PARAMOUNT SCIENCE NOTES

PRIMARY SIX

TERM ONE

TOPIC ONE: CLASSIFICATION OF LIVING THINGS

CLASSIFICATION OF LIVING THINGS

- This is the grouping of living things according to their characteristics and features.

LIVING THINGS

- These are things that have life.

CHARACTERISTICS OF LIVING THINGS

- They feed
- They reproduce
- They excrete
- They respond to their stimuli
- They respire
- They grow
- They move (locomote)
- They breathe

GROWTH

- This is the increase in size of organism

REPRODUCTION

- This is the process by which living things multiply
- ✓ It prevents extinction of living things
- ✓ It increases the population of living things
- ✓ It promotes continuity of life

MOVEMENT

- Living things move to different places for some reasons.
- All locomotions are movements but all movements are not locomotions

Why do animals move (locomote) from one place to another?

- To look for food
- To look for shelter
- To look for mates
- To run away from their enemies (to escape danger)
- To look for their friends
- To look for their young ones

How do animals move from one place to another? (Forms of locomotion)

- By swimming
- By walking
- By flying
- By jumping
- By leaping (hopping)
- By crawling
- By slithering
- By wriggling

EXCRETION

- This is the removal of metabolic waste products from the body.
- ✓ It prevents body poisoning

RESPIRATION

- This is the oxidation of food (glucose) in the living body cells to produce energy.
- ✓ Respiration provides energy

SENSITIVITY

- This is the ability of an organism to respond to external stimuli
- A **stimulus** is any change in the environment that causes an organism to react.
- ✓ It enables living things to detect danger

EXAMPLES OF EXTERNAL STIMULI

LIVING THINGS	STIMULI
Plants	▪ Touch ▪ Light ▪ Gravity ▪ Water ▪ Chemicals
Animals	▪ Heat ▪ Pain ▪ Cold ▪ Smell

FEEDING

- This is the act of taking food into the body

Why do living things feed?

- To replace the worn out cells
- To be healthy
- To get energy
- To grow
- To stay alive

TYPES OF NUTRITION IN LIVING THINGS

- Autotrophic nutrition: In plants
- Heterotrophic nutrition: In animals and fungi

Modes of heterotrophic nutrition / feeding

- Parasitic e.g in leeches, ticks, lice, mites, tapeworms and hookworms
- Saprophytic e.g in mushrooms, toadstools, yeast, moulds and puffballs
- Holozoic e.g in human beings, dogs and cats

REASONS FOR CLASSIFICATION OF LIVING THINGS (Why do we classify living things?)

- For easy identification
- For easy naming
- For easy study
- For conservation

FEATURES AND CHARACTERISTICS USED TO CLASSIFY LIVING THINGS

- Body symmetry
- Body colour
- Body size
- Body shape
- Body divisions
- Number of legs
- ✓ Form of reproduction
- ✓ Type of respiration
- ✓ Mode of movement
- ✓ Mode of feeding
- ✓ Adaptation to the environment

EXAMPLES OF LIVING THINGS

- Bean plant
- Maize plant
- Orange plant
- Pomegranate plant
- Cow
- Pig
- Goat
- Sheep
- Lion
- Zebra
- Horse
- Donkey
- Hen
- Duck
- Turkey
- Kite
- Hawk
- Owl
- Egret
- Bee
- Butterfly
- Tick
- Mite

KINGDOMS OF LIVING THINGS

- Kingdom Animalia (animal kingdom)
- Kingdom Plantae (plant kingdom)
- Kingdom Monera
- Kingdom Protista
- Kingdom Fungi

GROUPS OF LIVING THINGS

- Animals
- Plants
- Bacteria
- Fungi
- Protists

DIFFERENCES BETWEEN PLANTS AND ANIMALS

- Plants are autotrophs (make their own food) while animals are heterotrophs (feed on already made food)
- Plants have chlorophyll while animals lack chlorophyll
- Plants lack sense organs while animals have sense organs
- Plant cells have cell walls while animal cells have cell membrane
- Plants respond slowly to stimuli while animals respond quickly to stimuli
- Most plants are fixed in one place while most animals can move from one place to another freely
- Growth in plants occurs throughout life while growth in animals stops before their death.

ANIMALS

- These are multicellular organisms that are mobile, have no chlorophyll and have cells with cell membranes.

✓ A multicellular organism is an organism with many cells

GROUPS OF ANIMALS

- Vertebrates
- Invertebrates

VERTEBRATES

- These are animals with a backbone (spine or vertebral column)

Importance of a backbone

- It protects the spinal cord

Functions of a spinal cord

- It controls reflex actions
- It connects all nerves to the brain

CHARACTERISTICS OF VERTEBRATES

- They have a backbone
- They have endoskeleton
- They have waterproof skin
- They have large brain protected by the skull
- Their backbone is made up of many small bones called **vertebrae**
- They have alimentary canal
- They have bilateral symmetry
- They have closed circulatory system

GROUPS OF VERTEBRATES

- Fish
- Amphibians
- Reptiles
- Mammals
- Birds

Mention the two main classes of vertebrates

- Warm blooded (homoeothermic or endothermic animals)
- Cold blooded (poikilothermic or ectothermic animals)

A FLOW CHART SHOWING CLASSIFICATION OF VERTEBRATES

WARM-BLOODED VERTEBRATES (HOMEOTERMIC ANIMALS)

- These are animals that maintain a constant body temperature

Groups of warm-blooded vertebrates

- Mammals
- Birds

Examples of warm-blooded vertebrates

- Parrot
- Duck
- Emu
- Turkey
- Pigeon
- Goat
- Dog
- Cow
- Cat

COLD-BLOODED VERTEBRATES (POIKILOTHERMIC ANIMALS)

- These are animals whose body temperature changes with the surroundings

GROUPS OF COLD-BLOODED ANIMALS

- Fish
- Reptiles
- Amphibians

EXAMPLES OF COLD-BLOODED VERTEBRATES

- Tilapia
- Mudfish
- Nile perch
- Chameleon
- Gecko
- Common lizard
- Crocodile
- Turtle
- Green snake
- Frog
- Toad
- Newt

BIRDS

- These are vertebrates with feathers on their bodies

CHARACTERISTICS OF BIRDS

- They have feathers
- They have beaks
- They have wings
- They have streamlined bodies
- They reproduce by laying eggs
- They undergo internal fertilization
- They have scales on their legs
- They are warm blooded animals
- They have a backbone
- They breathe by means of lungs
- They have three eyelids (the lower, upper and nictitating membrane)
- They care for their young

EXTERNAL FEATURES OF A BIRD

PART OF A BIRD	FUNCTION
Eyes	▪ For sight
Beak	▪ For feeding ▪ For protection ▪ For egg turning during incubation
Legs	▪ For walking
Wattle and comb	▪ For temperature regulation
Nostril	▪ For smelling
Feathers	▪ For flight ▪ For warmth ▪ For body protection

ADAPTATIONS OF BIRDS TO FLIGHT

- They have a streamlined body
- ✓ To reduce air resistance/viscosity/friction in air
- They have hollow bones
- ✓ To reduce body weight
- They have many quill (flight)feathers
- ✓ For flight
- They have strong wings
- ✓ To support the bird in air
- ✓ To propel the bird forwards
- They have large pectoral muscles
- ✓ To move the wings
- They have a keel on their breast bone
- ✓ For attachment of pectoral muscles
- They have no pinna that would obstruct wind
- They have air sacs attached to the lungs
- ✓ To improve gaseous exchange
- They have nictitating membrane on their eyes
- ✓ To protect the eyes from wind
- They have a high metabolic rate
- ✓ To provide the high amount of energy needed
- They have a keen eye sight
- ✓ To judge distances correctly
- They have a quick digestive system

REASONS WHY SOME BIRDS ARE UNABLE TO FLY

- They have heavy bones with bone marrow
- They have weak and small wings
- They have few flight feathers.
- They have no keel on their breast bone

MOULTING IN BIRDS

- This is shedding of old feathers in birds
- Birds moult once each year

Why do birds moult their feathers?

- To grow new feathers

FEATHERS

- These are the outermost covers of the bird's body

USES OF FEATHERS TO A BIRD

- They help a bird to fly (for flight)
- They streamline the bird's body (they give the bird shape)
- They keep the bird's body warm (for warmth)
- They protect the bird's body from injury (for protection against injury)
- They help a male bird to attract mates (for courtship)
- They give the bird colour for identification

USES OF FEATHERS TO PEOPLE

- They are used as costumes
- They are used for decoration
- They are used to make pillows
- They are used to make mattresses
- They are used as writing materials

TYPES OF FEATHERS

- Quill (flight) feathers
- Covert (body) feathers
- Down feathers
- Filoplume feathers

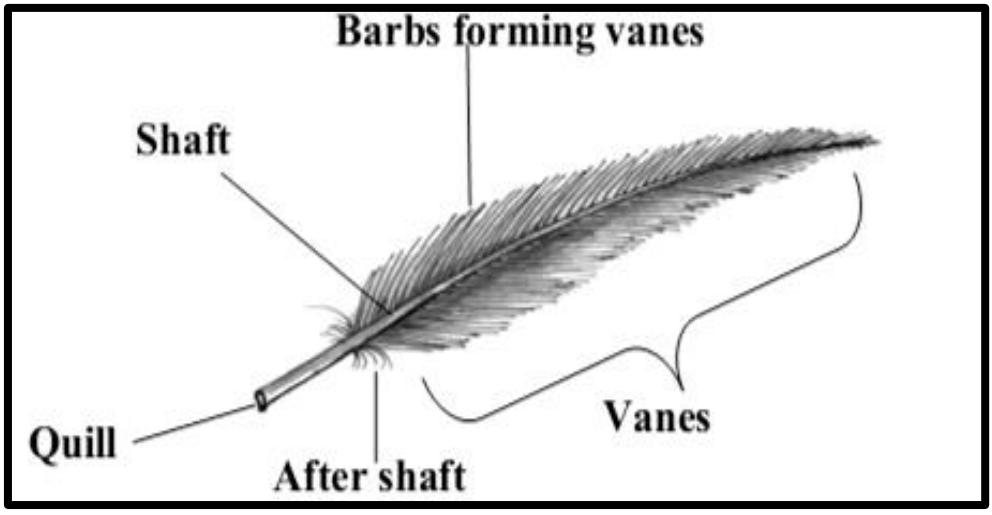
QUILL FEATHERS (FLIGHT FEATHERS)

- They are found on the **wings** and **tail**
- They are divided into **primary** and **secondary feathers**
- Primary feathers are bigger than secondary feathers

Importance of quill feathers

- For flight (they help in flying)

STRUCTURE OF A QUILL FEATHER



Shaft (rachis)

- It holds the vane (it is where the vane is attached)

Vane

- It is the flat expanded part of the feather

Barbs

- They form the vane

Quill (calamus)

- It is the extreme end of the shaft

COVERT FEATHERS (BODY FEATHERS)

- They are found on **the neck** and **bases of wings and tail**
- They cover most of the body
- They are smaller than the quill feathers

Importance of covert feathers

- They insulate the bird's body
- They streamline the bird's shape (they give the bird shape)

STRUCTURE OF A BODY FEATHER

Why are bird streamlined?

- To overcome viscosity (to reduce air resistance)

What is viscosity (fluid friction)?

- This is the friction in liquids and gases

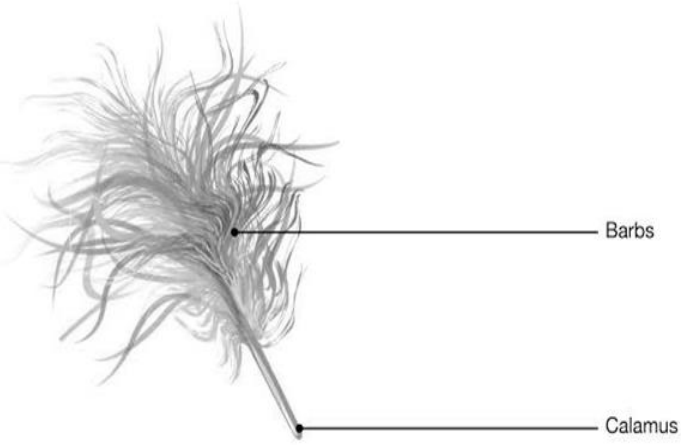
DOWN FEATHERS

- They are found on the **abdominal region**
- They are the first feathers to appear on a bird
- They have no vane
- They have loose barbs

Importance of down feathers

- They insulate the bird's body

STRUCTURE OF A DOWN FEATHER



FILOPLUME FEATHERS

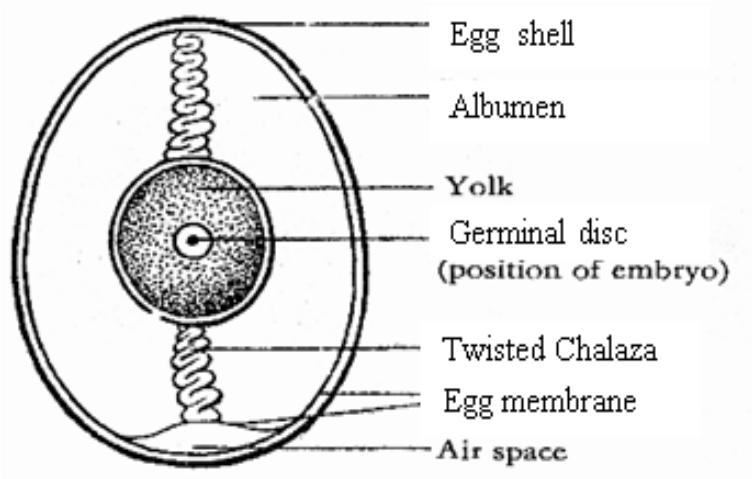
- These are the feathers that remain when a bird has been plucked
- They are found nearest to the skin between the covert feathers
- They are the tiniest (smallest) feathers
- They have no quill

A DRAWING OF A FILOPLUME FEATHER

REPRODUCTION IN BIRDS

- They reproduce by laying eggs (they are oviparous)
- Their eggs are fertilized internally
- Birds undergo **internal fertilization**
- Fertilization in birds occurs in the **oviducts**

STRUCTURE OF A FERTILIZED EGG OF A BIRD



FUNCTIONS OF EACH PART OF A FERTILIZED BIRD'S EGG

EGG SHELL

- It protects the inner parts of an egg
- It allows exchange of gases

Why is the egg shell porous?

- To allow gaseous exchange

How is the egg shell adapted to gaseous exchange?

- It is porous

How is the egg shell adapted to protection of the inner parts of an egg?

- It is hard

Why should layers be given mash (feeds) rich in calcium?

- To lay hard shelled eggs

Why should layers be given mash (feeds) rich in calcium?

- To lay hard shelled eggs

SHELL MEMBRANE

- It prevents an egg from drying up

AIR SPACE

- It keeps oxygen for the embryo
- It supplies oxygen to the embryo

EGG YOLK

- It provides fats and proteins to the embryo

ALBUMEN (EGG WHITE)

- It provides water and proteins to the embryo

CHALAZA

- It holds the yolk and embryo in position
- It is the passage of oxygen to the embryo
- It is the passage of wastes from the embryo

GERMINAL DISC

- ✓ It is found in unfertilized egg
- It develops into an embryo after fertilization

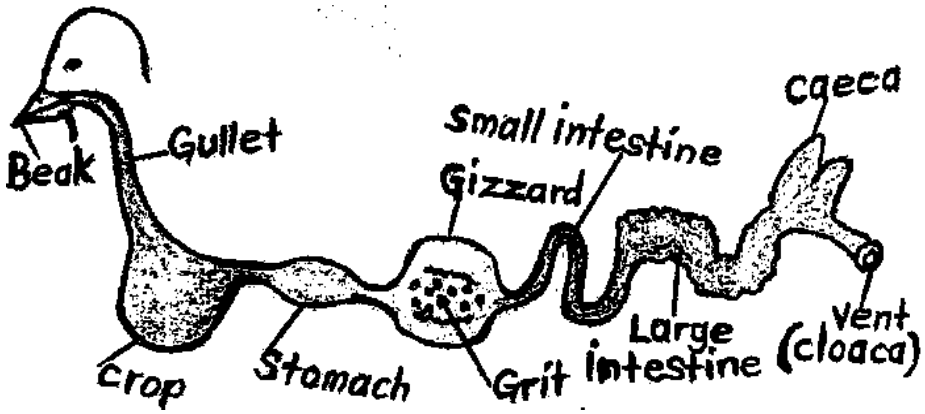
EMBRYO

- ✓ It is found in a fertilized egg
- It develops into a young bird

FEEDING IN BIRDS

- Birds have no teeth
- They have horny beaks (bills)
- The shapes of beaks indicates the bird's general diet

DIGESTIVE SYSTEM OF A BIRD (HEN)



FUNCTIONS OF EACH PART OF THE DIGESTIVE SYSTEM OF A BIRD

BEAK (BILL)

- It picks food

GULLET (OESOPHAGUS)

- It passes food to the crop

CROP

- It stores food for a short time (for temporary storage of food)
- It moistens and softens food
- It produces crop milk to feed the chicks e.g. in pigeons

Things that happen to food while in the crop of the bird

- Food is moistened
- Food is softened

Examples of birds that do not have a crop

- Owl
- Goose
- Button quail

Why does a goose have no crop on its alimentary canal?

- It eats little food at a time

TRUE STOMACH (PROVENTRICULUS)

- It is where food is mixed with digestive juices
- It secretes digestive enzymes that begin the digestion of proteins

GIZZARD

- It crushes (grinds) food

How is the gizzard adapted to its function?

- It has grit (small stones) that grind food

How is the gizzard able to withstand the grit?

- It has thick (muscular) walls

Which part of the human digestive system perform the same function as the gizzard of a bird?

- Teeth

Grit

These are small stones found in the gizzard

- They crush food into small particles

SMALL INTESTINES (ILEUM)

- It is where food digestion ends
- It is where food absorption occurs (it absorbs digested food)

Main processes that take place in small intestines

- Food absorption
- Food digestion

LARGE INTESTINES

- It is where water absorption occurs (it absorbs water)

CAECUM

- It stores undigested food for a short time

VENT (CLOACA)

- It passes out droppings

FACTORS CONSIDERED WHEN GROUPING BIRDS

- Way of feeding
- Type of beak
- Type of foot
- Type of food they eat
- Way of movement

GROUPS OF BIRDS

- Birds of prey (preying birds/raptors)
- Perching birds
- Scratching birds
- Swimming birds
- Wading birds
- Flightless (walking) birds
- Climbing birds
- Scavenger birds

BIRDS OF PREY (RAPTORS)

- These are birds that hunt and kill their prey.

A prey is an organism which is eaten by another organism

Characteristics of preying birds

- They have strong eye sight.

To spot their prey from long distances

- They have strong sharp hooked beaks

For tearing their prey (flesh)

- They have strong sharp curved claws or talons

For gripping and killing their prey

Examples of preying birds

- Hawks
- Eagles
- Secretary birds
- Owls
- Kites
- Falcons
- Osprey
- Buzzard
- Harrier

✓ **An eagle** is termed as the king of all birds.

An owl

- It is a nocturnal bird of prey
- It has no crop

Why is an owl able to see at night?

- It has more rod cells than cone cells in its eyes

FOOD FOR PREYING BIRDS (RAPTORS)

- Rats
- Fish
- Mice
- Geckos
- Chicks
- Smaller birds

DIAGRAM SHOWING BEAK AND FOOT OF A PREYING BIRD

How are birds of prey (raptors) dangerous to poultry farmers?

- They eat chicks (they kill poultry)

SCAVENGER BIRDS

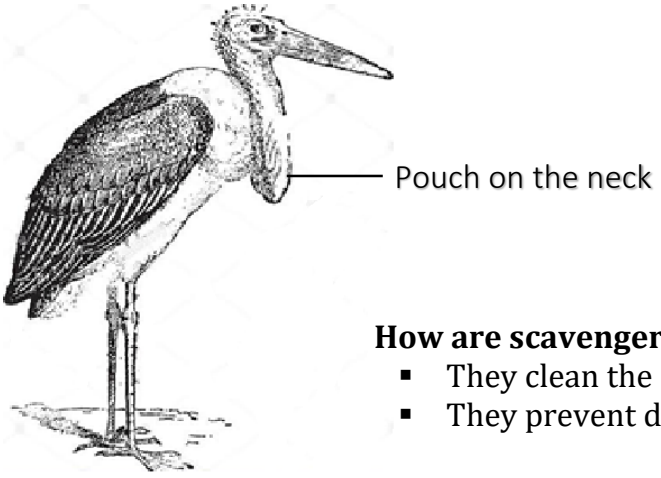
- These are birds that feed on carrion (leftover meat/carcasses/abandoned meat)

EXAMPLES OF SCAVENGERS

- Vulture (condor)
- Crows
- Marabou stork

✓ A marabou stork has long pointed heavy beak and long legs

A DRAWING SHOWING A MARABOU STORK



How are scavenger birds important in the environment?

- They clean the environment by eating carrion (dead animals)
- They prevent diarrhoeal diseases by eating rotten meat

How do scavengers clean the environment?

- By feeding on carrion (dead animals)

Places where scavenger birds are commonly found

- Dustbins
- Abattoirs
- Rubbish heaps

Explain the meaning of the term carrion

- This is the dead decaying meat

Of what importance is the pouch on the neck of a marabou stork?

- It is used during courtship

Name one scavenging bird of prey

- Vulture

CLIMBING BIRDS

- These are birds that climb trees.

EXAMPLES OF CLIMBING BIRDS

- Parrot
- Woodpecker

Why does a woodpecker peck trees?

- To make nesting sites
- To look for food (insects)

Why does a woodpecker drum on trees?

- To attract mates
- To chase away predators
- To communicate to other woodpeckers

FOOD FOR CLIMBING BIRDS

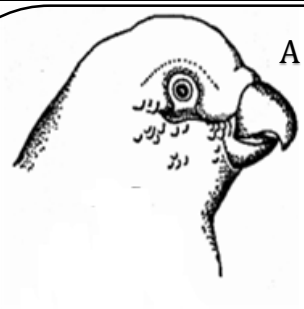
- Insects
- Seeds

CHARACTERISTICS OF CLIMBING BIRDS

- They have two toes facing forward and two backward
- ✓ For climbing trees
- They have long stiff tails
- ✓ For support when climbing upwards
- They have long toes with claws
- ✓ For holding trees
- A parrot has strong short hooked beak
- ✓ For cracking hard seeds (nuts)
- ✓ For climbing trees
- A parrot has a small space between the upper and lower beak
- ✓ To hold seeds
- A woodpecker has chisel-shaped beak
- ✓ For making holes in trees (for pecking wood)
- They live in trees

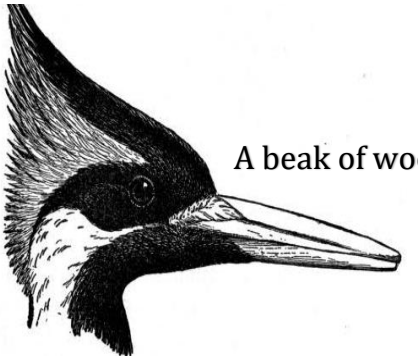
DIAGRAMS SHOWING BEAKS AND FEET OF CLIMBING BIRDS

A beak of a parrot

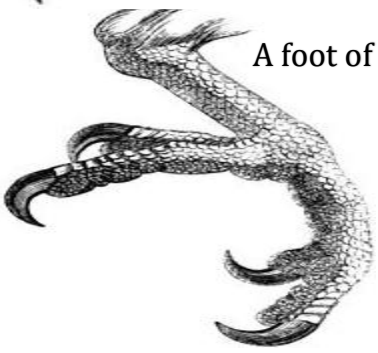


A foot of a parrot

A beak of woodpecker



A foot of woodpecker



SWIMMING BIRDS

- These are birds that have fully webbed feet for swimming in water.

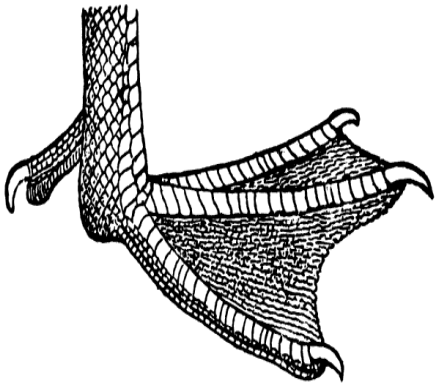
CHARACTERISTICS OF SWIMMING BIRDS

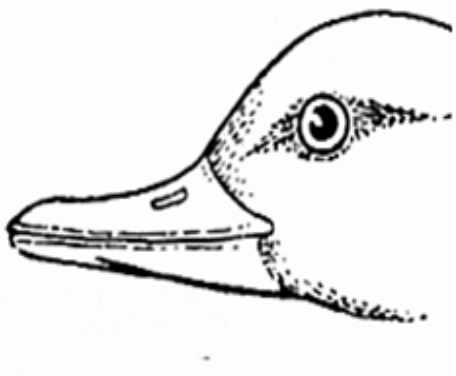
- They have fully webbed feet
- ✓ For swimming (paddling in water)
- They have broad breastbone.
- They have many oil glands in their skins
- ✓ To produce oil that protects the bird from cold water.
- ✓ To produce oil that makes the feathers waterproof
- They have a spoon shaped beak (have a beak with small cross plates on the margins)
- ✓ To strain (sieve) food from water

EXAMPLES OF SWIMMING BIRDS

- Ducks
- Swans
- Geese
- Penguins
- Seagulls
- Pelicans
- Cormorant

STRUCTURE OF A FOOT AND BEAK OF A SWIMMING BIRD





FOOD FOR SWIMMING BIRDS

- Tadpoles
- Worms
- Pond weeds
- Insects
- Small fish

WADING BIRDS

- These are birds that can walk through water

✓ These birds live near water bodies to get food easily

CHARACTERISTICS OF WADING BIRDS

- They have long flexible necks

✓ To reach food below water surface

- They have thin long legs with half webbed feet

✓ To prevent the bird from sinking in water

- They have thin long beaks

✓ To catch food in water

How are the thin long legs with half webbed widely spread toes useful to a wading bird?

