.
- Exchange of materials takes place in the capillaries.
- They transport blood to all body cells, i.e. they take in food, oxygen and mineral salts to the body.

- They transport body tissues and cells in the body.

A diagram showing capillaries



Differences between arteries and veins

Arteries	Veins
i. Arteries carry blood away from the heart.	Veins carry blood towards the heart.
ii. Arteries have thick walls	Veins have thin walls.
iii. Arteries have narrow lumen.	Veins have wide lumen.
iv. Arteries carry blood containing more oxygen.	Veins carry blood containing more carbon dioxide.
v. Arteries have a rhythmic flow of blood called pulse.	Veins have valves to prevent the back flow of blood.

Note

- Special blood vessels in the body
  1) Pulmonary artery –is the only artery that carries de-oxygenated blood from the heart to the lungs.
  2) Pulmonary vein – it carries oxygenated blood from the lungs to the heart.

Major blood vessels in the body

1. Carotid artery – it takes oxygenated blood to the head.
2. Jugular vein – it returns de-oxygenated blood from the head.
3. Hepatic artery – carries oxygenated blood to the liver.
4. Hepatic portal vein – it carries blood containing digested food to the liver.
5. Hepatic vein – it returns de-oxygenated blood from the liver to the vena cava.
6. Renal artery – it carries oxygenated blood containing waste materials to the kidney.
7. Renal vein – it carries de-oxygenated filtered blood away from the kidney.

DISEASES OF THE CIRCULATORY SYSTEM

1) AIDS

- It is a sexually transmitted disease caused by a virus called Human Immunodeficiency Virus.
- It attacks and destroys the white blood cells making a person to lack immunity.
- The diseases a person suffers after his or her immunity has been weakened by HIV are called opportunistic infections.

Examples of opportunistic infections:

- ✓ Malaria

- ✓ Dysentery
- ✓ Tuberculosis
- ✓ Pneumonia

2) Coronary heart disease

- This is caused by failure of the coronary artery to supply oxygenated blood to the muscles of the heart.

3) Malaria

- This is caused by plasmodium germ. The plasmodium germs attacks and destroys the red blood cells.

4) Anaemia

- Anaemia is caused by lack of enough iron in the body.
- Anaemia can be prevented by feeding on food rich in iron.

5) Sickle cell anaemia

- This is a condition in which one`s red blood cells are sickle-shaped.
- The sickle-shaped cells often block the blood vessels and make a person very ill.
- The sickle cells also fail to transport oxygen to all body part.
- Anaemia is passed on from the parent to the child.

6) Haemophilia

- It is a condition in which one`s blood is unable to clot.
- It is passed on from the parent to the child.
- It is caused due to lack of enough vitamin K in the body

7) Leukaemia

- This is cancer of the blood.
- This is a condition in which a person has large number of immature white blood cells.
- The immature white blood cells prevent production of normal blood cells.

Prevention and control of diseases of the circulatory system.

Disease	Prevention and control
AIDS	• Abstain from sex • Have protected sex • Have one lifelong sexual partner • Use screened blood for blood transfusion • Avoid sharing skin piercing objects
Malaria	• Drain stagnant water • Sleep under treated mosquito nets • Spray using insecticides
Sick cell Anaemia	• It has no cure
Anaemia	• Feed on food containing iron • Seek for early medical advice

	to treat symptoms
Coronary Heart disease	• Avoid eating a lot of fatty foods • Avoid smoking • Doing body physical exercises regularly.

Disorders of the circulatory system:

- Heart attack/Heart stroke/Heart failure

How to maintain proper functioning of the circulatory system.

- Feed on a balanced diet.
- Have regular physical body exercises
- Eat meals containing low animal fats.

ALCOHOL, SMOKING AND DRUGS IN THE SOCIETY

ALCOHOL IN SOCIETY

What is alcohol?

- Alcohol is a liquid substance that makes people drunk when they drink too much of it.
- It is contained in many drinks like beers, wines and spirits.