- They prevent the bird from sinking in water

EXAMPLES OF WADING BIRDS

- Heron
- Flamingo
- Crested crane (crane)
- Marabou stork (stork)
- Sandpiper
- Ibis
- Egret
- Kingfisher
- Plover
- Jacana
- Spoonbill

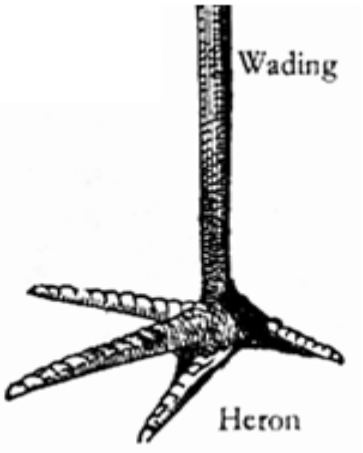
How are white egrets important to cattle farmers?

- They eat up ticks on their cattle

FOOD FOR WADING BIRDS

- Fish
- Frogs
- Worms

STRUCTURE OF A BEAK AND FOOT OF HERON



FLIGHTLESS BIRDS (WALKING BIRDS)

- These are birds that cannot fly

CHARACTERISTICS OF FLIGHTLESS BIRDS

- They have small weak wings.
- They have heavy bones with bone marrows
- They run very fast

FOOD FOR FLIGHTLESS BIRDS

- Worms
- Insects
- Small animals

EXAMPLES OF FLIGHTLESS BIRDS

- Kiwi
- Ostrich
- Emu
- Rhea
- Cassowary

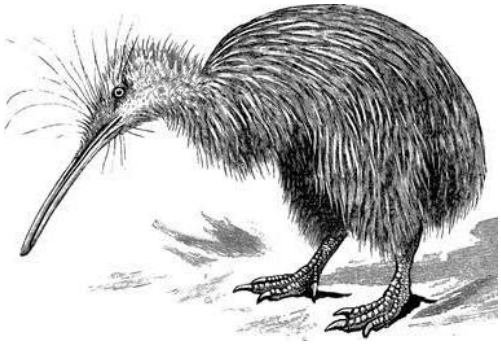
Ratites

✓ Penguin

Kiwi

- It is the only bird with a nostril at the end of its beak

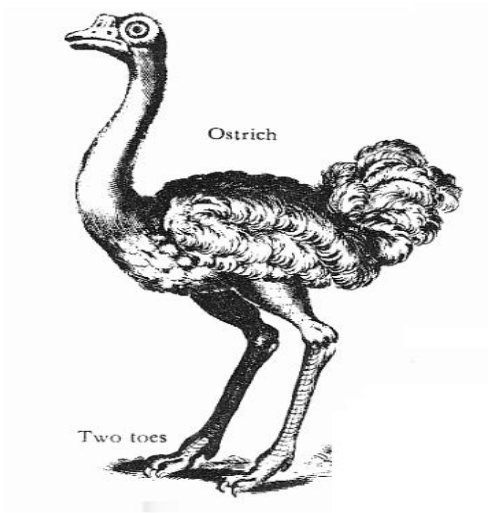
AN ILLUSTRATION SHOWING A KIWI



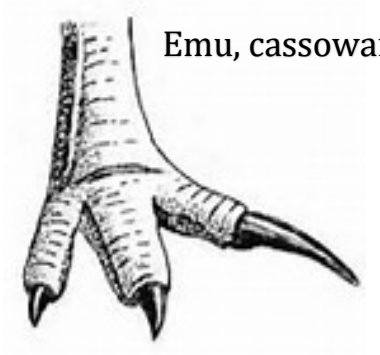
OSTRICH

- It is the largest and fastest flightless bird.
- It can run faster than most **horses**.
- It can run at an average speed of 45 miles per hour
- It is the only bird with two toes on each foot

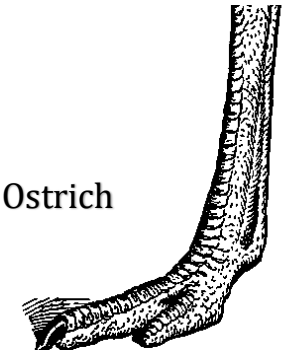
A DIAGRAM SHOWING AN OSTRICH



DRAWINGS SHOWING FEET OF FLIGHTLESS BIRDS



Emu, cassowary, rhea and kiwi



Ostrich

How do some flightless birds (ostrich, emu and cassowary) protect themselves?

- By kicking with their strong huge legs

Give a reason why some domestic fowls are unable to fly high

- They have heavy bones with bone marrow

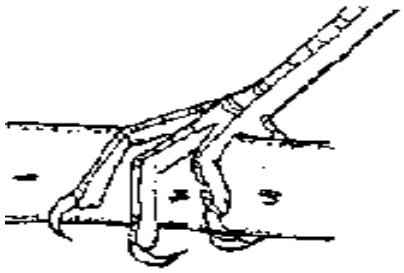
PERCHING BIRDS (SONG BIRDS/PASSERINES)

- These are birds that can roost (rest) on branches of trees.
- ✓ **A perch** is a piece of wood on which a bird sleeps (rests)

CHARACTERISTICS OF PERCHING BIRDS

- They have split feet and walking legs.
- They have three toes pointing forwards and one pointing backward
- ✓ For gripping the perches
- They have strong toes to grip on the trees.

A DRAWING SHOWING FOOT OF PERCHING BIRDS



GROUPS OF PERCHING BIRDS

- ✓ Perching birds are grouped according to their feeding habits
- Seed eaters
- Nectar suckers
- Insect eaters
- Fruit eaters

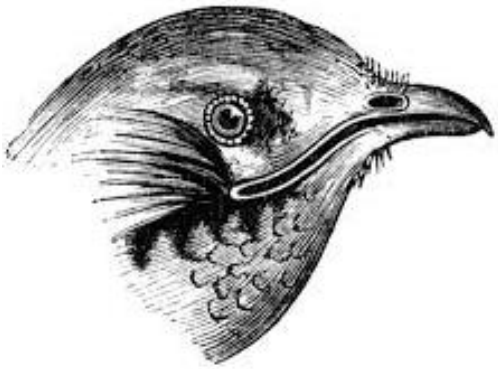
1. INSECT EATERS

- These are perching birds that feed on insects.
- They have short narrow beaks;
- ✓ For picking up insects from tree barks

Examples of insect eaters

- Swifts
- Shrikes
- Swallows
- Nightjars
- Sparrows
- Robins
- Woodcreepers
- Bee-eaters

A DRAWING SHOWING A BEAK OF INSECT EATERS (E.G SWIFT)



Why do swifts and swallows have short and wide open beaks?

- To catch insects while flying

Why shrikes are sometimes called butcher birds?

- They spear insects on thorns to eat it later

2. SEED EATERS

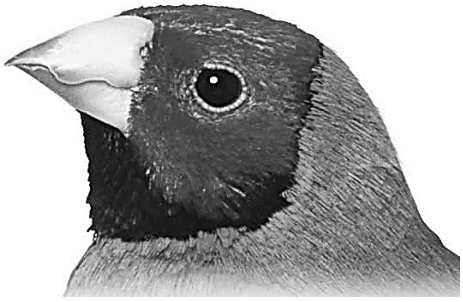
- These are perching birds that feed on seeds.
- They have strong short conical beaks;

✓ For breaking up seeds

EXAMPLES OF SEED EATERS

- Pigeon
- Dove
- Weaverbird
- Finch

A DRAWING SHOWING A BEAK OF A SEED EATER (E.G DOVE)



3. NECTAR SUCKERS (HONEY EATERS)

- These are perching birds that feed on nectar from flowers.
- They have long slender curved beaks;

✓ For sucking nectar from flowers

EXAMPLES OF NECTAR SUCKERS

- Sunbird
- Hummingbird

DIAGRAMS SHOWING A BEAK AND FOOT OF A SUNBIRD

4. FRUIT EATERS (FRUGIVORES)

- These are perching birds that feed on fruits from trees.
- They have long down curved beaks;
- ✓ For collecting fruits from trees

EXAMPLES OF FRUIT EATER

- Hornbill
- Toucan

A DRAWING SHOWING A BEAK OF HORNBILL

Importance of fruit eating birds

- They help in fruit and seed dispersal

Disadvantage of fruit eating birds

- They are crop pests

SCRATCHING BIRDS

- These are birds which scratch the ground for food.

CHARACTERISTICS OF SCRATCHING BIRDS

- They have strong feet with blunt claws.
- ✓ For scratching
- They have strong short pointed beaks
- ✓ For picking up food from soil

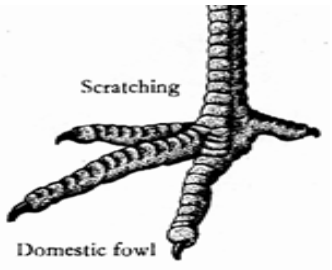
EXAMPLES OF SCRATCHING BIRDS

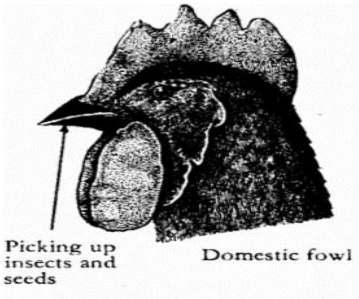
- Chickens
- Turkeys
- Guinea fowls
- Pheasants
- Crested francolin

FOOD FOR SCRATCHING BIRDS

- Seeds
- Insects

Structure of the beak and foot scratching bird





IMPORTANCE OF BIRDS IN THE ENVIRONMENT

- Some birds are a source of meat
- Some birds are a source of eggs
- Some birds are a source of income when sold
- Some birds attract tourists e.g flamingo birds and ostriches
- Some birds pollinate flowers e.g sunbirds and hummingbirds
- Some birds help in seed dispersal
- Some birds are used as dowry
- Some birds are used as sacrifices
- Some birds help to clean the environment by feeding on rotten meat (carrion)
- Their droppings are used as manure
- Their bones are used for making glue
- Their feathers are used for decoration
- Their feathers are used to make costumes

DISADVANTAGES (DANGERS) OF BIRDS

- Some birds are crop pests e.g weaverbirds
- Some birds cause airplane accidents. (They lead to bad strikes)
- Some birds make a lot of noise e.g weaverbirds.
- Some birds hide parasite e.g fleas and mites
- Birds of prey kill poultry

MAMMALS

- These are animals with mammary glands

MAIN /UNIQUE CHARACTERISTICS OF MAMMALS

- They have mammary glands
- They have hair (fur) on their bodies
- They have ossicles (they have three middle ear bones)
- They have sweat glands

OTHER CHARACTERISTICS OF MAMMALS

- They are warm blooded
- They breathe by means of lungs
- They have backbone
- They undergo internal fertilization
- They care for their young
- They have four chambered heart
- Most mammals give birth to live young ones (most of them are viviparous)
- Most mammals have well developed pinnae (ear lobe)

State the importance of mammary glands to female mammals

- To produce milk for feeding their young

IMPORTANCE OF BODY HAIR/FUR ON MAMMALS

- It keeps the body warm (for temperature regulation)
- It protects the body from injury
- For sensing

MAIN GROUPS / CLASSES OF MAMMALS

- Pouched mammals (marsupials)
- Egg laying mammals (monotremes)
- Placental mammals

1. **POUCHED MAMMALS**
   - These are mammals that give birth to immature young and care for them inside their pouch

2. **MONOTREMES**
   - These are mammals that reproduce by laying eggs

3. **PLACENTAL MAMMALS**
   - These are mammals that give birth to fully grown young

GROUPS OF PLACENTAL MAMMALS
- Primates (fingered mammals)
- Ungulates (hoofed mammals)
- Carnivorous mammals (flesh eating mammals)
- Gnawing mammals (rodents and lagomorphs)
- Insectivorous(insect eating mammals)
- Flying mammals (chiroptera)
- Sea mammals (cetaceans and sirenians)

PRIMATES (FINGERED MAMMALS)
- These are mammals with well-developed brain

Why are primates regarded as the most advanced group of mammals?
- They have well developed brain

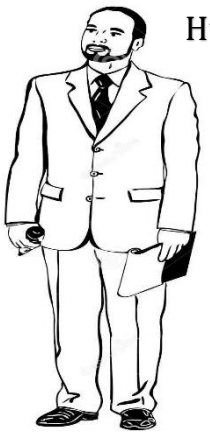
CHARACTERISTICS OF PRIMATES
- They have a well-developed brain
- They have 5 fingers on each hand and 5 toes on each foot.
- They are omnivores
- They have forward facing eyes
- They have four types of teeth (incisors, canines, premolars and molars)
- They have four limbs
- ✓ Fore limbs for holding and hind limbs for walking.

Why are mammals called omnivores?
- They feed on both meat and vegetation

EXAMPLES OF PRIMATES
- Human being
- Chimpanzee (bonobo)
- Gorilla
- Orangutan
- Gibbons

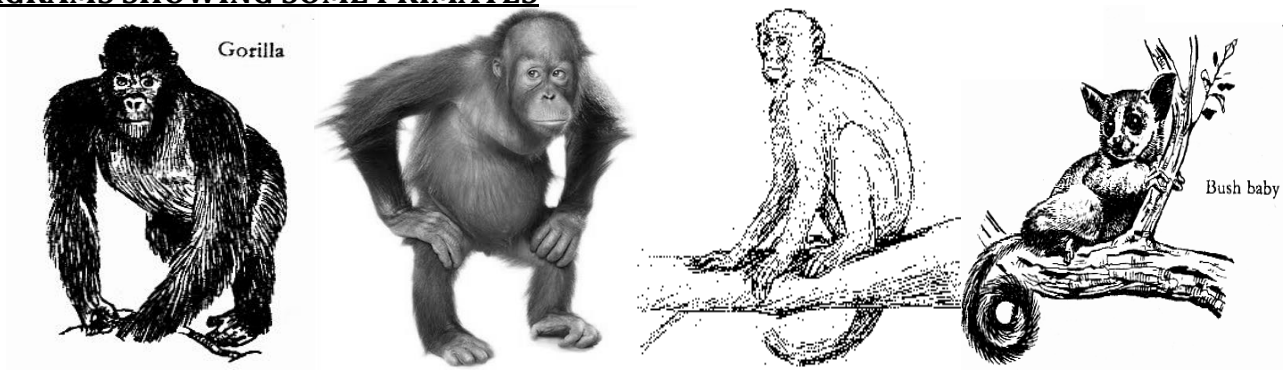
Apes

- ✓ Monkey
- ✓ Baboon
- ✓ Bushbaby



What are apes?
- These are primates with no tails

DIAGRAMS SHOWING SOME PRIMATES



Gorilla Orangutan Monkey Bushbaby

EGG LAYING MAMMALS (MONOTREMES)

- These are mammals that lay eggs
- ✓ They lay 1 to 3 eggs
- ✓ Monotremes have characteristics of birds, mammals and reptiles

REASONS WHY MONOTREMES ARE THE MOST PRIMITIVE IN THE CLASS OF MAMMALS

- They lay eggs
- They have only one opening (cloaca) for reproduction and excretion
- They feed using a beak (bill)

Why are monotremes regarded as mammals?

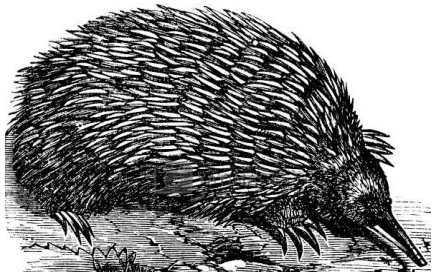
- They have hair on their bodies
- They have mammary glands (they produce milk for their young ones)
- They care for their young after hatching

EXAMPLES OF EGG LAYING MAMMALS (MONOTREMES)

- Duck billed platypus
- Spiny anteater (echidna)

DIAGRAMS SHOWING MONOTREMES

Spiny anteater



Duck billed platypus

How do monotremes locate their food?

- By electroreception

UNGULATES (HOOFED MAMMALS)

- These are mammals with hooves
- ✓ All ungulates are herbivores (feed on vegetation)

GROUPS OF UNGULATES

- Odd toed ungulates
- Even toed ungulates

1. **ODD TOED UNGULATES**
   - These are ungulates with one or three toes on each foot

EXAMPLES OF ODD TOED UNGULATES

- Horse
- Donkey
- Zebra

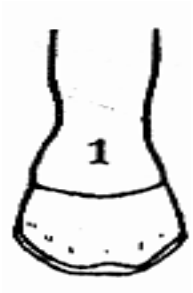
} One toe on each foot

- ✓ Elephant
- ✓ Rhino

} Three toes on each foot

DRAWINGS SHOWING TOES OF ODD TOED UNGULATES

Horse



Elephant

2. **EVEN TOED UNGULATES**
   - These are ungulates with two toes on each foot

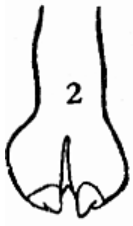
EXAMPLES OF EVEN TOED UNGULATES

- Cattle
- Goat
- Sheep
- Antelope
- Giraffe
- Camel
- Okapis
- Deer
- Elk
- ✓ Pig
- ✓ Warthog
- ✓ Hippo

DRAWINGS SHOWING TOES OF ODD TOED UNGULATES

Cow

Camel



SUBGROUPS OF EVEN TOED UNGULATES

- Ruminants
- Nonruminants

i) RUMINANT ANIMALS

- These are animals that chew cud
- ✓ They have four stomach chambers

EXAMPLES OF RUMINANT ANIMALS

- Cattle
- Goat
- Sheep
- Giraffe
- Camel
- Deer
- Antelope
- Elk

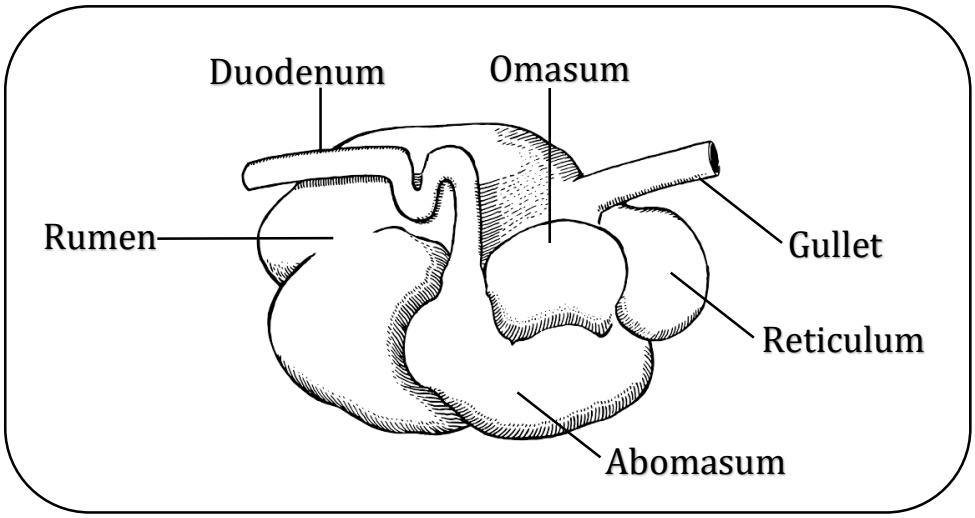
How do most ruminants protect themselves?

- By using their horns

Name the four stomach chambers of ruminant animals

1. Rumen
2. Reticulum
3. Omasum
4. Abomasum

A DIAGRAM SHOWING THE FOUR STOMACH CHAMBERS OF RUMINANTS



GULLET (OESOPHAGUS)

- It passes food to the rumen

RUMEN

- ✓ It is the first and largest stomach chamber
- It stores food for a short time before rumination
- It ferments and softens food

RETICULUM

- ✓ It is the second stomach chamber
- It retains foreign bodies

OMASUM

- ✓ It is the third stomach chamber
- It absorbs water

ABOMASUM (TRUE STOMACH)

- ✓ It is the fourth stomach chamber
- It mixes food with digestive enzymes

NONRUMINANT ANIMALS

- These are animals that do not chew cud
- ✓ Nonruminants have **well developed canines for protection**

EXAMPLES OF NONRUMINANT ANIMALS

- Pig
- Hippo (hippopotamus)
- Warthog

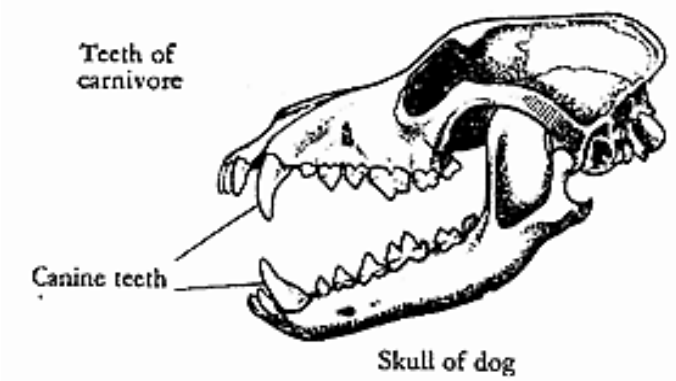
CARNIVOROUS MAMMALS (FLESH EATING MAMMALS)

- These are mammals that feed on flesh/meat

CHARACTERISTICS OF CARNIVOROUS ANIMALS / ADAPTATIONS OF CARNIVOROUS MAMMALS TO HUNTING

- They have well developed canines
- ✓ For tearing flesh (prey)
- They have strong sharp claws
- ✓ For gripping and killing their prey
- They have very good speed
- They have good sense of smell, vision and hearing
- They have soft pads in their feet
- ✓ To run after their prey silently
- They are strong animals

A DIAGRAM SHOWING A SKULL OF A CARNIVOROUS MAMMAL



FAMILIES (SUBGROUPS) OF CARNIVOROUS MAMMALS

- Dog family
- Cat family

a) DOG FAMILY

- These are dog-like carnivorous mammals

EXAMPLES OF CARNIVOROUS MAMMALS UNDER THE DOG FAMILY

- Domestic dog
- Fox
- Jackal
- Wolf

b) **CAT FAMILY**

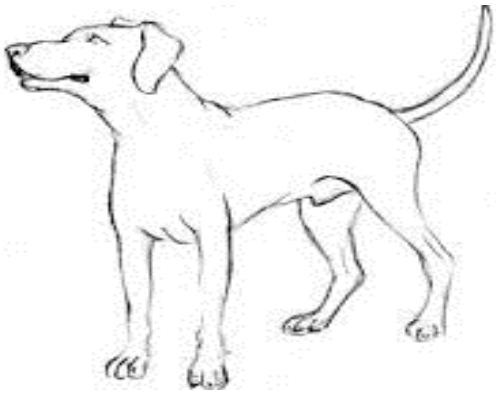
- These are cat-like carnivorous mammals
- ✓ They have retractile claws

Examples of carnivorous mammals under cat family

- Domestic cat
- Cheetah
- Lion
- Leopard
- Tiger
- Jaguar
- Mongoose
- ✓ Hyena
- Civet
- Puma/cougar/panther
- Lynx

Cheetahs can run as fast as 70 miles per hour (120kph)

DRAWINGS OF DOMESTIC DOG AND CAT



NOTE

- Most carnivorous mammals are **predators**
- **Predators** are animals that hunt and kill their prey
- Some carnivorous mammals are **scavengers**
- **Scavengers** are animals that feed on **carrion** (abandoned meat)

EXAMPLES OF SCAVENGER MAMMALS

- Jackal
- Hyena
- Fox

IMPORTANCE OF CARNIVOROUS MAMMALS TO MAN

- Domestic dogs are used for hunting
- Domestic dogs are used for protection at home
- Domestic cats are used to kill rats at home
- Civets produce musk used in perfumes

GNAWING MAMMALS

- These are mammals with well-developed incisors for chewing rapidly

CHARACTERISTICS OF GNAWING MAMMALS

- They have well developed incisors
- They lack canines.

GROUPS OF GNAWING MAMMALS

- Rodents
- Lagomorphs

Of what importance is gnawing (chewing rapidly) to rodents and lagomorphs

- It helps to keep their incisors short

RODENTS

- These are gnawing mammals with one pair of upper incisors

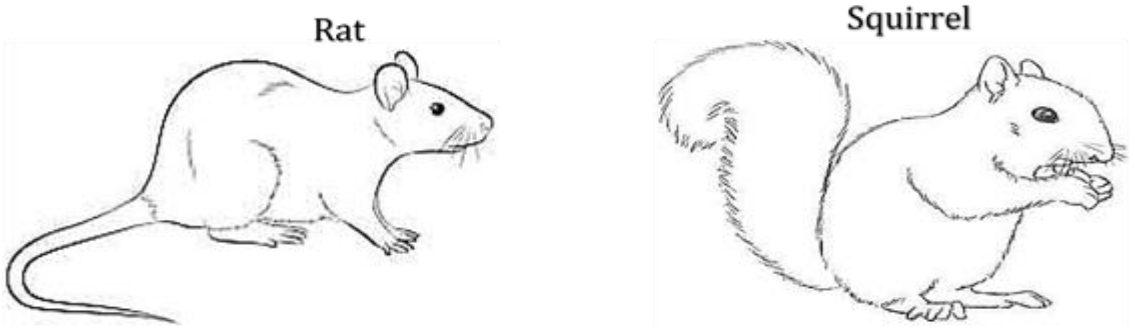
Characteristics of rodents

- They have one pair of upper incisors
- They are omnivores
- They have long tails

Examples of rodents

- Rat
- Squirrel
- Mouse
- Mole
- Porcupine
- Guinea pig
- Beavers
- Marmot
- Chipmunks
- Prairie dog
- Voles
- Lemming
- Muskrat
- Hamster

DRAWINGS SHOWING RODENTS (RAT AND SQUIRREL)



LAGOMORPHS

- These are gnawing mammals with two pairs of upper incisors

CHARACTERISTICS OF LAGOMORPHS

- They have two pairs of upper incisors
- They are herbivores
- They have short tails (rudimentary)

EXAMPLES OF LAGOMORPHS

- Rabbits
- Hares
- Pikas

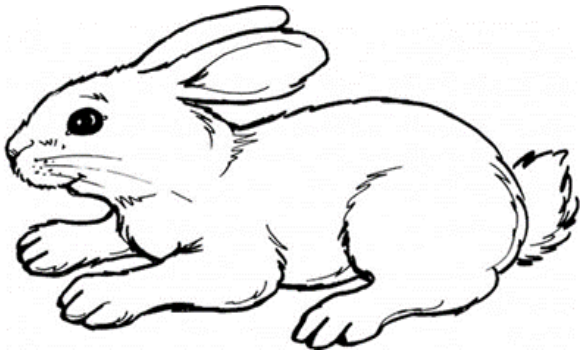
SIMILARITIES BETWEEN LAGOMORPHS AND RODENTS

- Both have well developed incisors
- Both have no canines
- Both chew rapidly

DIFFERENCES BETWEEN LAGOMORPHS AND RODENTS

- Lagomorphs have two pairs of upper incisors while rodents have one pair of upper incisors
- Lagomorphs are herbivores while rodents are omnivores
- Lagomorphs have short tails while rodents have long tails

A drawing showing a lagomorph (rabbit)



INSECT EATING MAMMALS (INSECTIVORES)

- These are mammals which feed on insects.