Types of alcohol

There are two types of alcohol namely:-

(i) Methanol
(ii) Ethanol

- Methanol is found mostly in home distilled alcohol.
- It is very dangerous and poisonous and may cause blindness or death.
- It is mainly used as a fuel or for sterilizing medical instruments.
- Ethanol is contained in all alcoholic drinks that are consumed.
- It can also be used as fuel.

Reproduction of Alcohol.

- Common alcoholic drinks are made from juices of bananas, pineapples, sugarcane, maize, millet, sorghum, rice, barley, cassava, potatoes etc.

- Yeast is added to the mixture of water and these food substances to speed up fermentation.

Methods of producing alcohol

(i) Fermentation.
(ii) Distillation.

Fermentation

- Fermentation is the process by which sugar solution is turned into alcohol with the help of yeast.
    - ✓ Fermented fruit juices make wine.
    - ✓ Fermented starch mixture from grains or cereals form beer.

Examples of drinks produced locally by fermentation

- Mwengebigere - from bananas

- Malwa (ajono) - from millet / sorghum
- Kwete - from cassava / maize
- Munananansi - from pineapples
- Omuramba - from sorghum.
- Beers - from oats and barley

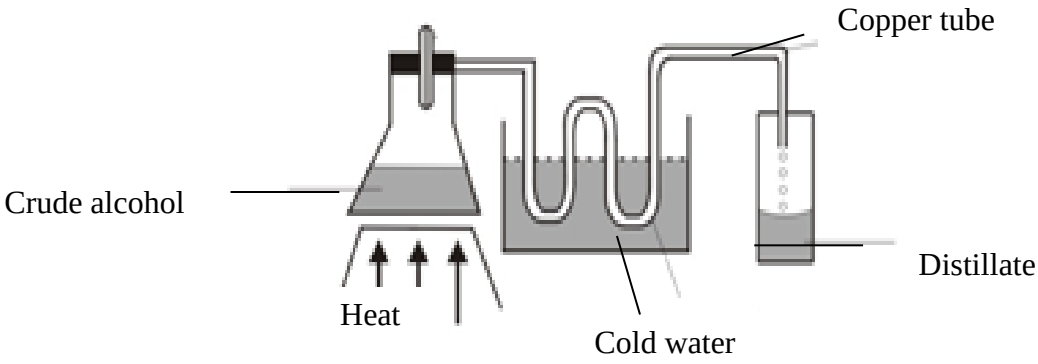
Distillation

- This is the process of heating fermented alcohol to form vapour and condensing alcohol vapour to form distillate.

How distillation of alcohol is done.

- Crude alcohol is boiled to produce alcohol vapour.
- The vapour is condensed to get liquid alcohol with the help of cold water in a condenser.
- The liquid alcohol now called distillate is passed through a coiled delivery tube into a clean container i.e. bottles or jerrycans.
- The delivery tube is usually coiled to increase the surface area for condensation of alcohol vapour

Illustration showing distillation method



Uses of alcohol

- For disinfecting wounds
- Used in making cosmetics and perfumes.
- Used in making nail varnish solutions.
- It is mixed with petrol to form gasohol fuel.
- Used to sterilize clinical instruments e.g. clinical thermometer
- Used in the manufacturing of soap.
- Used to dissolve paint solutions.

Reasons why people drink alcohol

(Factors that lead to alcoholism).

- Idleness
- Frustration
- Peer pressure

- The desire to pastime, with friends.
- Family back ground and social environment
- To show that they are rich.
- People's culture in ceremonies/ celebrations
- Misleading adverts on T.V, radio, magazines
- To forget their problems.
- Influence by people one admires e.g. parents, teachers etc.
- Bad behavior among children

Alcoholism

Alcoholism is a condition when a person cannot do away with drinking alcohol

Who is an alcoholic?