CHARACTERISTICS OF INSECT EATING MAMMALS

- They have good sense of smell
- They are nocturnal (they are active at night)
- They live in burrows or trees
- They have sharp claws for digging out insects from soil
- They have long sensitive snouts
- They have abnormal appetite for food

EXAMPLES OF INSECT EATING MAMMALS

- Hedgehog
- Elephant shrew
- Aardvark
- Aardwolf
- Golden mole
- Solenodon

A DRAWING OF A HEDGEHOG

How does a hedgehog protect itself?

- It rolls up itself into a spiny ball

FLYING MAMMALS (CHIROPTERA)

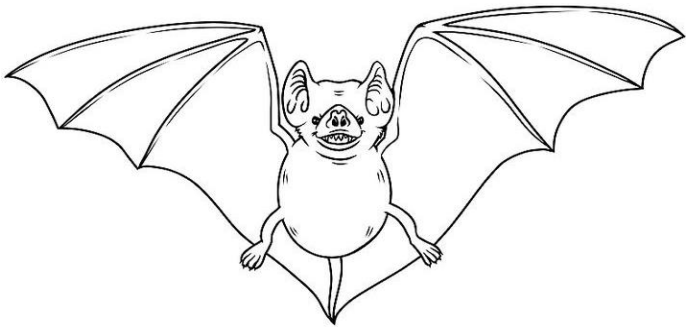
- These are mammals that can fly

AN EXAMPLE OF A FLYING MAMMAL

- **Bats**

✓ **A bat** is the only true flying mammal

A DRAWING SHOWING A BAT



How is a bat adapted to flight?

- Its fore limbs are modified into wings (it has wings)

Why are bats called nocturnal animals?

- They are active at night (they hunt at night)

GROUPS (TYPES) OF BATS

- Insectivorous bats (insect eating bats)
- Frugivorous bats (fruit eating bats)
- Blood-sucking bats (vampire bats)

INSECT EATING BATS (INSECTIVOROUS BATS)

- These are bats that feed on insects

FRUIT EATING BATS

- These are bats which feed on fruits

BLOOD SUCKING BATS/VAMPIRE BATS

- These are bats that feed on blood

IMPORTANCE OF BATS IN THE ENVIRONMENT

- They feed on insect vectors e.g mosquitoes
- They feed on insect pests
- They help in pollination
- They help in seed dispersal
- Their guano is used as fertilizers

DANGERS OF BATS

- They hide parasites e.g fleas
- Infected bats are disease vectors (they spread histoplasmosis)
- They make a lot of noise
- Their dung causes bad smell in houses
- Vampire bats bite farm animals
- Some bats destroy fruits on crops
- Vampire bats suck blood from farm animals e.g cattle

WAYS OF PROTECTING BANANA CROPS AGAINST FRUIT EATING BATS.

- By early harvesting
- By using net traps
- By using plastic banana bunch bags

Bats are blind, how are they able to locate food at night?

- They use echoes

How are echoes useful to bats?

- They help bats to find food at night
- They help bats to find their way at night (to dodge obstacles at night)

POUCHED MAMMALS (MARSUPIALS)

- These are mammals with a pouch (marsupium) to carry their young
- A young marsupial is **called** joey

EXAMPLES OF POUCHED MAMMALS (MARSUPIALS)

- Kangaroo
- Koala
- Wallaby
- Opossum
- Wombat
- Numbat

- Quokka
- Phalanger
- Dasyure
- Tasmanian devil
- Bandicoot

✓ They are most common in **Australia** and some few in **America**

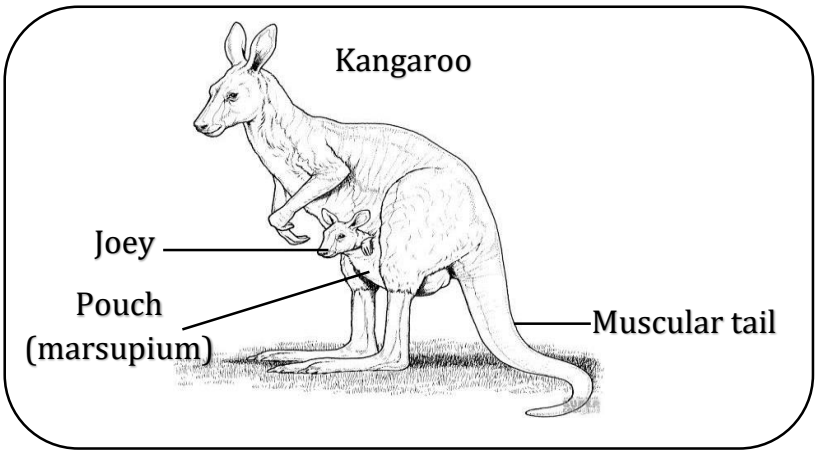
Why does a kangaroo carry its joey in a pouch?

- To feed its immature young (joey)

How are marsupials different from other mammals?

- They feed their immature young inside a pouch unlike other mammals

A DIAGRAM SHOWING A KANGAROO



IMPORTANCE OF EACH BODY PART OF A KANGAROO

Long muscular tail

- To maintain body balance when standing

Pouch (marsupium)

- To carry its young (joey)

MARINE MAMMALS

- These are mammals that live in seas

✓ They are also called **sea mammals** or **aquatic mammals**

CHARACTERISTICS OF MARINE MAMMALS

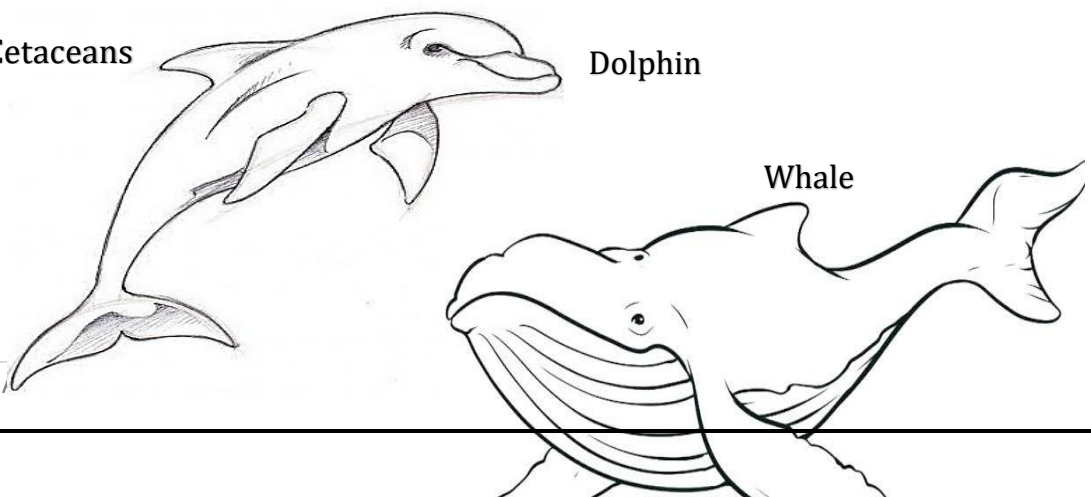
- They have blubber
- They have streamlined bodies
- They have flippers for swimming
- They have well developed brain next to primates

EXAMPLES OF SEA MAMMALS (MARINE MAMMALS)

- Whale
- Porpoise
- Dolphin

Cetaceans

❖ Dugong
❖ Manatee
- Seal
- Sea lion
- Walrus
- Sea otter



- ✓ **A blue whale** is the largest known living mammal.

How do sea mammals breathe?
- By means of lungs

BLUBBER
- This is a fatty layer under the skin of sea mammals
- ✓ It keeps sea mammals warm in water

How is blubber useful to sea mammals?
- It keeps the sea mammal warm in cold water

How does blubber keep the sea mammals warm in water?
- It prevents heat loss

How is a sea mammal able to survive in cold seawater?
- It has blubber

IMPORTANCE OF MAMMALS
- Some mammals are a source of food
- Some mammals are used for transport e.g horses
- Some mammals provide animal labour
- Some mammals attract tourists
- Some mammals guard our homes e.g dogs
- Some mammals are sold for money
- Some mammals provide skins to leather industries
- Some mammals eat disease vectors e.g bats
- Their wastes are used to make biogas and farmyard manure

DISADVANTAGES OF MAMMALS
- Some mammals are crop pests
- Some mammals kill people
- Some mammals are disease vectors e.g rabid dogs

AMPHIBIANS
- These are cold blooded vertebrates that can live in water and on land

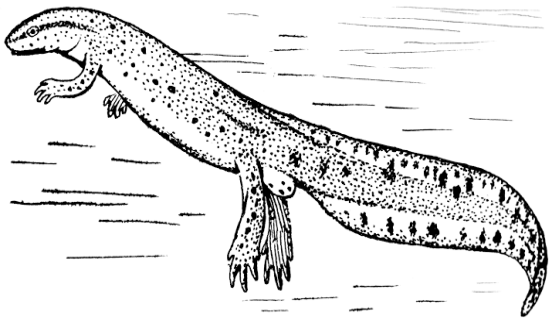
CHARACTERISTICS OF AMPHIBIANS
- They can live in water and on land
- They are cold blooded/poikilothermic animals
- They reproduce by laying eggs
- They undergo external fertilization
- They have a backbone
- They have no external ears
- They breathe by means of lungs on land
- They have three chambered hearts
- They have scaleless skin/have no scales on their skins
- They lay their eggs in water
- They do not produce amniotic eggs
- They go through metamorphosis
- They spend their first life in water and later go on land

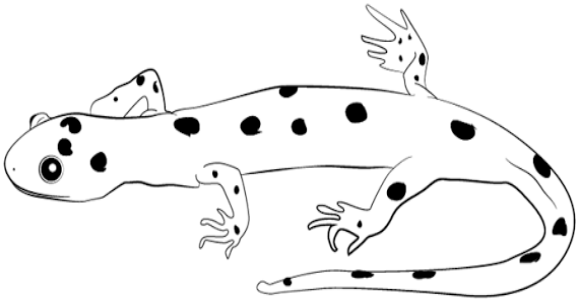
EXAMPLES OF AMPHIBIANS

- Frogs
- Toads
- Newts
- Salamanders (axolotl)
- Caecilians

✓ **Frogs and toads** have no tails
✓ **Newts and salamanders** have tails
✓ **Caecilians** have no limbs (they are limbless amphibians)

A DRAWING OF A SALAMANDER AND A NEWT

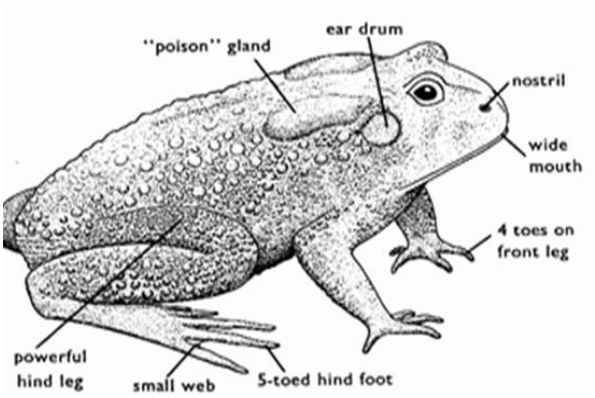




Name the amphibian shown in the diagram below

Caecilian

EXTERNAL FEATURES OF A TOAD



IMPORTANCE OF EACH PART OF A TOAD

- **Mouth**

✓ For feeding

- **Nostril**

✓ For smelling food

- **Eyes**

✓ For sight

- **External eardrum**

✓ For hearing

- **Paratoid gland/poison gland**

✓ To produce poison which keeps away predators

- **Strong hind legs**

✓ For hopping/leaping

- **Webbed feet**

✓ For swimming in water

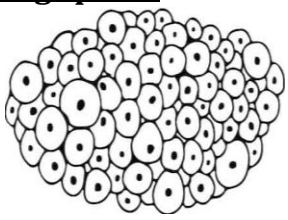
DIFFERENCES BETWEEN A FROG AND A TOAD

- A frog lives in water while a toad lives on land.
- A frog has smooth skin while a toad has rough skin
- A frog lays eggs in clusters/bunch/big spawn while a toad lays eggs in strings/ribbon-like spawn
- A toad has poison/paratoid gland while a frog has no poison gland
- A frog has fully webbed hind feet while a toad has half webbed feet
- A frog can breathe through its skin while a toad cannot breathe through its skin
- A frog has teeth in upper jaw while a toad has no teeth
- A frog has brown tadpoles while a toad has black tadpoles

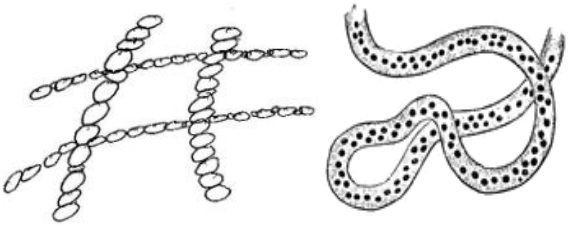
EGGS OF FROGS AND TOADS

- Their eggs are called **spawn**

Frog spawn



Toad spawn



IMPORTANCE OF JELLY ON EGGS OF FROGS AND TOADS

- It prevents eggs from drying up/it keeps the eggs moist
- It protects the eggs from predators
- It prevents bacterial infections
- It activates the sperms to fertilize the eggs

How does the jelly protect eggs of amphibians from predators?

- It has unpleasant taste
- It sticks (binds) the eggs together

MOVEMENT IN AMPHIBIANS

- Amphibians move in water **by swimming**
- Toads and frogs move on land by **leaping/hopping/jumping**
- Strong hind legs **help the frog or toad to leap/jump**
- Fore legs **absorb shock on landing**
- Webbed hind feet **help a frog or toad to swim in water**
- Newts and salamanders move **by walking**

FEEDING IN FROGS AND TOADS

- They are carnivorous animals
- They feed on worms and insects (e.g houseflies, mosquito larvae, cockroaches and beetles)
- They have wide mouth and long sticky tongues

- ✓ To trap their prey (insects)
- A frog has teeth in the upper jaw
- ✓ To prevent the prey in mouth from escaping
- Tadpoles feed on water weeds and small water animals

How do frogs in ponds help in control of malaria?

- They eat mosquito larvae

BREATHING IN TOADS AND FROGS

AMPHIBIAN	BREATHING ORGANS
Frog	▪ Lungs ▪ Moist skin ✓ In water, a frog breathes **through its moist skin** ▪ Buccal cavity (lining of the mouth)
Toad	▪ Lungs ▪ Buccal cavity (lining of the mouth)
Salamander	▪ Lungs ▪ Gills ▪ Moist skin
Newts	▪ Lungs ▪ Moist skin

How is a frog able to live in water and on land?

- It can breathe through its moist skin in water and through the lungs on land

Why can a frog breathe through is skin?

- Its skin is smooth and moist

Why can't a toad breathe through its skin?

- Its skin is rough and dry

How do amphibians protect themselves?

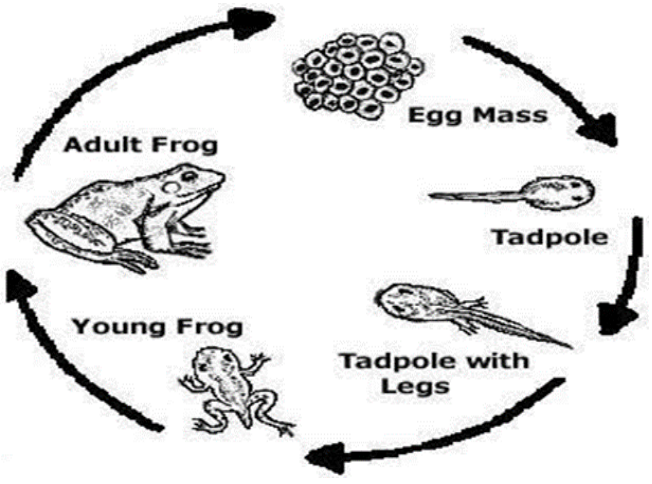
- **Toads**

By producing poison to kill small enemies, by swelling to scare away enemies

- **Frog**

By using their slippery skin to escape from enemies, by hiding in water, by swelling to scare away enemies, by camouflaging

A DIAGRAM SHOWING THE LIFE CYCLE OF A FROG



REPRODUCTION IN FROGS AND TOADS

- Breeding/mating/reproduction in frogs and toads occurs in **wet/rainy season**
- They reproduce by laying eggs
- The spawn (eggs of amphibians) are **fertilized externally**
- The eggs of amphibians are called **spawn**
- The lay their eggs in water (ponds and stagnant water)
- ✓ To prevent the eggs from drying up (desiccation)
- The frogspawn and toadspawn are covered with **smelly jelly**
- The eggs hatch into larvae called **tadpoles**
- A tadpole has **gills** for breathing and a **tail** for swimming
- As a tadpole grows, it loses the gills and develops lungs
- Tadpoles later grow into adult frogs and toads.

TADPOLE

- ✓ This is the larva stage of frogs and toads
- A tadpole lives in water
- A tadpole has **gills** for breathing and a **tail** for swimming / movement

Why do amphibians lay very many eggs?

- To prevent extinction of their species

Why do male frogs and toads croak/make noise?

- To attract females for mating

How is sun's heat important to spawn?

- It enables the spawn to hatch

Briefly explain how the eggs of amphibians are fertilized externally?

- The male sheds sperms over the eggs after being laid

Why are eggs of amphibians fertilized as they come out of the female?

- To prevent the eggs from swelling before fertilization

Toads live on land. Why do they sometimes go into water?

- To lay eggs

ADAPTATIONS OF A FROG TO ITS LIFE IN WATER

- It has streamlined body to overcome friction in water
- It has webbed hind feet for swimming in water
- It has moist skin for breathing in water
- It has slippery body to escape enemies in water

HIBERNATION AND AESTIVATION IN ANIMALS

- **Hibernation** is the inactive state in some animals during winter
- **Aestivation** is the inactive state in some animals during summer/hot weather

DURING INACTIVE/DORMANT PERIODS:

- Frogs hide in burrows and breathe through their moist skin
- They feed on fats and glycogen stored in their body

Why do amphibians aestivate?

- To prevent their bodies from drying up
- To maintain body temperature
- To survive during harsh weather (e.g drought and winter)

DIFFERENCES BETWEEN A TADPOLE AND A FROG

- A tadpole breathes through gills but a frog breathes through moist skin, lungs and lining of mouth
- A tadpole swims by means of tail while a frog swims by means of webbed hind feet

IMPORTANCE OF AMPHIBIANS TO PEOPLE

- They eat insect vectors
- They eat insect pests
- They are used in science experiments
- Some amphibians act as food

REPTILES

- These are vertebrates that move by crawling and slithering

CHARACTERISTICS OF REPTILES

- They have scales on their bodies
- They use lungs for breathing
- They are cold blooded animals
- They undergo internal fertilization
- They lay hard shelled eggs
- They have a backbone
- They have three chambered hearts
- They have waterproof skin
- Most reptiles have four limbs except snakes (they are tetrapods)
- They move by crawling and slithering
- Most reptiles reproduce by laying eggs
- Most reptiles are terrestrial animals (live on land) though some swim in water

EXAMPLES OF REPTILES

- Kingsnake
- Gaboon viper
- Mamba
- Chameleon
- Skink
- Crocodile
- Tortoise
- Turtle
- Alligator
- Gecko
- Common lizard

GROUPS (CLASSES) OF REPTILES

- Snakes
- Lizards
- Testudines (turtles and tortoises)
- Crocodilians (crocodiles and alligators)

TORTOISES AND TURTLES

- These are reptiles with hard bony shells

CHARACTERISTICS OF TORTOISES AND TURTLES

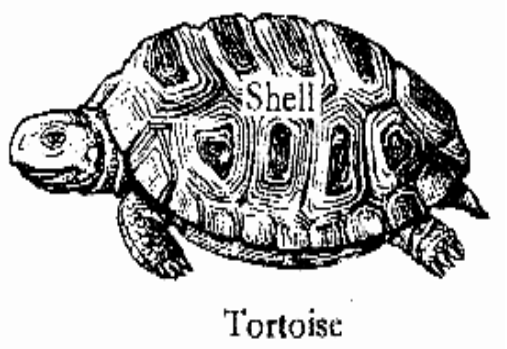
- They have hard shells
- ✓ To protect the animal from predators
- ✓ To prevent the animal from drying up
- They have no teeth but have sharp jaws to tear food
- They breathe by means of lungs
- They lay their eggs in loose sand
- They have four limbs
- They have very long lifespan

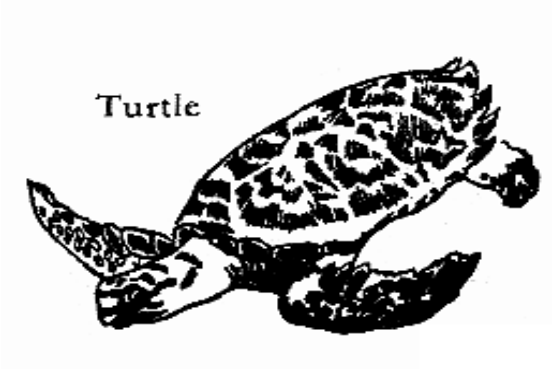
- ✓ Tortoises may live for 150 to 300 years
- ✓ Turtles live for about 20 to 40 years

EXAMPLES OF TURTLES AND TORTOISES

- Tortoise
- Turtle
- Terrapin
- ✓ Terrapins are turtles that live in fresh and salty water

DRAWINGS SHOWING TORTOISE AND TERRAPIN





What do we call the upper and lower shells of turtles and tortoises?

- Upper shell is called **carapace**
- Lower shell is called **plastron**

How do turtles and tortoises protect themselves?

- By hiding in their hard shells

DIFFERENCES BETWEEN TURTLES AND TORTOISES

- Tortoise has raised(dome shaped) shell while a turtle has flat shell
- Tortoise lives on land while turtle lives in water
- Tortoises have strong stumpy feet for walking while turtles have webbed feet (flippers) for swimming in water
- Tortoises are herbivores while turtles are omnivores

FOOD FOR TURTLES AND TORTOISES

- Insects
- Small animals
- Vegetation

SNAKES

- These are limbless reptiles

CHARACTERISTICS OF SNAKES

- They have no limbs/they are limbless
- They undergo moulting
- ✓ To grow/to increase in size
- They move by slithering/gliding
- They are carnivorous animals/feed on flesh
- They have a forked tongue
- ✓ For smelling
- ✓ For tasting
- They have Jacobson's organ

- ✓ For tracking their prey
- Their teeth point backward
- ✓ To prevent the prey in mouth from escaping
- They have no external ears

What is moulting?
- This is the shedding of outer skin in reptiles

Why do reptiles moult?
- To grow (to increase in size)

How do snakes detect movement?
- By feeling vibration in the ground with their jawbone

Why do snakes move while bringing out their forked tongue?
- For smelling
- For tasting

FOOD FOR SNAKES
- Small insects
- Eggs

GROUPS (CLASSES) OF SNAKES
- Venomous snakes
- Non-venomous snakes
- Constrictors

VENOMOUS SNAKES
- These are snakes that have venom

CHARACTERISTICS OF VENOMOUS SNAKES
- They have fangs
- They have triangular heads
- They have a slit-like (elliptical) eye pupil
- They have venom

EXAMPLES OF VENOMOUS SNAKES
- Cobra
- Mamba (green mamba/black mamba)
- Death adder
- Viper (Gaboon viper/pit viper)
- Boomslang
- Coral snakes
- Rattlesnakes
- Water moccasins
- Taipan
- Sea snakes


Cobra

REASONS WHY PEOPLE GREATLY FEAR THE FOLLOWING VENOMOUS SNAKES

Gaboon viper
- Its venom kills within 30 minutes
- ✓ Gaboon viper is the most venomous snake on land

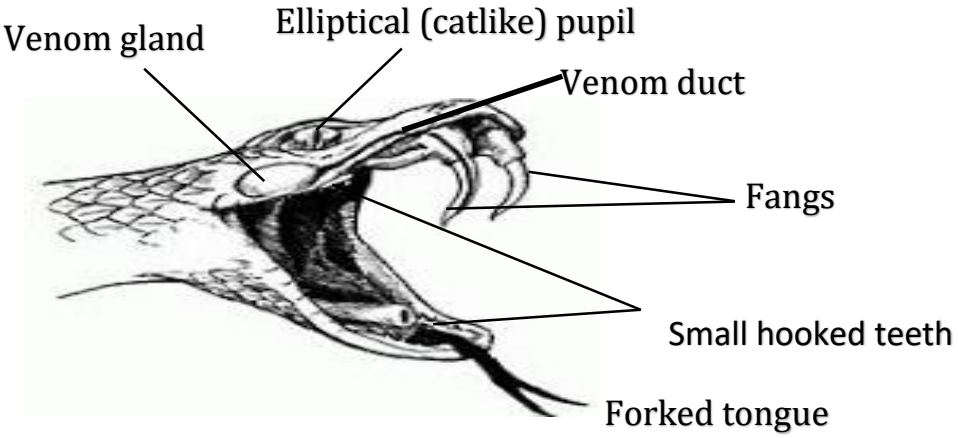
BLACK MAMBA

- It is always quick and ready to bite

COBRA

- It spits venom that can cause blindness
- ✓ A cobra rarely bites

A DIAGRAM SHOWING THE HEAD OF A VENOMOUS SNAKE



FORKED TONGUE

- For smelling
- For tasting

SMALL HOOKED TEETH

- For preventing the prey in mouth from escaping

VENOM GLAND

- To produce/secrete venom

VENOM DUCT

- It passes venom to fangs

FANGS

- ✓ These are the two long pointed hollow teeth of venomous snakes
- For injecting venom
- For protection

How are fangs adapted to injecting venom into the prey?