- A person who cannot stay without taking alcohol
- Addiction is a condition in which a person has a very strong desire to take alcohol every day

Effects of alcohol to an individual

- People who are drunk become forgetful.
- People who are drunk lose respect for laws.
- People who are drunk lose body balance.
- Loss of appetite
- Peptic ulcers
- It damages the liver, brain and pancreas.
- Leads to self neglect
- Poor job performance
- Too much and constant drinking may cause hand tremors.

Effects of alcohol to a family.

- It leads to family neglect.
- It leads to poverty in the family.
- It causes spouse and child abuse.
- It leads to bad behaviour among children.

Effects of alcohol on the community

- May lead to job neglect causing low productivity.
- May cause traffic accidents, accidents at home, suicidal behavior.
- High crime rate in the society e.g. rape, defilement, robbery etc.
- Can lead to increase of certain diseases in the community e.g. AIDS.
- Alcoholics become public nuisance.
- Nation may lose very important people.
- Loss of income tax base due to less production.

How to avoid alcoholism

- Avoid bad peer groups.
- Never believe in advertisements which praise alcohol as a good drink.
- Never drink alcohol to overcome a problem.
- Join groups whose members do not take alcohol.
- Engage in activities which help you to spend free time properly.
- Take your parents and other people's warning about the dangers of alcohol seriously.=

Uganda laws on alcohol.

- People under 18 years of age are not allowed to drink alcohol in public places.
- No one is allowed to drive a vehicle when he or she is drunk.
- Home distillation of alcohol is forbidden without license.
- No one is allowed to transport or sell home distilled alcohol without license.
- Public places that sell alcoholic drinks are allowed to operate up to a limited time.
- Alcohol is not for sale to persons under 18 years

Smoking:

- This refers to the inhaling of tobacco smoke.

Ways of smoking

People smoke tobacco in form of:

Cigars, cigarettes, pipes and shisha

Types of smoking

Active smoking.

- It is where people inhale the smoke from the burning tobacco.

Passive smoking

- This refers to the inhaling of air containing tobacco smoke from an active smoker.

Reasons why some people smoke?

- ❖ To fit in the society
- ❖ To pastime
- ❖ To feel confident
- ❖ To relax and feel at ease
- ❖ To concentrate on what they are doing
- ❖ Due to achievement they have/they see
- ❖ To show how they are rich
- ❖ To feel warm

Dangers or effects of smoking

- Tobacco contains two harmful substances called nicotine & tar.
- Tobacco contains a poisonous gas called **carbon monoxide**.

Smoking Tobacco can cause the following:-

- It causes cancer of the lips, throat and mouth.
- It worsens the conditions of people suffering from Tuberculosis, Lung cancer, Bronchitis and emphysema.
- It narrows the blood vessels to the lungs and heart increasing the risk of getting coronary heart diseases.
- It can cause premature birth in expectant mothers
- May harm the developing baby and cause underweight in babies
- May stain the teeth.
- It causes bad breath and loss of appetite

Harmful effects of smokers on Non-Smokers Family and Community.

- Passive smokers eventually develop the same disease as the active smoker.
- Children in the family may copy smoking habits from their parents.
- Family members may become passive smokers
- Loss of family income on buying cigarettes
- Family needs may not all be fulfilled as money is spent on tobacco

- Patients with asthma, TB and Heart diseases are likely to be affected by tobacco smoke in their environment.
- Smokers often cause outbreak of fires with burning cigarette buts.

How to avoid Smoking

- Decide one day not to smoke and make the decision yourself and abide by it.
- Join social groups with good people.
- Learn more facts about smoking before you decide.
- Destroy all things connected with smoking in the house e.g. cigarette lighters, ash trays etc.
- Take part in activities that keep you busy during your free time

Drugs

What is a drug?

- A drug is a chemical substance, which affects the way one's brain and body work when taken.

Groups of drugs:

- Essential drugs
- Narcotic drugs(drugs of dependence)

1. Essential drugs:

- These are drugs that satisfy people's health needs when they are used correctly.