- They are hollow and sharp pointed

Importance of venom to venomous snakes

- It helps to kill the prey

DANGERS OF SNAKE VENOM TO HUMAN LIFE

- It poisons blood leading to death
- It clots blood
- It destroys nerve cells
- It leads internal bleeding
- ✓ By breaking the cells and tissues
- It paralyzes the heart

MEDICAL IMPORTANCE OF SNAKE VENOM

- It is used to make antivenin/anti-venom serum
- ✓ Each venomous snake has its own antivenin

Why is it advisable to identify the colour, markings and shape of a snake in case of a snakebite?

- To be given the right antivenin

A DIAGRAM SHOWING A BITE OF A VENOMOUS SNAKE

SIGNS OF VENOMOUS SNAKEBITE

- Two puncture wounds/fang marks on the injured part
- Bleeding from the injured part
- Swelling of the injured part
- Excessive sweating

FIRST AID FOR SNAKEBITE

- Keep the victim calm and at rest
- ✓ To prevent venom from spreading in the body
- Tie a bandage slightly above the bitten part
- ✓ To prevent the flow of venom to the heart
- Apply a blackstone
- ✓ To absorb venom from the injured part
- Rush the victim to the hospital

NON VENOMOUS SNAKES

- These are snakes that do not have venom

CHARACTERISTICS OF NON-VENOMOUS SNAKES

- They have no fangs
- They have round eye pupil
- They have round heads
- They have no venom
- They swallow their prey alive

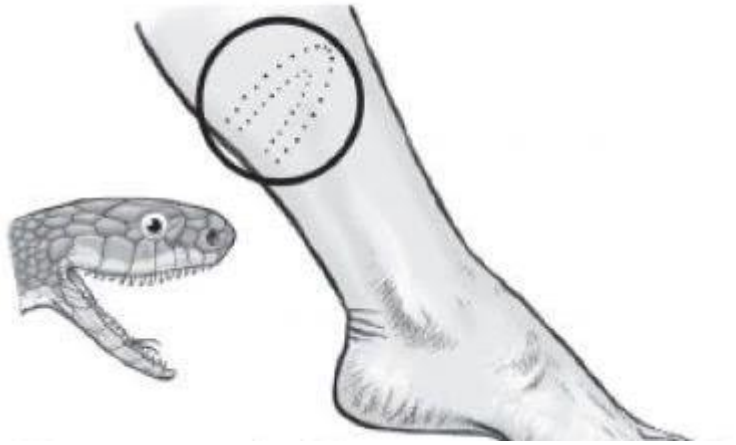
EXAMPLES OF NON-VENOMOUS SNAKES

- Grass snake
- Milk snake
- Rat snake
- Hognose snake
- Garter snake

NOTE

- Although non-venomous sometimes bite, they do not have venom

A DIAGRAM SHOWING A BITE OF A NON-VENOMOUS SNAKE



CONSTRICTORS

- These are very big snakes that kill their prey by squeezing them

CHARACTERISTICS OF CONSTRICTORS

- They have no venom
- They kill their prey by squeezing them
- They have well developed teeth
- ✓ To prevent the prey in mouth from escaping

Why do constrictors lick their prey before swallowing?

- To make them slippery (smooth)

How does squeezing kill the prey?

- It blocks the flow of blood

Examples of constrictors

- Python
- Anaconda
- Boa constrictor
- Bull snake
- Kingsnake

DON'TS WITH A SNAKEBITE

- Don't apply ice on the snake bite
- ✓ It causes frostbite (it blocks blood circulation)
- Don't suck the wound with mouth
- ✓ To prevent swallowing the venom
- Don't cut across the wound.
- ✓ To prevent causing more pain
- Don't apply a tourniquet
- ✓ It makes the cells to be rapidly destroyed by concentrated venom
- ✓ It blocks blood flow completely which can lead to amputation
- Don't try to capture the snake
- ✓ To prevent the snake from biting you again

What is amputation?

- This is the surgical removal of a limb.

WAYS OF PREVENTING SNAKE BITES

- Stay away from bushes
- Never play with any snake
- Use torchlight at night
- Wear boots and gloves when working in a bush
- If you meet a snake, give it room to move away

Name any two snakes that give birth to live young ones

- Boa constrictor
- Green anaconda
- Pit viper
- Garter snake
- Rattlesnake
- Sea snake

LIZARDS

- These are reptiles with four limbs and a tail which can grow when it breaks off

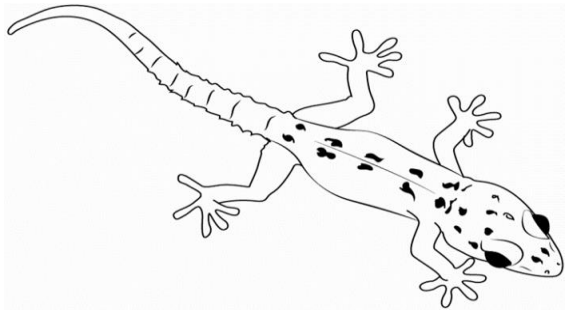
CHARACTERISTICS OF LIZARDS

- They have fleshy tongue
- They have movable eyelids
- They undergo moulting
- They have four limbs
- They move by crawling
- They breathe by means of lungs
- They reproduce by laying eggs
- They undergo internal fertilization
- Most lizards are carnivorous animas
- They can regenerate their tails if the old one breaks
- They have adhesive pads to grip smooth surfaces

EXAMPLES OF LIZARDS

- Sinks
- Geckos
- Chameleons
- Anoles
- Agama lizards
- Monitor lizards
- Iguana lizards
- Komodo dragon

GECKO



- This is a small carnivorous nocturnal lizard
- It is yellowish brown in colour
- It is commonly found in houses
- It protects itself by **losing (casting off) its tail**

How are wall geckos able to walk on vertical and upside-down surfaces?

- They have adhesive pads in their toes

How are geckos useful in our houses?

- They eat insect vectors like mosquitoes and cockroaches

SKINKS

- They protect themselves **by breaking off their tails**
- The tail moves and attracts the attention of the enemy

CHAMELEON

- This is a slow moving lizard with a large head and bulging eyes
- It protects itself **by camouflaging/changing its skin colour**
- It can move its bulging eyes in all direction
- ✓ To look front and back at the same time
- It uses its feet and tail **to hold small branches of trees**
- It has a long sticky tongue for **catching insects (trapping its prey)**
- Most chameleons **reproduce by laying eggs**

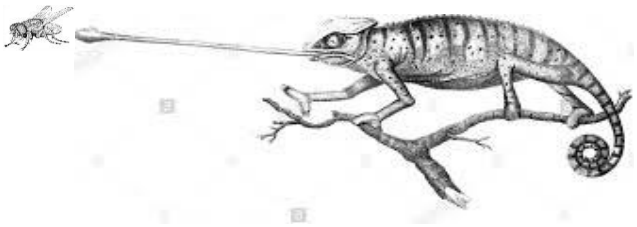
Why does a chameleon camouflage/change its skin colour?

- For protection
- To trap its prey

How is a chameleon able to change colours?

- It has chromatophores in its skin

A DIAGRAM SHOWING A CHAMELEON TRAPPING A HOUSEFLY



Importance of chameleons in the environment

- They eat insect vectors (e.g houseflies and mosquitoes)
- They eat insect pests

CROCODILIANS (CROCODILES AND ALLIGATORS)

- These are the largest of reptiles
- Alligators are commonly found in America
- Crocodiles are commonly found in Africa

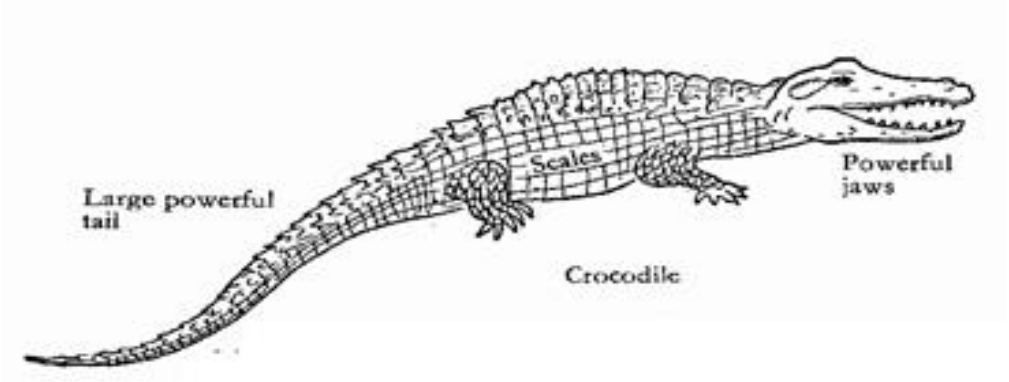
Examples of crocodilians

- Crocodile
- Alligator
- Gavial
- Caiman

CHARACTERISTICS OF CROCODILES AND ALLIGATORS

- They have a strong tail
- ✓ For swimming
- ✓ For attacking their enemies
- They lay hard shelled eggs in sand
- They have strong pointed teeth
- ✓ For biting their enemies
- ✓ For tearing their prey
- They have strong jaws
- They have scales on their bodies
- ✓ For protecting their bodies from injuries
- They have streamlined bodies
- ✓ To reduce friction in water
- They reproduce by laying eggs
- They feed on prey after it had begun to rot
- They are lethargic/lazy animals

A DIAGRAM SHOWING A CROCODILE



Why do crocodiles sometimes gape/open their mouth widely?

- To cool down body temperature/to cool themselves

How do crocodiles protect themselves against enemies?

- By biting using strong pointed teeth
- By attacking with its strong tail

How is sun's heat useful to female crocodiles?

- Their eggs are hatched by sun's heat

IMPORTANCE OF REPTILES TO MAN

- Some reptiles attract tourists e.g crocodiles
- Some reptiles eat insect pests e.g chameleon
- Some reptiles eat insect vectors e.g gecko
- Some reptiles are sources of food to man
- Their skins are sold for income
- They provide skins to leather industries
- They are used in biological research

NOTE:

- **Oviparous animals** are animals which lay eggs
- **Viviparous animals** are animals which produce living young ones
- **Ovoviviparous animals** are animals that give birth to live young ones from the eggs that hatch inside its body
- **Terrestrial animals** are animals which mainly live on land
- **Aquatic animals** are animals that live in water
- **Amphibious animals** are animals that live in water and on land
- **Nocturnal animals** are animals that are active at night
- **Diurnal animals** are animals that are active during day time
- **Tetrapods** are animals with four limbs or descended from four limbed animals

FISH

- These are cold blooded vertebrates with fins

CHARACTERISTICS OF FISH

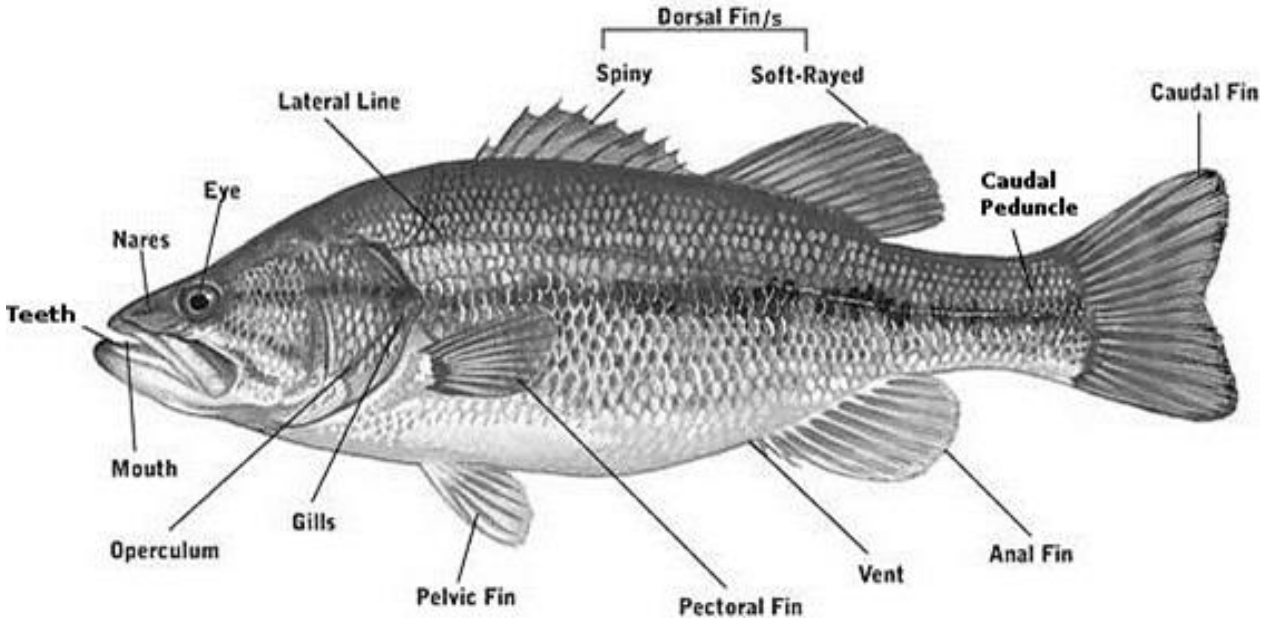
- They have fins
- They have streamlined bodies
- ✓ To reduce water resistance during movement
- ✓ To reduce viscosity friction in water
- They are cold blooded/poikilothermic animals
- They live in water/they are aquatic animals
- They breathe by means of gills

- They undergo external fertilization
- They have no eyelids
- Most fish have scales **except** catfish
- They reproduce by laying eggs
- They have two chambered hearts
- They have no external ears
- They have a backbone
- Their body is divided into head, trunk and tail

EXAMPLES OF FISH

- Tilapia
- Nile perch
- Dogfish
- Trout
- Salmon
- Skates
- Catfish
- Sawfish
- Herring
- Cichlid
- Shark
- Stingray
- Tuna
- Codfish
- Cyprinid fish/minnow fish

EXTERNAL FEATURES OF A FISH



FUNCTIONS OF EACH PARTS OF A FISH

Scales

- To protect the skin from injuries

Nostril (naris)

- For smelling food
- For tasting food

Eyes

- For sight

Operculum (gill cover)

- It protects the gills

Gills

- For breathing

Mouth

- For feeding
- For taking in water with dissolved oxygen for breathing

Lateral line

- For detecting sound vibrations in water/for hearing
- For detecting pressure changes in water
- For feeling

Paired fins (pectoral fin and pelvic/ventral fin)

- For balancing in water
- For swimming upwards and downwards
- For slowing down speed/they act as brakes

DORSAL FIN

- For balancing
- For protection
- ✓ It is spiny

CAUDAL FIN (TAILFIN)

- For increasing speed
- For forward movement
- For turning in water/for changing direction when swimming/it acts as steering

ANAL FIN

- It stabilizes the fish during swimming

ANUS

- To pass out wastes

FINS

- For swimming
- For protection

TYPES OF FINS

- Paired fins
- Medium fins

PAIRED FINS

- These are fins that act as limbs in other vertebrates

Examples of paired fins

- **Pectoral fin**

It acts as forelimbs

- **Pelvic fin/ventral fin**

It acts as hind limbs

MEDIUM FINS

- These are fins that control rolling and unsteady turning of fish in water

Examples of medium fins

- Caudal fin (tailfin)
- Dorsal fin

WAYS THROUGH WHICH FISH PROTECT THEMSELVES

- Some fish use slippery scales to escape from enemies

- Some fish use spiny dorsal fin
- Some fish use electric organs e.g electric eel
- Some fish change colours/camouflage
- Some fish use their teeth to bite enemies
- Some fish inject venom e.g stingray

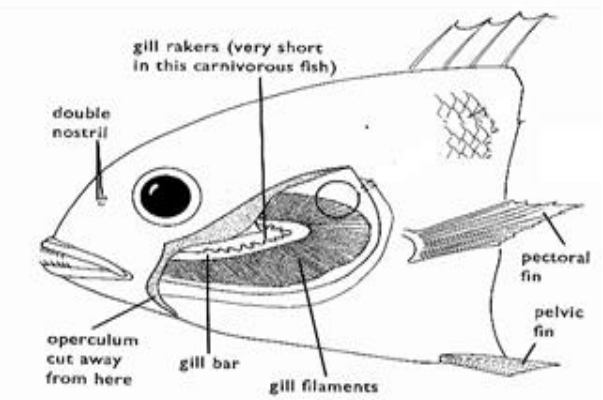
SIMILARITIES BETWEEN A TILAPIA AND A TADPOLE.

- Both use gills for breathing
- Both live in water

BREATHING IN FISH

- Fish breathe by means of gills
- They take in water with dissolved oxygen through the mouth
- Gill filaments absorb dissolved oxygen in water
- Water is passed out through the gill cover

THE STRUCTURE OF FISH GILLS



Gill bar/gill arch

- It holds/supports the gill rakers and gill filaments

Gill rakers

- They trap solid materials from damaging the gills
- They prevent food from escaping through the gills

Gill filaments

- For gaseous exchange

Why are gill filaments numerous/very many in number?

- To increase the surface area for gaseous exchange

Why does a fish die when removed from water?

- It lacks dissolved oxygen

TYPES (GROUPS) OF FISH

- Bony fish
- Cartilaginous fish
- Lungfish

BONY FISH

- They have no eye lids
- Their skeleton is made up of bones

- They have swim bladder **to keep the fish buoyant**
- They have gill cover/operculum to protect the gills
- They have overlapping scales (so that the free ends of the scales point backwards)

EXAMPLES OF BONY FISH

- Nile perch
- Tilapia
- Salmon
- Trout
- Catfish
- Herrings
- Tuna
- Codfish
- Sardine

CARTILAGINOUS FISH

- They have tough and shiny skin
- They have gill slits instead of gill cover
- Their skeleton is made up of cartilage instead of bones
- They have no swim bladder

EXAMPLES OF CARTILAGINOUS FISH

- Shark
- Skates
- Ray/stingray
- Dogfish

LUNGFISH

- They breathe by means of gills and swim bladder modified as lungs
- They live in dirty pools, swamps or rivers
- They have long thin pelvic and pectoral fins
- They are inactive in dry seasons

Why is lungfish called so?

- It has gills and lungs

EXAMPLES OF LUNGFISH

- African lungfish/ mudfish
- South American lungfish
- Australian lungfish

Why does a lungfish take long to die when removed from water?

- It can breathe using its swim bladder/its swim bladder is modified as lungs for breathing

Why does lungfish aestivate/produce mucus that dries into cocoon around its body?

- To survive drought

THE SWIM BLADDER (AIR BLADDER)

- It is a gas filled sac near the backbone of most fish

DIAGRAM SHOWING A SWIM BLADDER

USES OF THE SWIM BLADDER TO A FISH

- It keeps the fish buoyant/it helps the fish to float in water/it controls the depth of fish in water
- It is used by some fish for breathing e.g lungfish
- It acts as sound producing organ
- It aids in hearing

REPRODUCTION IN FISH

- A fish reproduces **by laying eggs**
- Eggs of a fish are called **roe**
- Eggs of a fish (roe) are **fertilized externally**
- A fish undergoes **external fertilization**
- A young fish is called **fry**
- Most fish do not care for their young ones **except** tilapia

FEEDING IN FISH

- Fish feed on planktons (e.g wriggler, small insects and seaweeds)
- **Planktons** are small organisms that float in water
- Some fish feed on other types of fish

CLASSES OF FOOD BASED ON THEIR FEEDING HABITS

- **Carnivores**

They feed on flesh e.g earthworms and wrigglers

- **Herbivores**

They feed on plants.
They are grazed on leafy vegetables e.g spinach

- **Omnivores**

They feed on plants and flesh

- **Limnivores**

They feed on mud

KEEPING FISH

- **Aquaculture** is the rearing of aquatic animals
- **Aquarium** is a transparent glass tank for keeping aquatic organisms
- Fish can be kept in ponds or aquarium
- Fish are kept in fresh water because **it is not salty**
- Aquaculturists in Uganda mainly keep **tilapia**

State one biological method of controlling the spread of malaria

- Keeping fish in ponds to feed on mosquito larvae and eggs

ADAPTATIONS OF A FISH TO ITS LIFE IN WATER

- They have fins for swimming
- They have gills for breathing in water
- They have streamlined bodies to overcome viscosity
- They have a swim bladder to keep them buoyant
- They have a lateral line to detect danger in water
- They have slippery scales for protection and to reduce viscosity

METHODS OF CATCHING (HARVESTING) FISH

- Use of basket
- Use of hooks
- Use of spears
- Draining water from ponds
- Use of fishing nets (e.g trawling and purse seining)

METHODS OF PRESERVING FISH

- Smoking
- Sundrying
- Salting

} Local methods

- Refrigeration
- Canning (tinning)

} Modern methods

How does smoking, sundrying or salting preserve fish?

- By absorbing moisture from fish

How does refrigeration preserve fish?

- It prevents multiplication of germs
- It keeps germs dormant and unable to multiply

USES (IMPORTANCE) OF FISH TO PEOPLE

- They are source of food (they are source of proteins and calcium)
- Their bones are used to make glue
- They are source of income when sold
- Fish in aquarium is used to decorate houses
- Fishing is an employment
- Fish reduce spread of malaria by feeding on mosquito larvae
- Fishing industry gives revenue to the government
- Fish oil is used to make paint
- Cod liver oil from codfish is rich in vitamin A and B

ANIMALS' FREEDOM

- Freedom from fear
- Freedom from pain
- Freedom from hunger
- Freedom from discomfort
- Freedom of reproduction

INVERTEBRATES

- These are animals without a backbone/spine/vertebral column

CHARACTERISTICS OF INVERTEBRATES

- They do not have a backbone
- They are multicellular animals
- They have soft bodies

CLASSES (GROUPS) OF INVERTEBRATES

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

COELENTERATES (CNIDARIANS)

- These are soft bodied invertebrates with only one body opening.

CHARACTERISTICS OF COELENTERATES

- They live in seawater
- They have stinging cells/cnidocytes
- ✓ For protection
- ✓ For paralyzing their prey
- They have only one body opening
- ✓ It acts as mouth and anus
- They have tentacles
- ✓ For holding food
- ✓ For holding stinging cells
- They reproduce by budding
- They hydrostatic skeleton
- They have cylindrical bodies with two layers (e.g endoderm and ectoderm)

EXAMPLES OF COELENTERATES

- Jellyfish
- Hydra: it moves by floating, gliding or somersaulting
- Corals
- Sea anemone
- Sea pen
- Sea fan
- Sea whip

A DIAGRAM SHOWING A JELLYFISH

ECHINODERMS

- These are spiny skinned invertebrates with tube feet
- They are exclusively marine animals

CHARACTERISTICS OF ECHINODERMS

- They have no heads
- They have spiny skins
- They have water vascular system

- They have a true coelom
- Most echinoderms have five arms

✓ For holding food

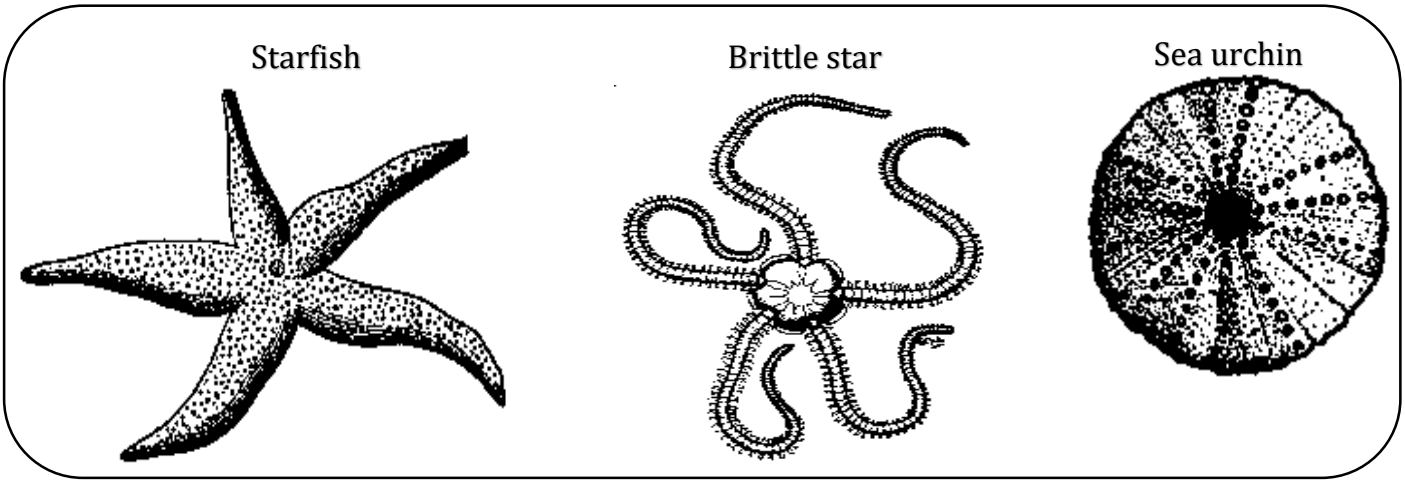
- They have tube feet

✓ For movement/locomotion

EXAMPLES OF ECHINODERMS

- Starfish/sea star
- Sea urchin
- Sand dollar
- Sea lily
- Sea cucumber
- Brittle star

DIAGRAMS SHOWING ECHINODERMS



WORMS

- These are long thin soft bodied invertebrates

CHARACTERISTICS OF WORMS

- They breathe through their moist skins
- They reproduceby laying eggs
- They have hydrostatic skeleton

✓ Some worms live in soil or water while others live inside other animals as parasites

- **Parasite** is an organism which depends on another organism for survival without killing it
- **Host** is an organism on or in which a parasite lives

GROUPS (CLASSES) OF WORMS

- Segmented worms (annelids)
- Round worms (nematodes)
- Flatworms (platyhelminthes)

SEGMENTED WORMS (ANNELIDS)

- These are worms with segmented bodies
- They are also called **ringed worms**
- They mostly live in soil and water

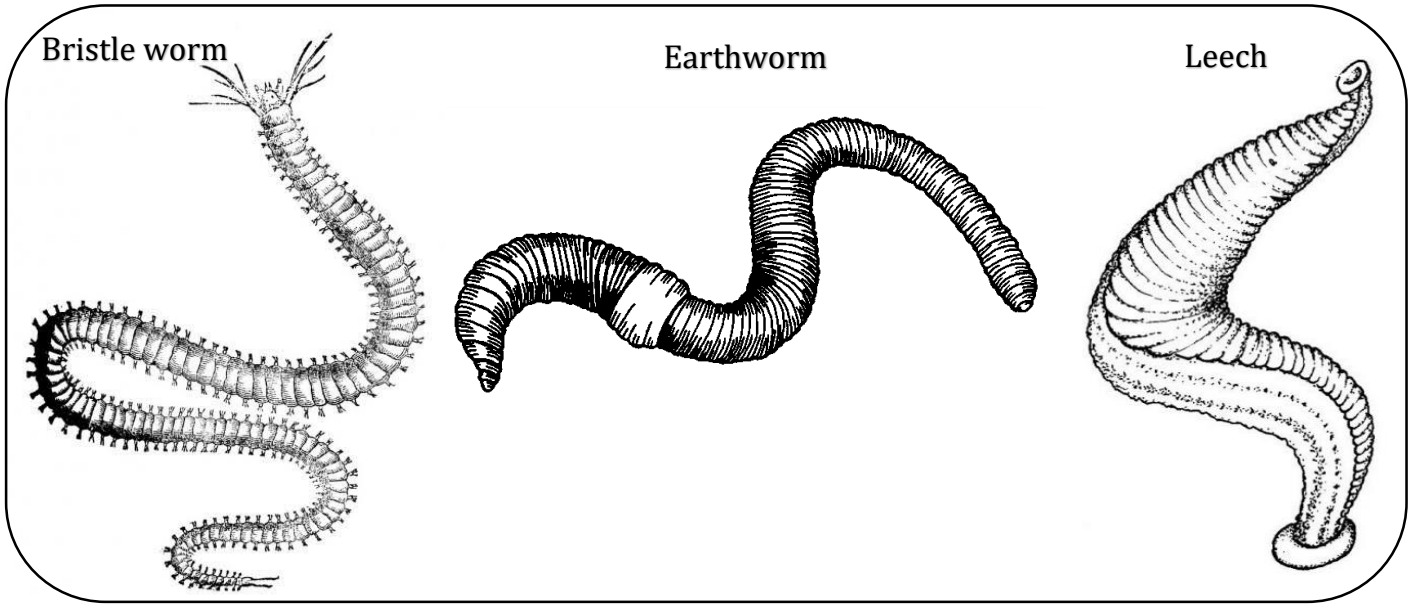
CHARACTERISTICS OF SEGMENTED WORMS (ANNELIDS)

- They are segmented
- They are hermaphrodites

EXAMPLES OF SEGMENTED WORMS

- Leech
- Lugworm (it is used as bait in fishing)
- Bristle worm
- Earth worm
- Sandworm: it lives in sand or mud

DIAGRAMS OF SEGMENTED WORMS



EARTHWORM

- It lives in soil
- It reproduces by laying eggs
- It has sexual reproduction
- It breathes through **its moist skin**
- It feeds on soil or decayed vegetation
- It is hermaphrodite
- Earthworms undergo regeneration
- The skin is kept moist by the **secretions from tiny glands**

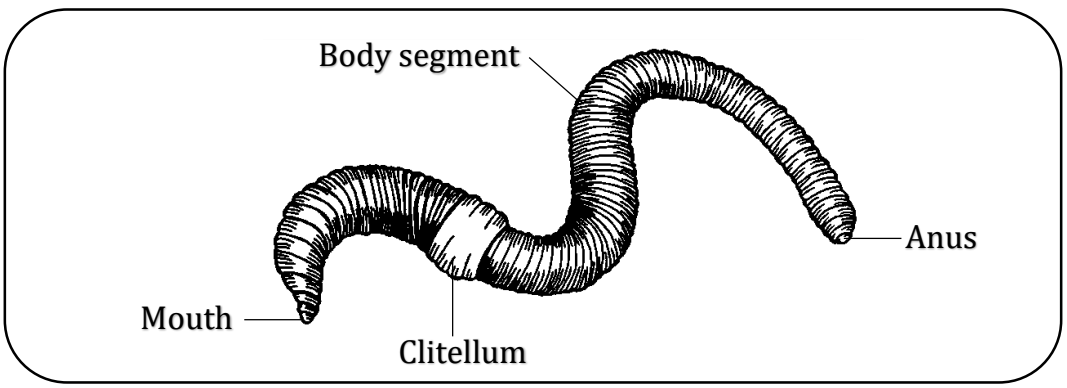
IMPORTANCE OF EARTHWORMS IN THE ENVIRONMENT

- They aerate the soil
- They improve soil drainage
- They break down organic matter
- They are used as fishing baits

How do earthworms improve soil aeration and drainage?

- By making holes in the soil (digging channels)

A DIAGRAM SHOWING AN EARTHWORM



Why are earthworms called hermaphrodites?

- They have both male and female sex organs

REGENERATION IN WORMS

- This is the ability of segmented worms to repair their injured parts

How are chaetae important to an earthworm?

- For gripping the ground during movement

Of what importance is clitellum to an earthworm?

- It produces the fluid in which eggs are deposited.

Why do earthworms come out of the ground when it rains?

- To get oxygen

Why do earthworms die when oil is poured onto it?

- Oil cuts off oxygen supply to their moist skin
- Oil closes their breathing holes

FLATWORMS (PLATY HELMINTHES)

- These are worms with thin flattened bodies

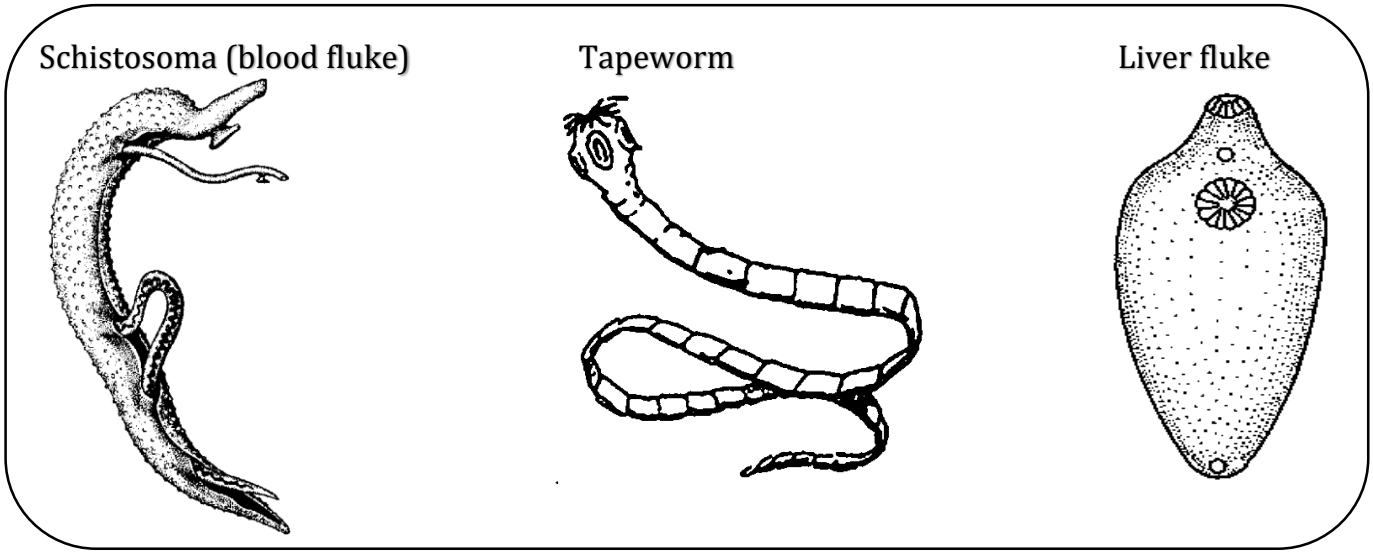
CHARACTERISTICS OF FLAT WORMS

- They have a flat body
- They are hermaphrodites
- Many of them are parasites

EXAMPLES OF FLAT WORMS

- Tapeworm
- Liver fluke
- Schistosoma (blood fluke): **causes bilharziasis or schistosomiasis**
- Pond flatworm

DIAGRAMS SHOWING FLAT WORMS



TAPEWORM

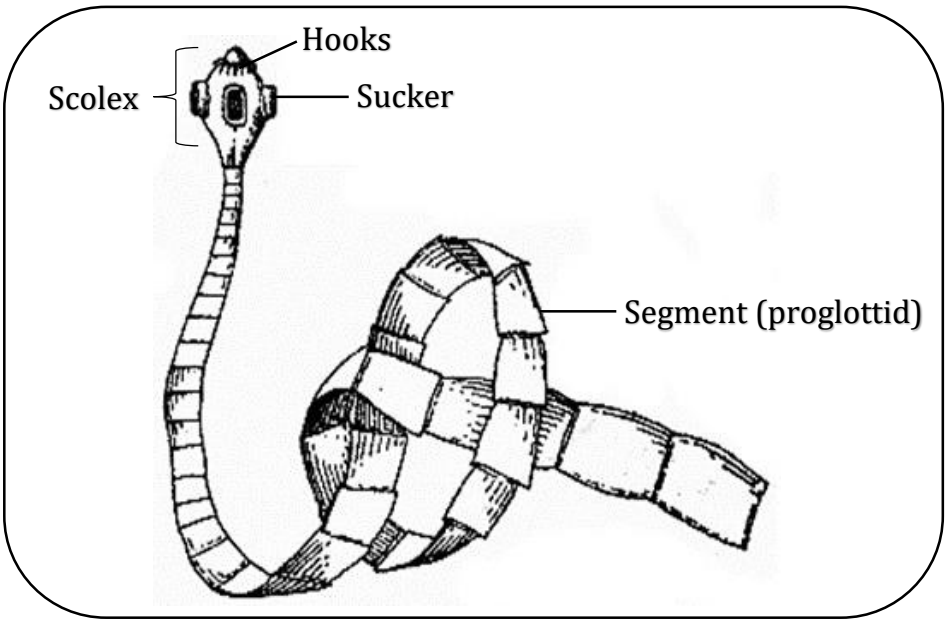
- A tapeworm is a hermaphrodite (has both male and female reproductive organs)

- It reproduces by laying eggs into the host
- It is an endoparasite in animals
- It is an intestinal worm which stays in the small intestines
- It feeds on digested food in the small intestines

How do tape worms enter (penetrate) into the body?

- Through eating infested half cooked meat or fish

DIAGRAM SHOWING TAPEWORM



FUCTION OF EACH PART OF A TAPEWORM

Hooks and suckers

- For attachment to the host

Segments (proglottids)

- To store eggs

Scolex

- ✓ This is the head of tapeworm
- It holds the hooks and suckers

How do tapeworms feed?

- They feed parasitically

Why does a tapeworm lack the digestive system?

- It feeds on already digested food

Tapeworms do not have a digestive tract. How do they absorb digested food from the host?

- Through their tegument (porous outer surface of their body)

Why can't tapeworms be digested by the host's digestive juices?

- They produce a substance that neutralizes the digestive juice

Why can't tapeworms be moved during peristalsis?

- They have hooks and suckers for firm attachment.

SIGNS OF TAPEWORM INFESTATION

- Diarrhoea
- Indigestion

EFFECTS OF TAPEWORM INFESTATION

- It leads to malnutrition
- It leads to hydatid disease (echinococcosis)

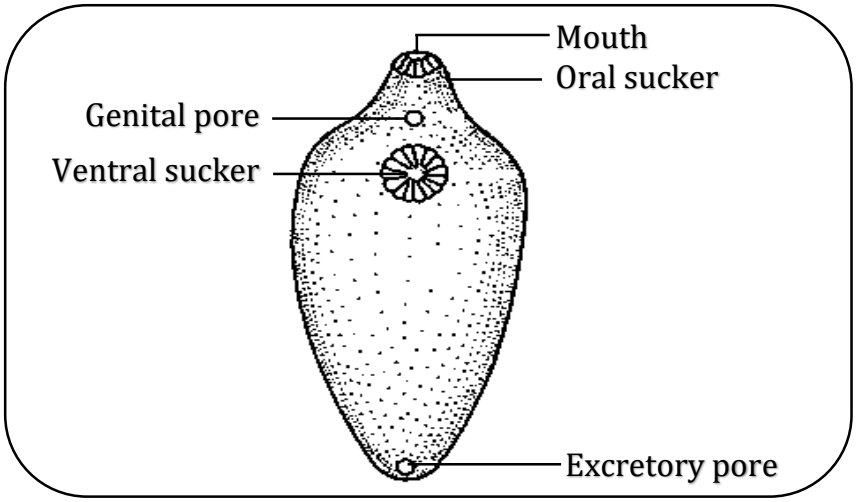
CONTROL OF TAPEWORM INFESTATION

- Feeding on well cooked meat
- Deworming

LIVER FLUKE

- It is found in the liver of infested animals
- It causes **liver rot** in sheep

A DIAGRAM SHOWING LIVER FLUKE



ROUNDWORMS (NEMATODES)

- These are unsegmented worms with a streamlined rounded body

CHARACTERISTICS OF ROUNDWORMS

- Their body is pointed at both ends
- They have no segments
- They have a cylindrical body (rounded body)

SIGNS OF ROUNDWORM INFESTATION

- Loss of appetite
- Dullness

SYMPTOMS OF ROUNDWORM INFESTATIONS

- General body weakness

EXAMPLES OF ROUNDWORMS

- Hookworm
- Eelworm (it affects plants)
- Threadworms (pinworm)
- Ascaris
- Filaria worm: **causes elephantiasis or filariasis**
- Onchocerca volvulus: **causes onchocerciasis or river blindness**

HOOKWORM

- It lives small intestines
- It feeds on blood

A DIAGRAM SHOWING A HOOKWORM

How do hookworms enter our bodies?

- By penetrating through the bare skin

Effects of hookworm infestation

- They lead to hookworm anaemia

PREVENTION OF HOOKWORM INFESTATION

- Always wear shoes when walking in dirty places
- Deworming

ASCARIS

- It is pink or white in colour
- It spreads through eating dirty fruits and vegetables which are eaten raw
- It spreads through drinking contaminated water
- It affects people and apes

CONTROL OF ASCARIS

- Always drink clean boiled water
- Wash fruits and vegetables before they are eaten

MOLLUSCS

- These are soft bodied invertebrates with a mantle
- They live in water and on land

CHARACTERISTICS OF MOLLUSCS

- They have soft bodies
- They have no segments
- They have a mantle
- ✓ To produce the shell
- Most of them have a shell
- ✓ For protection
- Mollusks reproduce by laying eggs.
- They have tentacles
- ✓ For sensing e.g smelling and hearing

EXAMPLES OF MOLLUSCS

- Snail
- Slug
- Squid
- Octopus
- Scallop
- Mussel
- Clam
- Oyster
- Mussel
- Chiton
- Nautilus

- Conch
- Cuttlefish: it ejects dark ink for protection
- Cowrie

Why are octopi, squids and cuttlefish regarded as the most intelligent mollusks?
- They have well developed heads and tentacles

How do octopus and squids move?
- By jet propulsion

UNIVALVES AND BIVALVES

UNIVALVES:
- These are molluscs with a shell having one piece

Examples of univalves
- Snail
- Conch

BIVALVES:
- These are molluscs with a shell having two hinged pieces

Examples of bivalves
- Scallop
- Clam
- Mussel
- Oyster

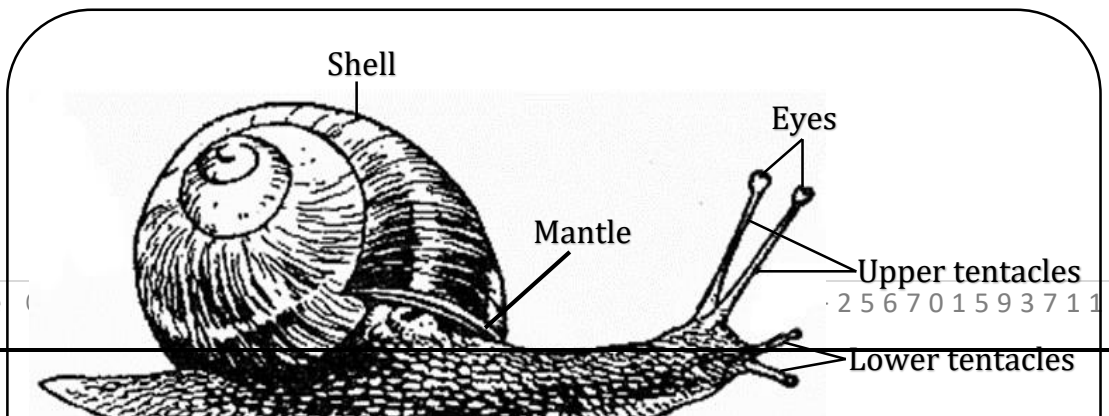
SNAIL
- It has a soft body with a shell
- It feeds on vegetation
- It has hydrostatic skeleton
- It protects itself **by hiding in its shell**
- Its body is made up of spiral coils
- Older snails have more spiral coils than the young ones
- It breathes through **the breathing pore near the entrance of the shell**
- It reproduces by laying eggs
- It is hermaphrodite (it has both male and female reproductive organs)
- Snails live on land and in water

GROUPS OF SNAILS
- Water snails
- Garden snails

✓ Water snails breathe through the **gills**

✓ Garden snails breathe through the **lungs**

A DIAGRAM SHOWING A SNAIL



IMPORTANCE OF EACH PART OF A SNAIL

Mantle

- It produces (secretes) the shell
- It repairs the shell

Shell

- For protection (it protects the body of a snail from predators)
- It prevents the body of a nail from drying out

Eyes

- For sight

Tentacles

- A snail has two pairs of tentacles

Upper tentacles (eye stalks)

- For holding the eyes

Lower tentacles

- They act as smelling organs
- They are sense organs for touch
- For detecting sound (hearing)
- For detecting change in temperature

Muscular foot (foot)

- For movement

Why does the snail produce slime (mucus)?

- To reduce friction during movement
- To keep its body moist
- It helps a snail to stick (adhere) to smooth surfaces

NOTE:

- Snails have external shells **while** slugs have lack external shells

IMPORTANCE OF MOLLUSCS

- Some molluscs are eaten as food (some snails and octopus are rich in proteins)
- Their shells are used to make poultry feeds
- Garden snails break down organic wastes to form soil

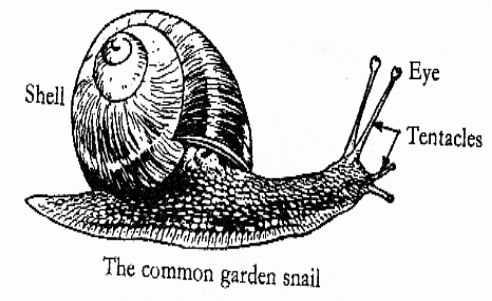
DANGERS OF MOLLUSCS

- Garden snails are crop pests
- Fresh water snails spread bilharziasis

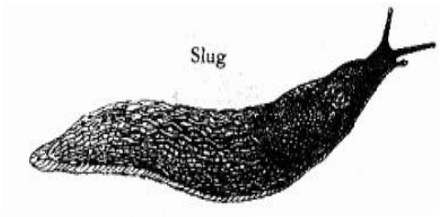
How are molluscs different from other invertebrates?

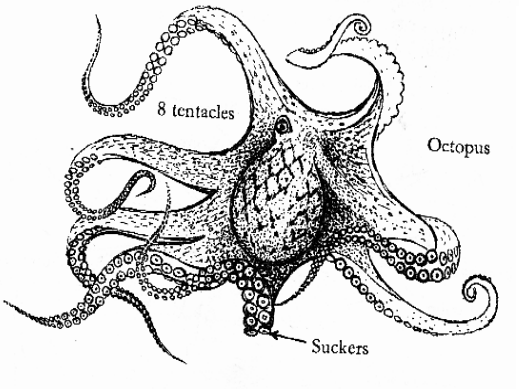
- They have soft bodies with a shell or mantle unlike other invertebrates

DIAGRAMS SHOWING SNAIL, SLUG AND OCTOPUS



The common garden snail





SPONGES

- These are marine invertebrates which live permanently attached to rocks at the sea floor
- They are sometimes called **poriferans**
- Porifera means pore bearing
- They have porous internal skeleton of silica
- They cannot move about
- They feed on tiny pieces of food in sea water
- They breathe and feed **through their porous bodies (ostia / body pores)**
- Sponges can reproduce sexually or asexually by **fragmentation or by producing gemmules**
- Sponges can regenerate parts of its body or even the entire body from fragments

Why are sponges regarded as primitive (simplest) animals?

- They do not move (are sedentary or sessile)
- They lack nerves, muscles and internal organs
- They lack head, mouth, digestive, circulatory or nervous system.

EXAMPLES OF SPONGES

- Bath sponge
- Glass sponge
- Silk cup sponge
- Calcareous sponge

IMPORTANCE OF SPONGES TO PEOPLE

- They are used as bath aids
- For wall painting
- For dish and car washing
- For art and craft
- They are used as cleaning tools
- They are used as drinking vessels

Why are sponges different from other invertebrates?

- They do not move while other invertebrates move

ARTHROPODS

- These are invertebrates with jointed legs, segmented bodies and exoskeleton

CHARACTERISTICS OF ARTHROPODS

- They have jointed legs
- They have segmented bodies
- They have exoskeleton

IMPORTANCE OF EXOSKELETON TO ARTHROPODS

- It protects the body
- It gives the body shape
- It protects the body from drying out

Disadvantages of an exoskeleton

- It prevents growth
- It increases body weight

MOULTING (ECDYSIS) IN ARTHROPODS

- This is the shedding of exoskeleton in arthropods

Why do arthropods moult (undergo moulting or ecdysis)?

- To increase in size (to grow)

DISADVANTAGE OF MOULTING IN SOME ANIMALS

- The animal may dry out
- The animal may be eaten by predators

EXAMPLES OF ARTHROPODS

- Millipede
- Centipede
- Crab
- Lobster
- Mite
- Tick
- Spider
- Harvestman
- Housefly
- Moth
- Butterfly
- Mosquito

GROUPS (CLASSES) OF ARTHROPODS

- Insects
- Arachnids
- Crustaceans
- Myriapods

MYRIAPODS

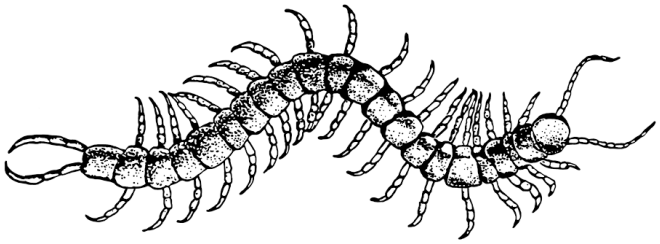
- These are arthropods with many legs and many segments
- They have 20 or more legs
- They can regrow new legs if they lose some legs

GROUPS OF MYRIAPODS

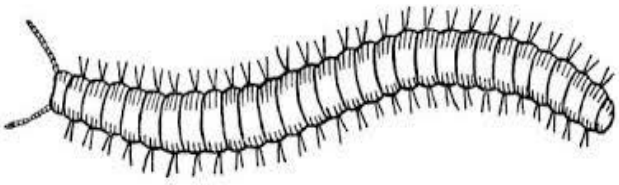
- Centipedes (chilopoda)
- Millipedes (diplopoda)

DIAGRAMS SHOWING MYRIAPODS

CENTIPEDE



MILLIPEDE



CENTIPEDES (CHILOPODA)

- They have one pair of legs on each segment
- Their first pair of legs is modified into poison fangs
- They are nocturnal animals (mostly active at night)
- They can move quickly
- They breathe **through spiracles**
- They are carnivores
- They feed on insects, worms and spiders

How do centipedes protect themselves?

- By biting using poison claws

How are poison claws useful to a centipede?

- For biting enemies
- For killing the prey

MILLIPEDES (DIPLOPODA)

- They have two pairs of legs on each segment
- They are herbivores
- They feed on decaying leaves
- They breathe through spiracles
- They are mostly active at night
- They are move slowly

How do millipedes protect themselves?