Qualities of essential drug

- They are available
- They are affordable
- They should have value for money
- They should have less side effects

Groups of essential drugs:

- Laboratory manufactured drugs.
- Traditional drugs.

a) Laboratory manufacture drugs:

- These are drugs which are carefully made in science laboratories.

Characteristics of laboratory manufactured drugs

- They are carefully made and tested
- Their strength , stability and purity is known
- They are the same for each quantity
- Their effect on human health is known
- They are packaged and properly protected
- They are well labeled

- They have expiry and manufactory dates

Examples of laboratory manufactured drugs

- Aspirin
- Chloroquine
- Quinine
- Fansidar
- Panadol
- Mabendazole
- Coartem

b) Traditional drugs:

- These are drugs which are obtained from the environment and are used in their form.

Characteristics of traditional drugs

- They are made of raw plants.
- Their strength, purity and stability changes
- Their effect on human health is not known
- They are not well labeled
- They are not well packaged

Examples of traditional drugs

- Mululuza
- Kigagi
- Bombo

Types of essential drugs:

- Pain killers
- Preventive drugs
- Curative drugs
- Contraceptives.

Drug prescription

- This refers to health workers written information on how a drug should be used.
- If a drug is taken without a prescription, the patient will either take under or over dose.

Over dose

- This is the taking in of more medicine than is required
- An overdose is dangerous to the body because it can lead to poisoning or death

Under dose

- This is when one takes fewer drugs than the required. The major disadvantage of an under dose is that it makes germs to become resistant to the medicine.

Advantages of drug prescription

- It helps the patient to know the correct drug.
- It prevents over dose
- It prevents under dose
- It prevents and controls misuse of drugs

Factors to consider when prescribing drugs

- Patient's age
- Degree of sickness

- Concentration of the drug
- Patient's body weight

Storage of drugs

- Drugs should be stored in clean, cool dry places.
- Drugs should always be kept out of reach of children

Note: This is done to prevent poisoning.

Advantages of proper storage of drugs

- It prevents drug misuse
- It controls poisoning which would result if children tool the drug
- It prevents contamination of the drug
- It helps to maintain the life span of the drug
- It prevents drugs from getting easily stolen

Dangers of buying drugs from shops

- They don't have prescriptions
- Some of the drugs are not stored properly
- Some of the drugs are sold might be expired
- Some of the drugs might be false (fake).

Drug misuse

- This is the use of a drug without the health workers advice

OR:

- It is the use of a drug in a wrong way.

Drug abuse

- This is the use of drugs in a way that is harmful to the body

Why people abuse drugs

- Some people abuse drugs to overcome fear '
- Due to peer influence
- To keep awake or sleep
- Due to good advertisement
- To pastime
- To feel warm
- To get energy
- To concentrate on what they are doing
- To gain more appetite

Drug dependency

- This is the use of a drug in a way that one cannot do without.

Drugs of dependence (Narcotic drugs)

- These are drugs which cause addiction after prolonged use
- An addiction to a drug is a condition when a person takes a drug even when not necessary

Common drugs of dependency / commonly abused drugs/ narcotic drugs

- Marijuana
- Miraa
- Cocaine
- Glue
- Aviation fuel
- Heroin
- Alcohol
- Tobacco
- Paint thinner

Effects of drugs of dependence to an individual

- Brain damage
- Loss of appetite

- Insomnia (inability to sleep)
- Job neglect
- Self neglect
- Low immunity to disease

Effects to the family

- Family neglect
- Family aggression and violence
- Criminal acts like defilement and rape
- Poverty
- It sets a bad example to the children

Effects to the community

- It leads to increased accidents
- Criminal behaviour
- Poor job performance

Life skills that can help you to avoid drugs

- Resist peer pressure
- Seek counseling and guidance
- Follow good morals from elders
- Spending leisure time constructively by engaging in productive activities
- Reading good material which is useful to life
- Assertiveness