- By curling (coiling)
- By producing bad smell

DIFFERENCES BETWEEN MILLIPEDES AND CENTIPEDES

- Millipedes have two pairs of legs in each segment while centipedes have one pair of legs on each segment
- Millipedes are herbivores while centipedes are carnivores
- Millipedes have many segments than centipedes
- Millipede protect themselves by curling while centipedes protect themselves by biting using poison claws

ADVANTAGES OF MYRIAPODS

- Millipedes help in soil aeration
- Millipedes recycle nutrients in the soil
- Centipedes eat insect vectors like flies and cockroaches

DANGERS OF MYRIAPODS

- Millipedes are crop pests (destroy root tubers)
- Centipedes bite people

- Millipedes produce bad smell that causes allergic reactions to some people

CRUSTACEANS

- These are arthropods with a hard crusty skin

CHARACTERISTICS OF CRUSTACEANS

- They have two main parts

i) Abdomen
ii) Cephalothorax (fused head and thorax)

- They breathe through gills
- They live in water or wet places
- They have 10 to 14 legs
- They have 2 pairs of antennae

Examples crustaceans

- Crab
- Prawn
- Lobster
- Shrimp
- Woodlice
- Barnacle
- Crayfish
- Water flea
- Sand flea (sandhopper)
- Krill

✓ Some crustaceans feed on worms and insects while others feed on vegetation

IMPORTANCE OF CRUSTACEANS

- They are eaten as food by people
- Some of them are used as baits in fishing
- They are source of income when sold in hotels

DIAGRAMS SHOWING LOBSTER, CRAB AND PRAWN

Uses of appendages to crustaceans

- For feeding
- For walking
- They act as sense organs

USES OF SWIMMERETS TO CRUSTACEANS

- For swimming
- For catching food

- Some crustaceans use them for brooding the eggs

ARACHNIDS

- These are arthropods with 2 main body parts and 8 legs

CHARACTERISTICS OF ARACHNIDS

- They have eight legs (four pairs of legs)
- They breathe through book lungs (lung books)
- They have 2 main body parts;

i) Cephalothorax (prosoma)
ii) Abdomen (opithosoma)

- They have no antennae

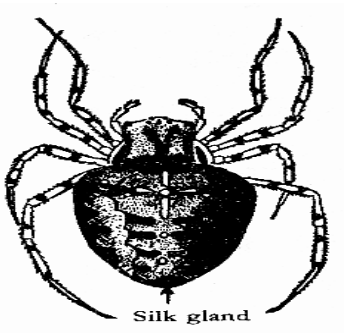
EXAMPLES OF ARACHNIDS

- Spider
- Tick
- Scorpion
- Mite
- Harvestman (daddy longlegs)

SPIDER

- They breathe through book lungs (lung books)
- They have two poison fangs near the mouth **to kill (paralyze) the prey**
- They reproduce by laying eggs
- They have **spinnerets** on the abdomen

A DIAGRAM SHOWING A SPIDER



How do spiders protect themselves?

- By injecting venom into their enemies

Importance of spinneret to spider

- To produce silk
- To spin spiderweb

Reasons why spiders produce silk

- To make spiderwebs
- To trap prey

Why do spiders make spiderwebs? (Importance of spiderwebs to spider)

- To trap prey
- For movement

- For protection
- To encase egg sacs

STRUCTURE OF SPIDERWEB

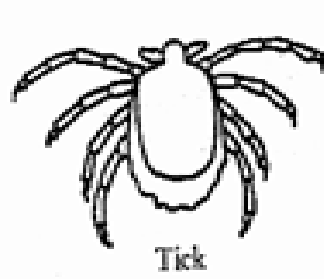
IMPORTANCE OF SPIDERS TO PEOPLE

- They eat on insect vectors e.g mosquitoes and houseflies

TICK AND MITE

- They live as ectoparasites on animals
- They are parasites and vectors
- They obtain food **by sucking blood from the host**

A DIAGRAM SHOWING A TICK



How are ticks and mites harmful to cattle keepers?

- Ticks and mites are ectoparasites on cattle

EXAMPLES OF TICKBORNE DISEASES
IN FARM ANIMALS (LIVESTOCK)

- Heart water
- East coast fever
- Anaplasmosis
- Red water

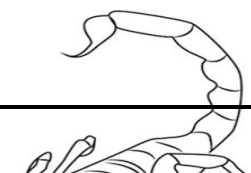
IN PEOPLE

- Lyme disease
- Relapsing fever
- Typhus fever

SCORPIONS

- They have a large tail with a poison sting
- Their front legs are modified into pincers
- They produce (give birth) to live young

A DIAGRAM SHOWING A SCORPION



How do scorpions protect themselves?

- By using its poison stinger on the tail
- By biting using its pincers

INSECTS

- These are arthropods with 3 main body parts and 6 legs.

CHARACTERISTICS OF INSECTS

- They have 3 main body parts (head, thorax and abdomen)
- They have 6 legs
- They breathe through spiracles

NOTE

- They reproduce by laying eggs
- They have an exoskeleton
- They undergo internal fertilization

EXAMPLES OF INSECTS

- Tsetse fly
- Housefly
- Mosquito
- Grasshopper
- Butterfly
- Cockroach
- Ants (safari ants, white ants, black ants and red ants)
- Sandfly
- Beetle
- Locust
- Midge
- Blowfly
- Cricket

EXAMPLES OF WINGLESS INSECTS (INSECTS WITHOUT WINGS)

- Red ants
- Safari ants
- Termites
- Silverfish
- Lice
- Fleas
- Firebrats

EXAMPLES OF INSECTS WITH A STINGER

- Worker bees
- Wasp

EXAMPLES OF EDIBLE INSECTS (INSECTS WHICH ARE EATEN BY PEOPLE)

- Grasshoppers
- White ants
- Crickets
- Termites

EXAMPLES OF DANGEROUS INSECTS TO PEOPLE

- Mosquito
- Flea
- Housefly

- Blackfly
- Bedbug
- Tsetse fly
- Locust
- Bumblebee
- Cockroach

GROUPS OF INSECTS
- Social insects
- Solitary insects

SOCIAL INSECTS
- These are insects which live and work together
- They live in a colony

EXAMPLES OF SOCIAL INSECTS
- Termites
- Ants
- Wasps
- Some bees (Honeybees and bumblebees)

SOLITARY INSECTS
- These are insects that live and work alone

EXAMPLES OF SOLITARY INSECTS
- Mosquitoes
- Houseflies
- Butterflies
- Carpenter bees
- Mining bees
- Dragon flies
- Leafcutter bees

THE THREE MAIN BODY PARTS OF AN INSECT
- Head
- Thorax
- Abdomen

THE HEAD
- It has the eyes, antennae and mouth parts.

Compound eyes
- For sight

Antennae (feelers)
- ✓ These are sense organs for;
- Feeling
- Smelling
- Hearing
- Tasting
- Detecting change in temperature and humidity
- Finding direction

MOUTH PARTS

Proboscis
- For sucking food (plant fluids and blood)

Insects with proboscis include; bees, moths, mosquitoes, butterflies and tsetse flies

Mandibles
- For cutting and grinding food

Insects with mandibles include; grasshoppers, locusts and cockroaches

THE THORAX

- It has the legs and wings
- It has three segments (pro, meso and metathorax)
- Each segment has two legs

Legs (appendages)

- For locomotion (movement)
- For capturing the prey
- For grasping the females during mating
- ✓ Their feet have **sticky pads** to walk on smooth surfaces
- ✓ Their feet have **tarsal claws** to grip and walk on rough surfaces

Wings

- For flight

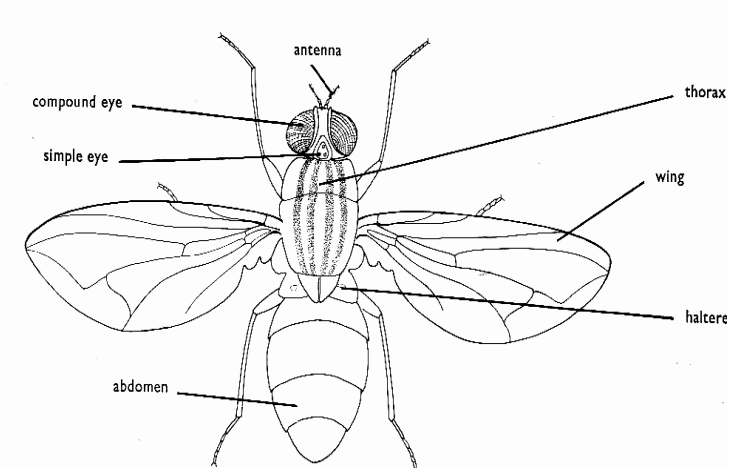
DIPTERANS (DIPTEROUS INSECTS)

- ❖ These are insects with two wings
- They have **halteres**
- ✓ For balancing during flight
- They have **proboscis**
- ✓ For sucking food
- Their larvae are called **maggots**

EXAMPLES OF TWO WINGED INSECTS (DIPTERANS)

- Housefly
- Mosquito
- Black fly
- Sandfly
- Cranefly
- Tsetse fly

A DIAGRAM SHOWING PARTS OF A HOUSEFLY (DIPTERAN INSECT)



ABDOMEN

- This is the largest main body part of an insect
- It has spiracles
- ✓ For breathing
- Female insects have a reproductive organ called **ovipositor**
- ✓ For laying eggs
- Some insects have **a stinger**
- ✓ For protection (for stinging their enemies)

LIFE CYCLE (METAMORPHOSIS)

- This is transformation of an organism during the stages of development

TYPES OF LIFE CYCLE (METAMORPHOSIS)

- Complete metamorphosis (complete life cycle)
- Incomplete metamorphosis (incomplete lifecycle)

COMPLETE LIFE CYCLE

- This is a life cycle which has four stages of development

Eggs – Larva – Pupa – Adult

EXAMPLES OF INSECTS WHICH UNDERGO COMPLETE METAMORPHOSIS

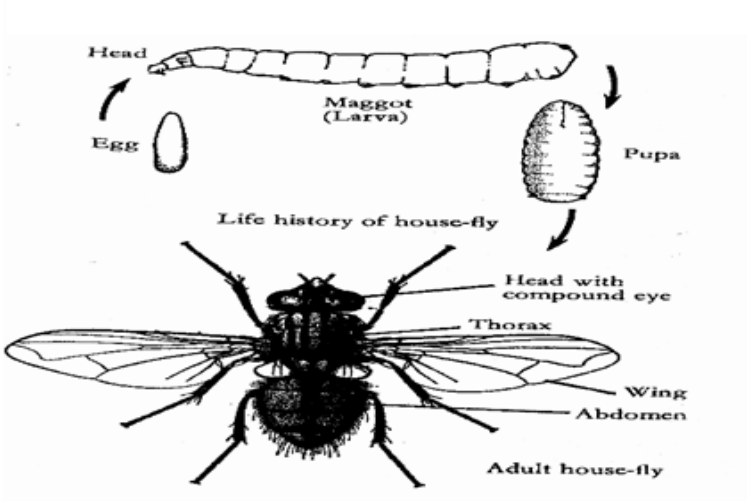
- Houseflies
- Mosquitoes
- Butterflies
- Bees
- Moth
- Wasps
- Tsetse flies
- Fleas

HOUSEFLY

Female houseflies lay their eggs on decaying matter like;

- manure heaps
- faeces
- rubbish pits

A DIAGRAM SHOWING THE LIFE CYCLE OF A HOUSEFLY



- Houseflies undergo complete life cycle
- They lay eggs which hatch into larvae
- The larvae are called **maggots**
- Maggots feed on **decaying matter**
- The larvae (maggots) turn into **pupae**
- The pupa is a **dormant stage**
- ✓ It neither feeds nor moves
- The pupa grows inside a protective case called **cocoon**
- ✓ The cocoon protects the pupa
- The pupae develop into adults
- An adult housefly is called **imago**
- Adult houseflies have two wings (they are dipterans)

Why do houseflies lay their eggs in decaying matter?

- For the larvae (maggots) to get food

How are maggots useful in pit latrines and sewage tanks?

- They reduce the volume of faeces

How do maggots reduce the volume of faeces?

- By feeding on faeces

DANGERS (ECONOMIC IMPORTANCE) OF HOUSEFLIES

- They are insect vectors (they carry germs which cause diseases)
- They help in disposal of rotting matter by feeding on it.

How is a housefly able to carry germs?

- It has a hairy body

How do houseflies spread germs?

- By vomiting juices on food
- By defecating on food
- By contaminating food
- Through the 4Fs germ path

State the importance of glandular pads in the feet of a housefly.

- They help a housefly to walk on smooth surfaces and upside down.

DISEASES TRANSMITTED BY A HOUSEFLY

- Diarrhoea
- Cholera
- Typhoid
- Trachoma
- Dysentery

CONTROL OF HOUSEFLIES

- Spraying with insecticides
- Disposing faeces in latrines
- Disposing rubbish in rubbish pits
- Smoking ordinary pit latrines
- Covering dustbins
- Burying kitchen refuse

MOSQUITOES

- They lay their eggs in stagnant water
- Their larva stage is called **wriggler**
- The larva (wriggler) breathes through **siphon**
- Its pupa stage is called **tumbler**
- The pupa breathes through **trumpet**
- An adult stage is called **imago**

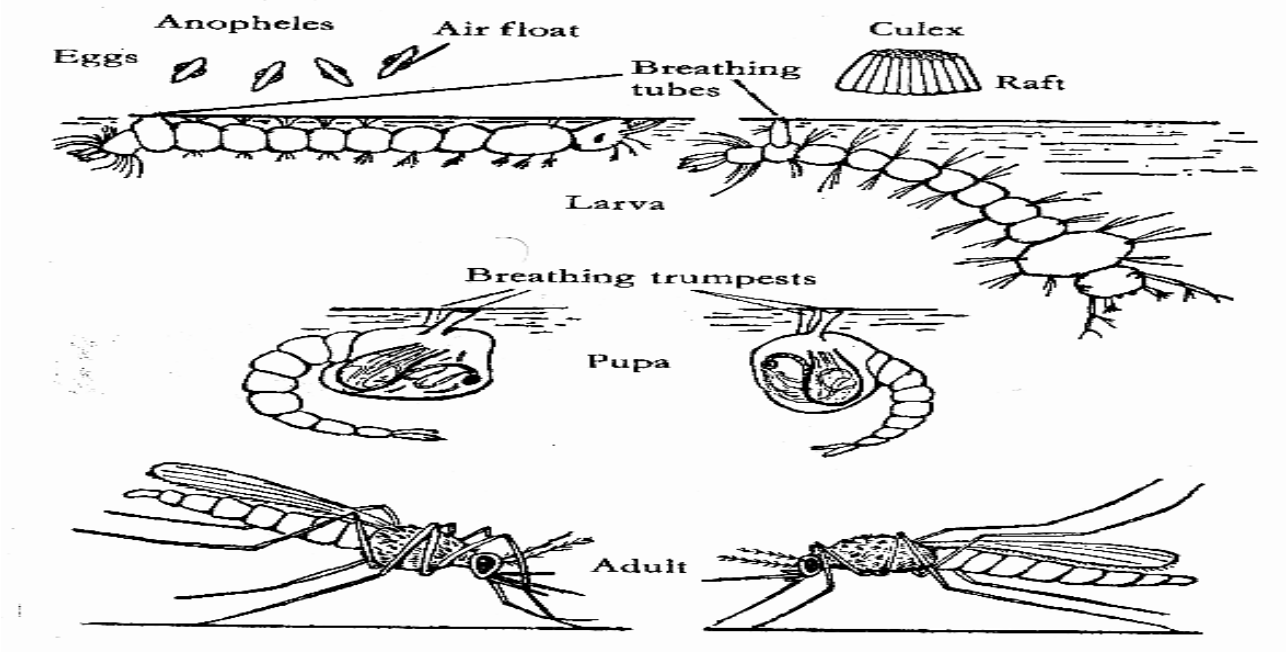
How does the wriggler (larva stage of a mosquito) move?

- By wriggling

TYPES OF MOSQUITOES

- Anopheles mosquito
- Culex mosquito
- Aedes (tiger) mosquito

DIAGRAMS SHOWING LIFE CYCLES OF ANOPHELES AND CULEX MOSQUITOES



DIFFERENCES BETWEEN ANOPHELES AND CULEX MOSQUITOES

Anopheles mosquito	**Culex mosquito**
Lays eggs with an air floats; to enable them float on water	Lays eggs in rafts
Larva lies parallel to the water surface	Larva lies at an angle to the water surface
Adult stands at an angle when at rest	Adult stands flat horizontally when at rest.

Why can't female anopheles mosquito spread HIV/AIDS yet it feeds on blood?

- HIV is destroyed by the enzymes in the digestive tract of a mosquito
- HIV is destroyed in the body of a mosquito

LIFE HISTORY OF MOSQUITOES

- Mosquitoes feed on nectar and plant juices
- Male mosquitoes do not suck blood
- Female mosquitoes suck blood **to develop their eggs**
- Female anopheles mosquitoes spread malaria
- Malaria is caused by a protozoan germ called **plasmodium**
- Culex mosquitoes spread **elephantiasis (filariasis)**
- Elephantiasis is caused by **filaria worm**
- Aedes (tiger) mosquito spreads **yellow fever, dengue fever, zika fever and chikungunya fever**
- Yellow fever, dengue fever and chikungunya fever are caused by **a virus** and can be prevented by **immunization**

WAYS OF CONTROLLING MOSQUITOES

Control of mosquitoes without using chemicals

- Drain stagnant water around homes
- Clear all bushes around homes
- Keep fish in ponds to eat mosquito larvae (wrigglers)
- Use of electric mosquito traps
- Close doors and windows early in the evening
- Use mosquito repellant plants in the compound like basil and lemon balm
- Burn broken plastic tins and bottles where mosquitoes can breed

BIOLOGICAL CONTROL OF MOSQUITOES

- Keep fish in ponds to feed on mosquito larvae
- Put mosquito repellant plants in the compound

CHEMICAL CONTROL OF MOSQUITOES

- Pour oil on stagnant water
- ✓ Oil cuts off oxygen supply to mosquito larvae
- Spray adult mosquitoes with insecticides
- Sleep under treated mosquito nets
- Apply mosquito repellant vaseline on your body
- Use of mosquito coils

BUTTERFLIES AND MOTH

- Butterflies and moths **protect themselves by camouflaging**
- They undergo complete metamorphosis

Eggs – Larva (caterpillar) – Pupa (chrysalis) – Adult (imago)

- Female lays eggs on the surface of leaves
- Eggs hatch into larva called caterpillar
- Caterpillar feeds on leaves
- Larva is protected by cocoon from which it develops into pupa
- Pupa (chrysalis) neither feeds nor moves (it is dormant)
- Adult breaks the cocoon and comes out when it is fully grown
- Moths are **nocturnal insects** (then are mostly active at night)
- They pollinate scented flowers at night. Other nocturnal insect pollinators are **beetles (ladybirds)**

Why butterflies and moths lay their eggs on leaves

- To enable their larvae get food

How are moths and beetles able to pollinate flowers at night?

- They have a good sense of smell

How a moth and butterfly protect themselves against enemies?

- They camouflage to confuse the predators
- Some moth have large two dots on its wings which look like eyes

How do caterpillars protect themselves?

- They use their prickly hair

ADVANTAGES OF BUTTERFLIES AND MOTHS

- They pollinate flowers of crops
- They eat weedy plants
- Some caterpillars are eaten as food
- They are used in advertisements to show health environment

DISADVANTAGES OF BUTTERFLIES AND MOTHS

- Their larvae destroy crops (caterpillar is a crop pest)
- Caterpillars have prickly (bristle) hairs which cause itching on the skin

DIFFERENCES BETWEEN BUTTERFLY AND MOTH

BUTTERFLY	**MOTH**
Active during day time (it is diurnal)	Active at night (it is nocturnal)
Has smooth body	Has hairy body
Has bright colours	Has dull colours
Has clubbed (long thin) antennae	Has short feathery antennae
Has slender body	Has stout body
Has rectangular wings	Has triangular wings
Rests with their wings closed	Rests with their wings open

TSETSE FLIES

- They suck blood from animals and people for food
- They have a complete life cycle
- Their eggs hatch inside their body

Where do female tsetse flies lay their eggs?

- Female tsetse flies do not lay eggs but produce larvae

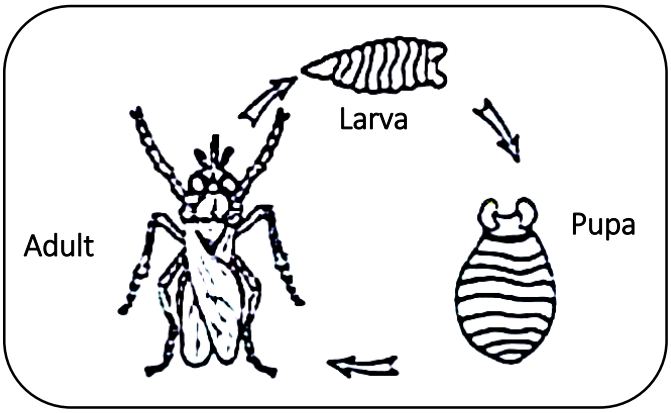
Why tsetse flies are called ovoviviparous insects

- Their eggs hatch inside their body and produce larvae

Why do tsetse flies produce larvae instead of laying eggs?

- Its environment does not favour laying eggs

A DIAGRAM SHOWING THE LIFECYCLE OF A TSETSE FLY



Where do tsetse flies breed from?

- In swamps
- In forests (bushes)

DISEASES THAT SPREAD THROUGH TSETSE FLY BITES

- **Nagana :** in farm animals
- **Sleeping sickness:** in people

INCOMPLETE METAMORPHOSIS

- This is a life cycle with three stages of development

Eggs – Nymph – Adult (imago)

Nymph is the second stage of the incomplete life cycle

Imago is an adult stage in the life cycle of an insect

After moulting, the nymph develops wings and becomes a fully adult.

DIFFERENCES BETWEEN NYMPH AND ADULT

- Nymph has no wings (it is wingless) but adult has wings
- Nymph is always smaller than adult

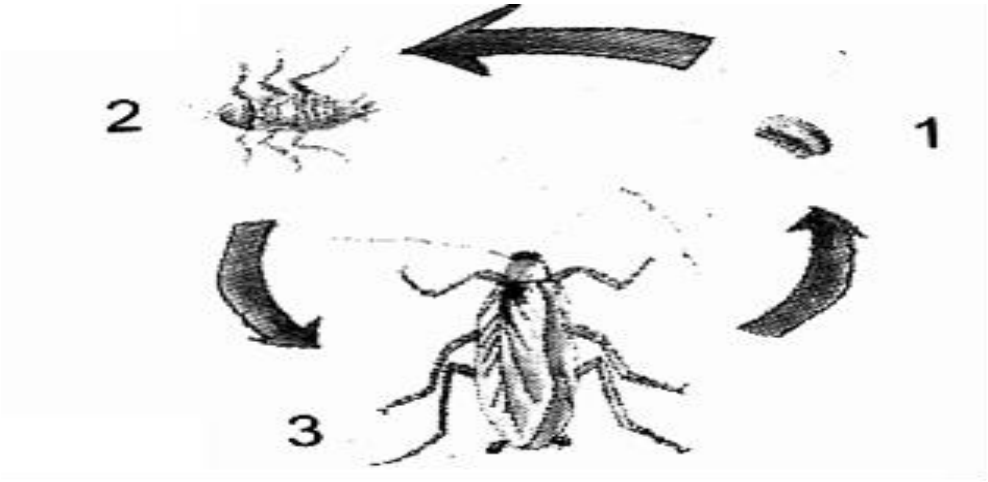
EXAMPLES OF INSECTS WHICH UNDERGO INCOMPLETE METAMORPHOSIS

- Cockroach
- Grasshopper
- Dragonfly
- Bedbug
- White ant
- Cricket
- Locust
- Termite
- Aphid
- Praying mantis
- Walking sticks
- Katydid

✓ Cockroaches are **nocturnal insects** (active at night)

A DIAGRAM SHOWING LIFE CYCLE OF A COCKROACH

- 1 is the egg
- 2 is the nymph
- 3 is the adult



Diseases transmitted by cockroaches

- Leprosy
- Poliomyelitis (polio)
- Cholera
- Typhoid
- Diarrhoea

IMPORTANCE OF INSECTS

- Some insects like moths and bees pollinate flowers of crops
- Some insects like white ants are edible
- Bees provide honey and wax
- Grasshoppers are sold for income

DANGERS OF INSECTS

- Some insects are vectors (spread germs)
- Some insects are crop pests (destroy crops)
- Some insects sting people
- Termites destroy wood and local houses

PROTISTA KINGDOM (single called organisms)

- This is a kingdom of simple organisms with one cell
- Members of this kingdom are unicellular organisms
- They have a nucleus enclosed in a membrane
- They are neither plants, fungi, bacteria nor animals.
- They live in liquids or in other organisms **to prevent themselves from drying out**

EXAMPLES OF PROTISTA

- Algae
- Euglena
- Protozoa

ALGAE

- They have no roots, stems and leaves
- They have chlorophyll and can make their own food
- Larger algae reproduce by **means of spores.**
- Smaller algae reproduce by **fragmentation**
- They are found in water and moist places

What is algal bloom?

- This is the dense spread of algae on water surface.

EXAMPLES OF ALGAE

- Fucus
- Spirogyra
- Diatom
- Nostoc
- Seaweeds (giant kelp)

TYPES OF ALGAE

- Red algae
- Green algae
- Brown algae

IMPORTANCE OF ALGAE

- They act as food for aquatic animals
- They are a source of iodine when eaten
- They are used as fertilizers
- They provide oxygen to aquatic animals
- They are used to make biofuels (algal biofuel)

PROTOZOA

- These are unicellular organisms with nucleus and cytoplasm.
- Protozoa are microscopic **because** they can only be seen using a microscope
- Protozoa are unicellular **because** they have one cell
- They do not have chlorophyll
- Amoeba uses **pseudopodia (false feet)** for locomotion/movement and feeding
- Paramecium uses **cilia** for locomotion and feeding
- They are found in fresh water, damp places and in bodies of animals as parasites.
- They reproduce by **binary fission**

EXAMPLES OF PROTOZOA

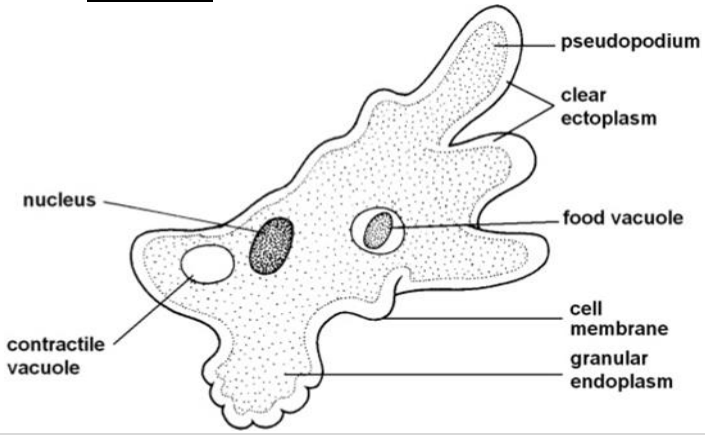
- Amoeba
- Plasmodium
- Paramecium
- Trypanosome

PROTOZOAN DISEASES IN HUMANS

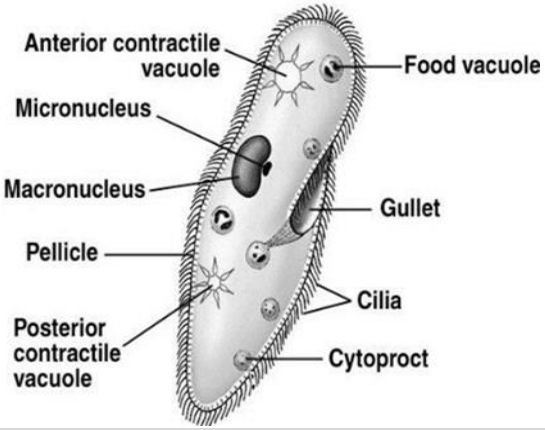
PROTOZOA	PROTOZOAN DISEASE
Plasmodium	Malaria
Trypanosome	Sleeping sickness
Amoeba	Amoebic dysentery

DIAGRAMS SHOWING AMOEBA AND PARAMECIUM

Amoeba



Paramecium



- An amoeba reproduces by **binary fission**
- Binary fission is an example of **asexual reproduction**
- **Binary fission** is the process by which the cell divides into two identical daughter cells

EUGLENA
- This is a unicellular organism which has both plants and animal features.
- It has chlorophyll so makes its own food.
- It can move from one place to another very quickly for protection
- It uses **flagella** for locomotion (movement) and feeding
- It is microscopic and lives in ditches and ponds.

FUNGI KINGDOM
- This a kingdom of organisms that lack chlorophyll and cannot make their own food
- Fungi belong to **Kingdom fungi**
- They can either be unicellular or multicellular organisms
- Fungi grow in **moist places**
- ✓ Due to presence of rotting / decaying matter
- They do not have leaves, stem and roots
- Fungi lack roots but they have threadlike structures called **hyphae**
- To absorb food from decaying matter
- A group of hyphae is called **mycelium**
- Fungi cannot make their own food
- Most fungi are saprophytes while others are **parasites**
- **Saprophytes** are organisms that feed on dead matter
- **Parasites** are organisms that depend on other host for survival
- **A host** is an organism on which a parasite depends

Why are fungi unable to make their own food?
- They lack chlorophyll

Why are fungi called saprophytes?
- They feed on dead organic matter

Why are fungi very common in wet season/moist places?
- There is a lot of rotting matter on which fungi feed
- There is enough water to support growth of fungi

REPRODUCTION IN FUNGI
- Most fungi reproduce by means of spores
- Yeast reproduces by budding

Feeding in fungi
- Most fungi feed saprophytically (feed on dead matter)
- Some fungi feed parasitically (get food from their host)

CHARACTERISTIC OF FUNGI
- They lack chlorophyll
- They have a nucleus
- Fungi have a cell wall
- Most fungi are filamentous
- Most fungi reproduce by means of spores and budding in yeast
- Most fungi feed saprophytically

CONDITIONS NECESSARY FOR GROWTH OF FUNGI

- Moisture
- Warmth

EXAMPLES OF FUNGI

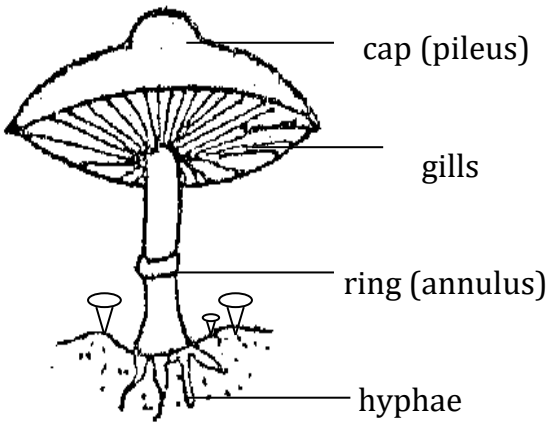
- Mushrooms
- Toadstools
- Yeast
- Moulds
- Mildews
- Puffballs
- Clubroot fungus
- Bracket fungus

Bracket fungi always grow on tree trunks

MUSHROOM

- It reproduces by means of spores
- It is propagated by means of spores
- It feeds saprophytically (feeds on dead organic matter)
- Some mushrooms are edible while others are poisonous

A DIAGRAM SHOWING A MUSHROOM



- The part of a mushroom visible above the ground is called **fruiting body (sporophore)**
- The part of a mushroom below the ground is called **mycelium**

FUNCTIONS OF EACH PART OF A MUSHROOM

CAP (PILEUS)

- It protects the gills

GILLS

- They produce and store spores

STALK / STIPE

- It holds the cap and gills

RING

- It protects the mushroom when it is still young

HYPHAE

- They absorb food (nutrients) from dead matter

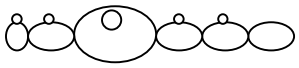
Why is a mushroom not called a plant?

- A mushroom has no chlorophyll while plants have chlorophyll
- A mushroom cannot make its own food (feeds on decaying matter) while a plant makes its own food

YEAST

- Yeast contains an enzyme called **zymase**
- Yeast speeds up fermentation of alcohol
- Yeast reproduces by **budding**

A DIAGRAM TO SHOW BUDDING IN YEAST



TOADSTOOLS

- They grow on decaying organic matter
- Toadstools resemble mushrooms
- They are poisonous

MOULDS

- These are furry tiny fungi that grow on rotten organic matter (rotten cassava, breads and sweet potato)

EXAMPLES OF MOULDS

- Penicillium
- Rhizopus
- Mucor

✓ Rhizopus causes rotting of fruits and vegetables
✓ Mucor spoils breads and cakes
✓ Penicillium is used to make penicillin and cheese

IMPORTANCE OF FUNGI (USEFUL FUNGI)

- Some fungi are eaten as food e.g some mushrooms, morels and truffles

(Some fungi are sources of proteins/fungal proteins)

- Mushrooms are sold for income
- Yeast helps in brewing/making alcohol/fermentation of alcohol

It speeds up fermentation

- Yeast helps in baking

It leavens breads/rise the dough

- Yeast extracts are a source of Vitamin B
- Penicillium are used to make penicillin (antibiotic drug)
- Penicillium is used in making cheese
- Fungi help in decomposition (break down organic matter)

DANGERS OF FUNGI (HOW FUNGI ARE HARMFUL/NUISANCE)

- Some fungi make food go bad e.g moulds
- Some fungi destroy wood
- Toadstools are poisonous when eaten
- Some fungi cause fungal diseases

FUNGAL DISEASES IN PEOPLE

- Ringworm
- Candidiasis
- Athlete's foot
- Barber's itch
- Jock itch

FUNGAL DISEASES IN PLANTS

- Black spot
- Tomato blight
- Potato blight
- Maize rust
- Powdery mildew
- Corn smut

Prevention and control of fungal diseases

- Regular bathing
- Avoid sharing dirty clothing with infected person
- Spray using fungicides
- Do not eat any mushroom that you don't understand
- Preserving food
- Using essential drugs
- Do not eat uncovered smelly food
- Store food in cool dry places

NEW TOPIC: SOUND ENERGY

ENERGY

- This is the ability of the body to do work.

TYPES OF ENERGY

- **Kinetic energy**

This is the type of energy possessed by a body in motion (moving body)

- **Potential energy**

This is the type of energy possessed by a body at rest (stationary body)

FORMS OF ENERGY

- Sound energy
- Heat energy
- Light energy
- Mechanical energy
- Chemical energy
- Magnetic energy
- Electrical energy

SOUND ENERGY (SOUND)

- This is the form of energy that enables us to hear
- This is the form of energy produced by vibration of matter

How is sound produced?

- By vibration of matter (when an object vibrates)

Why is sound called a form of energy?

- It does work (it can do work)

UNITS FOR MEASURING SOUND

- Decibels (dB)

TERMS USED IN SOUND

VIBRATION

- This is the rapid movement of an object to and fro or up and down
- This is the back and forth movement of an object

A diagram showing vibration of an object

Why do some objects vibrate?

- Some objects are springy or elastic

MUSIC

- This is organized sound with regular vibration

NOISE

- This is disorganized sound with irregular vibration

PITCH

- This is the highness or lowness of sound
- This is how high or low sound is

VOLUME

- This is the loudness or softness of sound

FREQUENCY

- This is the number of vibrations produced per second
- ✓ It is measured in **Hertz (Hz)**

AMPLITUDE

- This is the width / height of vibrations
- This is the height of the wave from the point of rest

TYPES OF SOUND

- Loud sound
- Soft sound
- High sound
- Low sound

IMPORTANCE OF SOUND

- For communication
- For entertainment
- For protection
- For evidence in courts of law
- Sound is used to show feeling

SOURCES OF SOUND

- These are things that produce sound.

TYPES OF SOURCES OF SOUND

- Natural sources of sound
- Artificial sources of sound

NATURAL SOURCES OF SOUND

- ✓ These are sources of sound that were created by God
- Thunder
- Earth quake
- Waterfall
- Rainfall
- Volcanic eruption
- Wind
- Animals

ARTIFICIAL SOURCES OF SOUND

- ✓ These are sources of sound that are made by people
- Aeroplanes
- Cars
- Trains
- Factories
- Radios
- Loudspeakers
- Guns
- Bombs

EXPLAIN HOW THE FOLLOWING ORGANISMS PRODUCE SOUND

MAMMALS (HUMAN BEINGS)

- By vibration of vocal cords

BIRDS

- By vibration of the walls of syrinx and pessulus

BEES, MOSQUITOES AND HOUSEFLIES

- By beating (flapping) their wings rapidly

GRASSHOPPERS

- By rubbing their hind leg on the forewings

CRICKETS

- By rubbing their wings together

MUSICAL INSTRUMENTS

- These are instruments that produce organized sound

Groups of musical instruments

- String instruments (chordophones)
- Wind instruments (aerophones)
- Percussion instruments (idiophones)

STRING INSTRUMENTS (CHORDOPHONES)

- These are instruments that produce sound by vibration of their strings when plucked or bowed

EXAMPLES OF STRING MUSICAL INSTRUMENTS

- Cello
- Viola
- Violin
- Bow harp
- Guitar
- Lyre
- Tube fiddle
- Harp
- Mandolin
- Banjo
- ➢ Double bass
- ➢ Ukulele

A DIAGRAM SHOWING BOW HARP

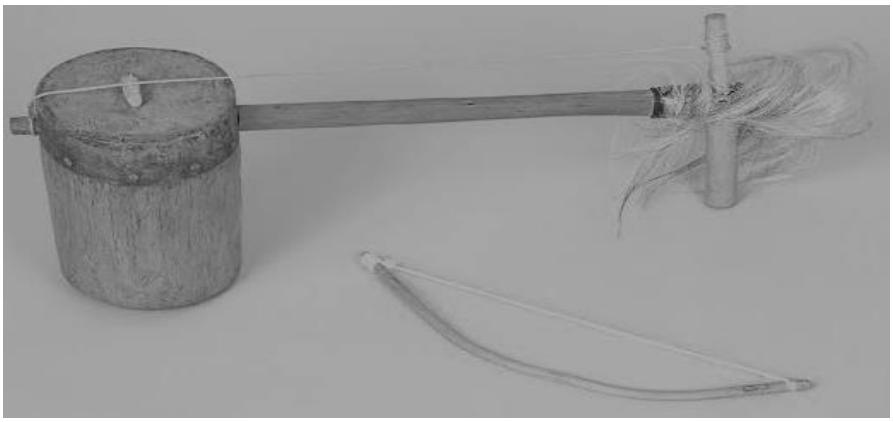
SOUNDBOARD

- It amplifies sound

SOUNDHOLE

- It amplifies sound
- It resonates with the tones
- It enhances the tone quality

A DIAGRAM SHOWING A TUBE FIDDLE



STRING

- It vibrates to produce sound when plucked

KNOB

- For changing the tension of the string
- For tightening or loosening the string

BRIDGE

- It supports the string
- It transmits sound vibration from the string to the soundboard

SOUNDBOARD

- It amplifies sound

CHANGING PITCH OF STRING MUSICAL INSTRUMENTS

- By tightening or loosening the strings
- By shortening or lengthening the strings

INCREASING THE PITCH OF STRING MUSICAL INSTRUMENTS

- By tightening the strings
- By shortening the strings

REDUCING THE PITCH OF STRING MUSICAL INSTRUMENTS

- By loosening the strings
- By lengthening the strings

PERCUSSION INSTRUMENTS

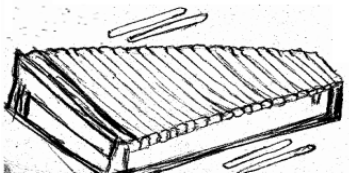
- These are instruments that produce sound by vibration of their surface when hit or struck or shaken or beaten.

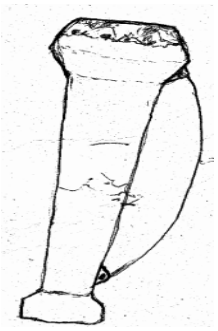
EXAMPLES OF PERCUSSION INSTRUMENTS

- ✓ Marimba
- ✓ Xylophone (balafon)
- ✓ Vibraphone
- Drum
- Long drum
- Thumb piano
- Piano
- Shakers
- Cymbals
- Shakers
- Rattles
- Timpani
- Castanet
- Triangle
- Bell
- Maracas
- Tambourine
- Gong
- Celesta

DIAGRAMS SHOWING SOME PERCUSSION INSTRUMENTS.

Drum Xylophone Long drum Bell





How do the following percussion instruments produce sound?

PIANO

- By vibration when its own hammer hits the strings

SHAKER

- By vibration of the objects inside it and its skin when shaken

DRUM, LONG DRUM AND GONG

- By vibration of its skin when hit

XYLOPHONE

- By vibration of its wooden bars/wooden keys when hit with mallets

PIANO

- By vibration of the gong and the hammer when shaken

CHANGING THE PITCH OF SOUND PRODUCED BY PERCUSSION INSTRUMENTS

- By reducing or increasing the size of vibrating surface
- By tightening or loosening the vibrating surface

INCREASING THE PITCH OF SOUND PRODUCED BY PERCUSSION INSTRUMENTS

- By reducing the size of the vibrating surface
- By tightening the vibrating surface

Of what importance are the strings on the sides of the drum?

- To keep the skin tight

WIND INSTRUMENTS (AEROPHONES)

- These are instruments which produce sound by vibration of air blown inside them

EXAMPLES OF WIND MUSICAL INSTRUMENTS

- Whistle
- Oboe
- Flute: By vibration of air blown inside it
- Saxophone: By vibration of the reed on the mouth piece when blown
- Bugle
- Clarinet
- Horn
- Vuvuzela
- Trumpet
- Panpipes
- Saxophone
- Tuba
- Trombone

DIAGRAMS SHOWING PANPIPES, HORN, WHISTLE AND FLUTE

How can the pitch of wind musical instruments be increased?

- By reducing the vibrating space (making the vibrating space smaller)

How can the pitch of wind musical instruments be decreased?

- By increasing the vibrating space (making the vibrating space bigger)

TRANSMISSION OF SOUND

- This is the movement of sound waves from one place to another

How does sound travel?

- Through sound waves

PROPERTIES OF SOUND

- It can be reflected
- It can be refracted
- It cannot travel through vacuum
- It travels in all directions from the source

MEDIUM OF SOUND

- This is a material through which sound is transmitted

MEDIA THROUGH WHICH SOUND TRAVELS

- Solid
- Liquid
- Gas

What enables sound to travel different media (states of matter)?

- Molecules

VACUUM

- This is the space without matter

Why is sound unable to travel through vacuum?

- There is no matter (molecules)

SPEED OF SOUND IN DIFFERENT MEDIA

MEDIUM (STATE OF MATTER)	SPEED OF SOUND
Gas (air)	330m/s
Liquid (water)	1500m/s
Solid (iron)	5000m/s

NOTE

- **Sound travels slowest in gases**

✓ Molecules are farthest apart (very loosely packed)

- **Sound travels faster in liquids**

✓ Molecules in liquids are close together

- **Sound travels fastest in solids**

✓ Molecules are tightly packed

Why does sound travel fastest through solids?

- Molecules in solids are tightly packed (closest together)

Why does sound travel faster in water (liquids) than in air (gases)?

- Molecules in water are closer together than those in air

FACTORS AFFECTING THE SPEED OF SOUND

- Temperature
- Wind
- Altitude
- Humidity
- Heat

TEMPERATURE

- When temperature is low, sound waves are nearer the ground and when temperature is high, sound waves raise above the ground.

Why is sound heard clearly at night than during day time?

- At night, temperature is low and sound waves travel nearer the ground during day time

WIND

- Sound waves travel faster when they are in the same direction with wind and sound waves travel slowly when they are in opposite direction with wind

ALTITUDE

- Low altitude increases the speed of sound and high altitude reduces the speed of sound

HEAT

- Heat of the day raises sound waves higher

PITCH, FREQUENCY AND VOLUME OF SOUND

PITCH

- This is the highness or lowness of sound

FACTORS THAT DETERMINE THE PITCH OF SOUND

i) Size of the vibrating surface

✓ Small surfaces produce high pitch while big surfaces produce low pitch

ii) Tension of the vibrating surface

✓ Tight surfaces produce high pitch while loose surfaces produce low pitch

iii) Frequency

✓ High frequency produces high pitch while low frequency produces low pitch

iv) Nature of the vibrating surface

✓ Thin surfaces produce high pitch while thick surfaces produce low pitch

v) Length of the vibrating surface

✓ Short vibrating surfaces have high pitch while long vibrating surfaces have low pitch

EXPERIMENTS ON PITCH OF DIFFERENT OBJECTS

BOTTLES

- Bottle A will produce the highest pitch
- ✓ It has the smallest vibrating space
- Bottle B will produce the higher pitch
- ✓ It has the bigger vibrating space
- Bottle C will produce the lowest pitch
- ✓ It has the biggest vibrating space

Why does an empty bottle produce lower pitch than a bottle half filled with water?

- It has a bigger vibrating space than a bottle half filled with water

DRUMS

- Drum 1 will produce the lowest pitch
- ✓ It has the biggest vibrating surface
- Drum 2 will produce the lower pitch
- ✓ It has the smaller vibrating surface
- Drum 3 will produce the highest pitch
- ✓ It has the smallest vibrating surface

BOW HARP

String X will produce the lowest pitch
- It has the longest vibrating surface

String C will produce the highest pitch
- It has the shortest vibrating surface

FLUTE

- When holes A and B are closed, a flute produces the highest pitch
- ✓ The vibrating space will be very big
- When holes B and C are closed, a flute produces the lowest pitch
- ✓ The vibrating space will be very small

How is a flute played?
- By blowing

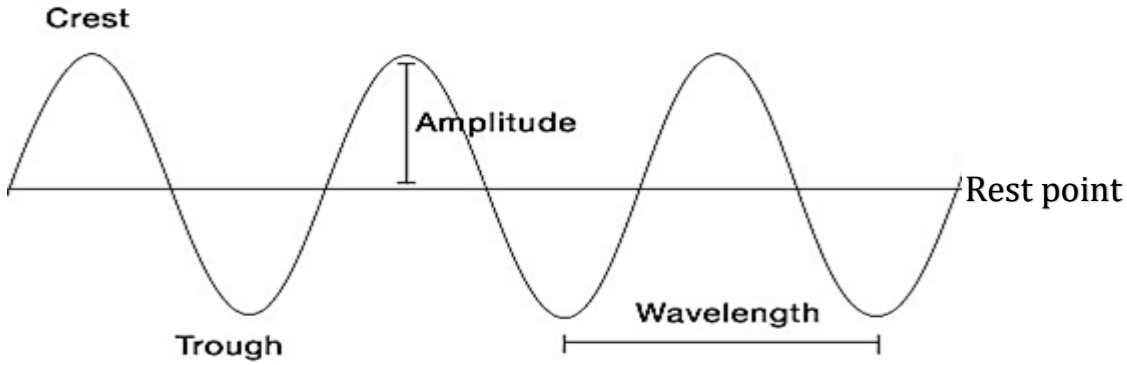
How can a pitch of a flute be changed?
- By opening or closing some holes with the fingers while blowing

FREQUENCY
- This is the number of vibrations produced per second
- This is the number of oscillations per second

UNITS FOR MEASURING FREQUENCY
- ➢ Hertz (Hz)

FACTORS THAT DETERMINE FREQUENCY (F) OF SOUND
- Mass of the object
- Force that shakes the object

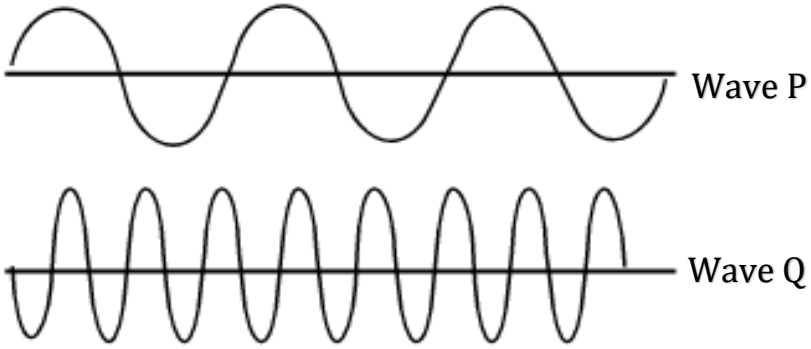
A DIAGRAM SHOWING A SOUND WAVE



WAVE LENGTH

- This is the distance between two consecutive crests or troughs

DRAWINGS SHOWING SOUND WAVES OF DIFFERENT FREQUENCY AND PITCH



- Sound wave P will produce sound with low frequency and low pitch
- It is slow
- Sound wave Q will produce sound with high frequency and high pitch
- It is quick

VOLUME

- This is the loudness or softness of sound
- This is the magnitude or intensity of a certain sound

FACTOR AFFECTING VOLUME OF SOUND

- Amplitude

Amplitude

- This is the height of the wave from the point of rest
- This is the height of sound vibrations
- ✓ Great amplitude forms loud sound while small amplitude forms soft sound

ECHO

- An echo is a reflected sound

How is an echo formed?

- By obstruction of sound waves (when sound waves hit a hard surface)

ECHOLOCATION

- This is the ability of an organism to locate objects using echoes.

Mention three animals that use echolocation

- Bats
- Dolphins
- Whales
- Porpoises

IMPORTANCE OF ECHOES

- They help bats and whales to dodge obstacles
- They help bats and whales to locate their food
- They help sailors to detect the depth of the water body
- They help fishermen to locate shoals of fish
- They help pilots to dodge tall buildings and mountains.
- They help blind people to dodge obstacles using sonar sticks
- They help doctors to detect heart beat

DISADVANTAGES OF ECHOES

- They turn music into noise in empty room
- They prevent people from communicating clearly

How can echoes be reduced in cinema halls, recording studios, conference halls and theatre halls?

- Covering the walls with soft boards
- Covering the walls with sponge and thick blankets
- Covering the windows with thick curtains
- Covering the floor with woollen carpets

SOUND REFLECTORS

- These are materials that bounce / send back sound waves

Characteristic of sound absorbers

- They are hard

Examples of sound reflectors (materials that reduce echoes)

- Mountains
- Hills
- Cliffs
- Rocks

SOUND ABSORBERS

- These are materials that absorb sound waves

Characteristics of sound absorbers

- They are soft
- They are porous

Examples of sound absorbers (materials that reduce echoes)

- Thick blankets
- Thick curtains
- Woollen carpets
- Soft boards
- Sponge

HOW DO SOFT POROUS MATERIALS (E.G SOFT BOARDS) PREVENT ECHOES?

- They absorb sound waves

Mention any two devices that use echoes to work

- **Fathometer**

It is used to measure the depth of seas and oceans

- **Stethoscope**

It is used to detect heart beat

Mention four groups of people who use echoes

- Pilots
- Sailors
- Doctors
- Fishermen

Why do we see lightning before thunder is heard during thunderstorm?

- Light travels faster than sound in air

CALCULATIONS ON SOUND

- Speed of sound in air is 330 m/s

EXAMPLES

1. If a man heard a gunshot after four seconds, how far was he from the firing point? (Take; speed of sound in air = 330 m/s)

D = S x T
D = 330 m/s x 4 s
D = (330 x 4) m
D = 1320 m

2. Mutaawe shouted while facing a cliff and it took him 10 seconds to hear the echo of the sound he produced. How far was he from the cliff if the speed of sound is 330m/s?

Sound moved two journeys 9Going to the cliff and coming back from the cliff to Mutaawe)

$$D = \frac{S \times T}{2}$$

$$D = \frac{330 \times 10}{2}$$

$$D = \frac{3300}{2}$$

D = 1650 metres

3. It took 3 seconds to hear echo of a man chopping wood. How far was the man from a chopping place?

There are two sets of sound waves (original waves and the reflected waves)

$$D = \frac{S \times T}{2}$$

$$D = \frac{(330 \times 3)}{2}$$

$$D = \frac{990}{2}$$

D = 495m

4. A cliff is 660m away from where Kato is standing. If Kato blows a whistle, how long will it take him to hear the echo if the speed of sound is 330 m/s?
Sound moves two journeys

$$T = \frac{(D \times 2)}{S}$$

$$T = \frac{660 \times 2}{330}$$

T = 2 x 2

T = 4 seconds

TRY THIS

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

$$T = \frac{D}{S}$$

$$T = \frac{165}{330}$$

T = 0.5 seconds

STORAGE OF SOUND

- This is the act of keeping sound for future use

REASONS FOR STORING SOUND (Why do people store sound?)

- For entertainment
- For communication
- For remembrance
- For evidence in courts of law

METHODS OF STORING SOUND

- Recording method
- Notation method

NOTATION METHOD

- This is the act of storing sound by writing musical symbols or notes

TYPES OF NOTATION

SOL-FA NOTATION

- This is the use of octaves (musical notes) to store sound

STAFF NOTATION

- This is the use of musical symbols marked on parallel lines to store sound

WAYS OF REPRODUCING SOUND STORED BY NOTATION

- Using a piano to play sound notes
- Using human voice to sing sound notes

RECORDING OF SOUND

- This is the act of making an audio record

DEVICES USED TO STORE RECORDED SOUND

- Memory cards
- Video Compact Discs (VCDs)
- Digital Video Discs (DVDs)
- Magnetic tapes (cassette tapes)
- Computer diskettes
- Projectors
- Mobile phones
- Flash drive
- Compact discs (CDs)
- Audio tapes / DAT (Digital audio tape)
- IPods
- Computer hard disks

DEVICES USED TO REPRODUCE RECORDED SOUND

- Record players (phonograph)
- Cassette players
- Film projectors
- DVD players
- VCD players
- Computers
- Mobile phones
- Gramophone
- Mp3 player

WAYS OF REPRODUCING RECORDED SOUND

- By playing CDs in CD players
- By playing VCDs in VCD players
- By playing flash discs in computers
- By playing memory cards in mobile phones
- By playing records in record players
- By playing cassette tapes in cassette players
- By playing DVDs in DVD players
- By playing mp3 in mp3 players

THE MAMMALIAN EAR

- It is a sense organ for hearing
- It is a receptor organ for sound
- The ear belongs to the **nervous system**

MAIN FUNCTIONS OF THE MAMMALIAN EAR

- For hearing
- For body balance

How are ears important to a deaf person?

- For body balance

Besides hearing and body balance, how else are ears useful to an elephant?

- For temperature regulation on hot days

REGIONS (MAIN PARTS) OF THE MAMMALIAN EAR

- Outer ear
- Middle ear
- Inner ear

THE OUTER EAR

- It is a hollow region

PARTS THAT MAKE UP THE OUTER EAR

- Pinna
- Auditory canal (ear canal)

THE MIDDLE EAR

- It is an air-filled region

PARTS THAT MAKE UP THE MIDDLE EAR

- Ear drum (tympanic membrane)
- Ossicles
- Eustachian tube
- Oval window

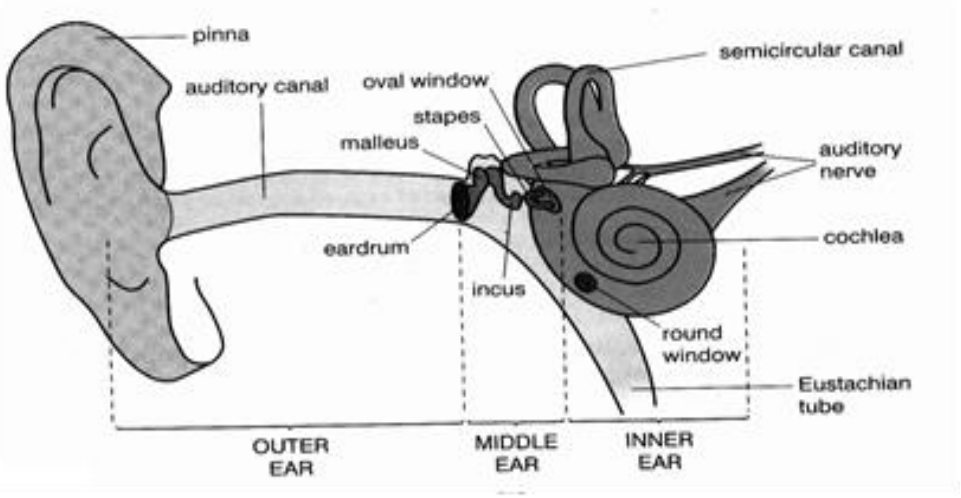
THE INNER EAR (LABYRINTH)

- It is a fluid-filled region

PARTS THAT MAKE UP THE INNER EAR

- Semicircular canals
- Cochlea
- Auditory nerves

THE STRUCTURE OF THE HUMAN EAR



FUNCTIONS OF EACH PART OF THE HUMAN EAR

PINNA

- It traps (collects) sound waves
- it receives and concentrates sound waves

How is the pinna adapted to its function?

- It is large and broad

How is the pinna able to keep open all the time?

- It is made up of cartilage

AUDITORY CANAL (EAR CANAL)

- It directs sound waves to the ear drum

COMPONENTS OF THE AUDITORY CANAL

Earwax (cerumen)

- To trap dust and small insects
- To kill germs in the ear canal

Cilia (tiny hair)

- To trap dust

EAR DRUM (TYMPANIC MEMBRANE)

- It changes sound waves to sound vibrations
- It separates outer ear and the middle ear
- ✓ An **otoscope** is an instrument used to examine the ear drum

How is the ear drum adapted to its function?

- It has a thin membrane which is sensitive to sound waves

OSSICLES

- ✓ These are the three small bones in the middle ear.
- They amplify sound (sound vibrations)
- They transmit sound vibrations to the oval window

Name the three small bones that make up the ear ossicles

- Malleus (Hammer)
- Incus (Anvil)
- Stapes (Stirrup)
- ✓ The **stapes** is the smallest bone in the human skeleton

OVAL WINDOW

- It transmits sound vibrations to the cochlea

ROUND WINDOW

- It balances air pressure in the cochlea

EUSTACHIAN TUBE

- ✓ This is a tube that connects the middle ear to the back of the throat
- It balances air pressure on both sides of the ear drum
- It drains a fluid from the middle ear to the back of the nose (throat)

SEMICIRCULAR CANALS

- It maintains body balance/posture

EXPLAIN THE MEANING OF THE FOLLOWING TERMS:

POSTURE

- This is the position of the body in everything we do

BODY BALANCE

- This is the ability of the body to keep upright

COCHLEA

- ✓ This is a snail/spiral- shaped part of the inner ear
- It changes sound vibrations to nerve signals/impulses

How is the cochlea adapted to its function?

- It has hair cells (sensory cells)

Which part of the human ear is greatly affected by alcohol?

- Cochlea

Name the two fluids in the inner ear (cochlear fluids)

- Perilymph
- Endolymph

AUDITORY NERVE (COCHLEAR NERVE)

- It transmits sound information to the brain
- It transmits nerve signals to the brain

VESTIBULAR NERVE

- It transmits balance information to the brain

State the importance of the vestibule cochlear nerve in the human ear

- It transmits sound and balance information to the brain

Why do nerve (neural) signals go to the brain?

- For interpretation

Name two parts of the human ear that maintains body balance

- Semicircular canals
- Vestibule

Mention three body organs that maintain body balance

- Ears
- Brain
- Eyes

COMMON DISEASES OF THE EAR

- Otitis
- Otomycosis
- ✓ It is a fungal disease
- Ear boils (furuncle)
- ✓ It is a bacterial disease
- Barotrauma
- ✓ It is due to change in altitude (air or water pressure)
- Cancer of the outer ear
- ✓ It is due to excessive exposure of ears to direct sunshine

OTITIS

- ✓ It is grouped into;

i) Otitis externa (swimmer's ear): due frequent moisture in ear canal
ii) Otitis media
iii) Otitis interna

SYMPTOMS OF INFECTED EARS

- Ringing in the ear (tinnitus)
- Dizziness (problems with body balance)
- Ear pain (earache)
- Mild hearing loss

SIGN OF INFECTED EARS

- Pus discharge from the ears

EAR DEFECTS (DISORDERS OF THE HUMAN EAR)

- Permanent deafness
- Partial deafness
- Sensory deafness
- Anotia

DEAFNESS (HEARING LOSS)

- This is the partial or total inability to hear

TYPES OF DEAFNESS

PERMANENT DEAFNESS

- This is the inability to hear any sound

CAUSES OF PERMANENT DEAFNESS

- It can be inherited from parents
- Broken (ruptured) eardrum
- Infections like German measles (Rubella)

TEMPORARY (PARTIAL) DEAFNESS

- This is the inability to hear properly

CAUSES OF TEMPORARY DEAFNESS

- Excess earwax (earwax impaction)
- Exposing ears to very loud sounds
- A lot of dust in the ear canal

How does excess ear wax cause temporary deafness?

- It blocks the ear canal

SENSORY DEAFNESS

- This is inability to distinguish some sounds
- In babies, it even affects the ability to talk normally

CAUSES OF SENSORY DEAFNESS

- Damage on the auditory nerve
- Damage on the hair cells in the cochlea
- Head injury (a blow to the head)
- Ototoxic drugs
- Old age

What do we call the sensory deafness where a person is unable to hear high-pitched sound?

- Presbycusis

✓ It affects people above the age of 65

✓ It occurs due to **old age (aging)**

ANOTIA

- This is the congenital deformity where a person has no pinna.

METHODS USED DURING COMMUNICATION WITH DEAF PEOPLE

- Sign language
- Lip-reading
- Cued speech
- Typed conversations

CARE FOR THE EARS

- Wash the ears with clean warm water and soap
- Do not push sharp objects into the ear.
- Avoid very loud sound
- Use a clean soft cloth to clean the ears
- Treat any ear infection as soon as possible
- By immunization

Why is it not advisable to push sharp objects in our ears?

- They may damage (rupture) the eardrum.

What first aid can be given to a person with a small insect in the ear?

- Pour clean cold water in the ear to make the insect come out

HEARING IN DIFFERENT ORGANISMS

MAMMALS (PEOPLE)

- By means of ears

BIRDS

- By means of ears covered with soft feathers

FISH

- A fish uses lateral line to detect sound vibrations in water

INSECTS

- By means of antennae/feelers

SNAKES

- They use their skull vibration when hit by sound waves in the air
- They use their jawbone connected to the cochlea to detect ground vibrations

EARTHWORMS

- By means of their entire body

Snails

- By means of tentacles

TOPIC: THE CIRCULATORY SYSTEM

THE CIRCULATORY SYSTEM

- This is the body system that deals with transportation of materials in the body
- This is the body system that deals with the movement of blood round the body

CELL

- This is the smallest unit of life

TISSUE

- This is ta group cells that work together to perform a specific function

ORGAN

- This is a group of tissues that work together to perform a specific function

SYSTEM

- This is a group of organs that work together to perform a specific function

EXAMPLES OF MATERIALS TRANSPORTED IN THE BODY

- Water
- Hormones
- Oxygen
- Food nutrients
- Antibodies

Useful materials

- Urea
- Carbon dioxide
- Poison

Harmful materials

BLOOD CIRCULATION

- This is the movement of blood round the body

Blood circulation was discovered by an English scientist known as **Sir. William Harvey**

Importance of blood circulation in the body

- It transports food and oxygen in the body
- It transports hormones in the body
- It transports wastes products to excretory organs

TYPES OF BLOOD CIRCULATION

- Pulmonary circulation
- Systemic circulation

Pulmonary circulation

- This is movement of blood from the heart to the lungs and back to the heart

Why is pulmonary circulation sometimes called double circulation?

Systemic circulation

- This is the movement of blood from the heart to the other body parts

COMPONENTS OF CIRCULATORY SYSTEM

- Heart
- Blood vessels
- Blood

THE HEART

Heart is a muscular organ that pumps blood in the body of a vertebrate

- It is located in the **chest cavity** between the lungs
- It is protected by the **rib cage**
- It is made up of special muscles called **cardiac muscles**
- It is enclosed in a serous membrane called **pericardium**
- **Pericardium** produces a fluid that lubricates the heart (produces pericardial fluid)
- **Pericardial fluid** lubricates the heart (reduces friction during heartbeat)
- **Coronary artery** supplies food nutrients and oxygen to the heart muscles.

Main function of the heart

- To pump blood in the body

The heart pumps about **5 litres of blood per minute**

PULSE

This is the number of times the heart beats per minute

- The normal heartbeat of an adult person at rest is **72 beats per minute**

Heartbeat

- This is the contraction and relaxation of the heart

Factors that can increase heartbeat or pulse

- Excitement
- Fright
- Physical exercises
- Increased level of adrenaline hormone
- High temperature
- Sickness

Adrenaline hormone prepares the body for a flight or fight

Why does the heart beat faster when doing a heavy body exercise?

- To pump more oxygenated blood to the body tissues

Note

Stethoscope is used to detect heartbeat/pulse

Sphygmomanometer is used to measure blood pressure

A diagram showing a stethoscope

It has a diaphragm, long rubber tube and two earpieces

PHASES OF HEART BEAT (CARDIAC CYCLE)

- **Systole phase**

This is contraction of the ventricles to push blood into the arteries.

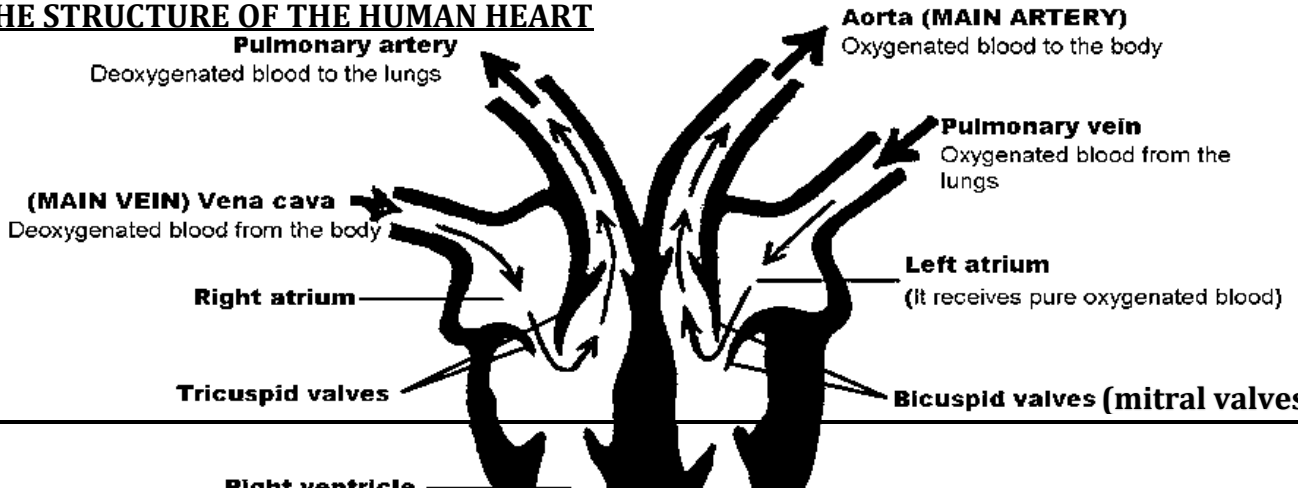
During this phase, the auricles are filled with blood

- **Diastole phase**

This is contraction of auricles to push blood into the ventricles

During this phase, the ventricles are filled with blood

THE STRUCTURE OF THE HUMAN HEART



The mammalian heart has 4 chambers

- Right auricle
- Left auricle
- Right ventricle
- Left ventricle
- The upper chambers are called **atria (auricles)**
- **Auricles** receive blood
- The lower chambers are called **ventricles**
- **Ventricles** pump blood out of the heart
- The left and right sides of the heart are separated by a thick wall called **septum**

FUNCTIONS OF EACH PART OF THE HEART

- **Vena cava**

It carries deoxygenated blood from all body parts to the heart
The **vena cava** is the largest vein in the body

- **Right auricle**

It receives deoxygenated blood from the body parts

- **Right ventricle**

It pumps deoxygenated blood to the lungs

- **Pulmonary artery**

It carries deoxygenated blood from heart to lungs
Why does blood go to the lungs?

- To pick oxygen (to be oxygenated)
- To drop carbon dioxide (to get rid of carbon dioxide)

- **Pulmonary vein**

It carries oxygenated blood from lungs to heart

- **Left auricle**

It receives oxygenated blood from the lungs

- **Left ventricle**

It pumps oxygenated blood to all body parts

- **Aorta**

It carries oxygenated blood from the heart to all body parts
The **aorta** is the largest artery in the body

- **Septum**

It prevents mixing of oxygenated blood and deoxygenated blood

- **Valves**

They prevent the back flow of blood

Why is the left ventricle thicker walled than the right ventricle?

- It pumps blood at a higher pressure than the right ventricle

BODY ORGANS RELATED TO BLOOD CIRCULATION

Kidneys

- They filter blood (they purify blood)

Liver

- It regulates blood sugar level
- It detoxicates blood

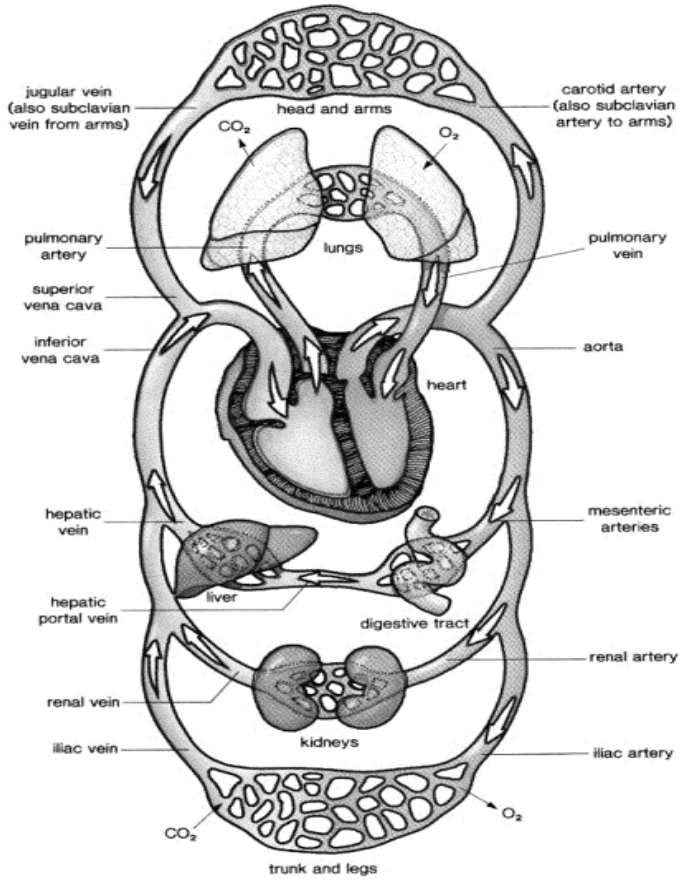
Lungs

- They oxygenate blood
- They remove carbon dioxide from blood

State the importance of the hepatic portal vein

- It carries blood with digested food from the ileum to the liver

THE DIAGRAM TO SHOW CIRCULATION OF BLOOD



BLOOD VESSELS

- These are tubes that transport blood in the body

Types of blood vessels

- Arteries
- Veins
- Capillaries

ARTERIES

These are blood vessels that carry blood away from the heart

- The main (largest) artery is the **aorta**
- Most arteries carry oxygenated blood **except** pulmonary artery
- Blood in arteries flows at a high pressure

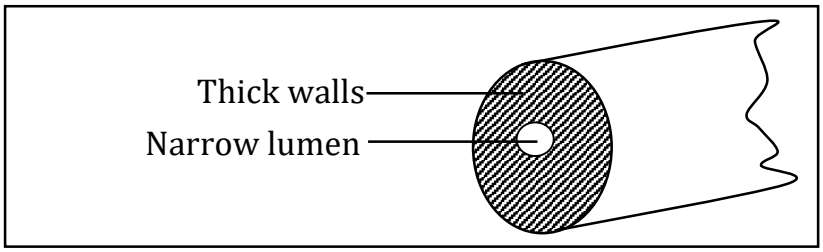
Characteristics of arteries

- They have thick walls
- They have a narrow lumen
- They have no valves

Function of arteries

- They carry blood away from the heart.

The structure of an artery



Adaptations of arteries to their function

- They are thick walled

To withstand the high pressure of blood that flows through them.

- They are elastic

To stretch so as to accommodate the large volume of blood that flows through them

Why do arteries have thick walls?

- To withstand the high pressure of blood that flows through them.

Why do arteries lack valves?

- They carry blood at a very high pressure

VEINS

These are blood vessels that carry blood to the heart

- The main (largest) vein is the **vena cava**
- Most veins carry deoxygenated blood **except** pulmonary vein
- Veins are seen near the skin surface
- **Hepatic portal vein** carries blood with digested food from the ileum to the liver

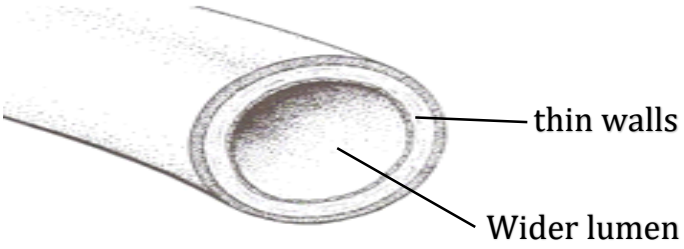
Characteristics of veins

- They have thin walls
- They have a wider lumen
- They have valves

Function of veins

- They transport blood to the heart.

The structure of a vein



A diagram showing the direction of flow of blood in a vein

Adaptations of the veins to their function

- They are thin walled

To withstand the low blood pressure in them

- They have a wider lumen

To encourage the flow of blood

- They have valves

To prevent the back flow of blood.

How are valves important in veins?

- Valves prevent the back flow of blood

Why are arteries thick walled than veins?

- Blood in arteries flows at a higher pressure than veins

CAPILLARIES

These are tiny blood vessels that join arteries to veins

- Capillaries are the **smallest** blood vessels
- They connect arteries and veins
- Exchange of materials occurs in capillaries

Characteristics of capillaries

- They have thin walls (have porous walls)
- They have no valves

Functions of capillaries

- They allow exchange of materials
- They join arteries to veins

Structure of capillaries

Adaptations of capillaries to exchange of body materials?

- They are numerous (very many in number)

To increase the surface area for exchange of materials

- They have thin walls (porous walls)

For easy diffusion of materials

DIFFERENCES BETWEEN ARTERIES AND VEINS

ARTERIES	**VEINS**
Functional difference	
They carry blood away from the heart	They carry blood towards the heart
Structural difference	
Have no valves	Have values
Have thick walls	Have thin walls
Have a narrow lumen	Have a wide lumen

BLOOD

This is a liquid tissue that transports materials in the body

- Blood in vertebrates is **red in colour**

Types of blood

- **Oxygenated blood**

It is rich in oxygen and digested food
It is bright red

- **Deoxygenated blood**

It is rich in carbon dioxide and waste products
It is dark red

COMPONENTS OF BLOOD (BLOOD CONSTITUENTS)

- Red blood cells (erythrocytes)
- White blood cells (leukocytes)
- Platelets (thrombocytes)
- Plasma

By what process are blood cells formed in the red bone marrow?

- Haemopoiesis

RED BLOOD CELLS

- They are the most numerous blood cells in the body
- They are made in the **red bone marrow**

Function of red blood cells

- They transport oxygen in the body

Characteristics of red blood cells (erythrocytes)

- They have no nuclei
- They have a bi-concave shape (disc shape)
- They contain haemoglobin

What is haemoglobin?

- This is the red pigment found in blood
- It is an iron compound in red blood cells that transport oxygen

Importance of haemoglobin

- It carries oxygen
- It determines the red colour of blood

NOTE

- Haemoglobin combines with oxygen to form **oxyhaemoglobin**
- RBCs become **bright red** with oxygen and **dark red** when they lose oxygen

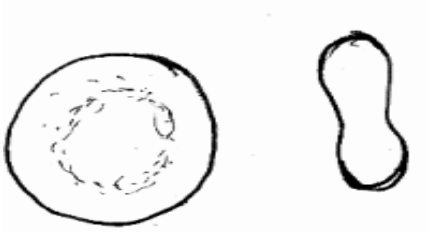
In which form is oxygen transported in blood?

- Oxyhaemoglobin

Why are red blood cells red in colour?

- Due to presence of haemoglobin

The structure of a red blood cell



ADAPTATIONS OF RED BLOOD CELLS TO THEIR FUNCTION

- They have haemoglobin

To absorb (carry) oxygen

- They are numerous
- They have no nucleus

To provide enough room for oxygen

- They have a biconcave shape

To increase the surface area for diffusion of oxygen

- They have a thin membrane

To allow easy diffusion of gases

Why do people living at higher altitudes have more RBCs?

- There is little oxygen at higher altitudes

Why do infants have more red blood cells than adults?

- Infants have a higher metabolic rate than adults

NOTE

- **Plasmodia germs (malaria parasites)** destroy the red blood cells
- **Sickle cell anaemia (sickle cell disease)** deforms red blood cells

WHITE BLOOD CELLS

- WBCs are fewer than RBCs in number

Characteristics of white blood cells

- They have a nucleus
- They do not have a defined shape (they have an irregular shape)
- They have no haemoglobin (so they are colourless)

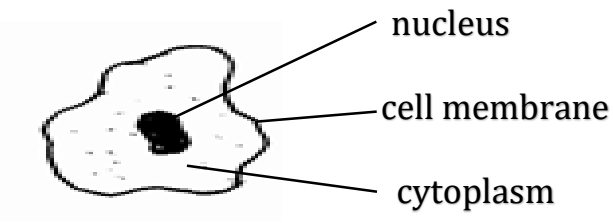
In which body parts are white blood cells made?

- Bone marrow of long bones
- Lymph nodes
- Spleen

Function of white blood cells

- They defend the body against diseases (infections)
- They fight against pathogens (disease causing germs)

The structure of a white blood cell



How do white blood cells defend the body against diseases?

- They engulf and digest germs
- They produce antibodies

Adaptation of a white blood cell to its functions

- It has a nucleus to control cell activities
- It has cytoplasm to engulf germs
- It has an irregular shape to engulf germs of different shapes

Why do children have more WBCs than adults?

- They are more prone to disease attack than adults

Diagrams showing how white blood cells engulf germs

NOTE:

- **HIV (human immunodeficiency virus)** destroys the white blood cells
- Too much white blood cells in blood cause **leukemia (blood cancer)**

How is pus formed?

- When some white blood cells and germs die during the fight (decaying in the tissue)

PLATELETS

- These are small colourless disc shaped particles in blood
- They are made in the **red bone marrow**

Characteristics of platelets

- They have no nucleus
- They have a disc shape

Function of platelets

- They help in blood clotting in case of a cut

How do platelets stop bleeding?

- By forming blood clots on cuts and wounds

STRUCTURE OF PLATELETS

NOTE

- A hereditary disease in which a person has uncontrolled bleeding is called **haemophilia**
- Haemophilia is caused by **lack of clotting factor in blood**
- Vitamin K **helps in formation of platelets**
- Lack of vitamin K in the diet **leads to poor blood clotting**

What health problem is a personal likely to get due to inadequate platelets in blood?

- Excessive bleeding in case a cut/poor blood clotting

BLOOD PLASMA

- ✓ This is the pale liquid component of blood
- It makes up about 55% of blood
- It is where red blood cells, white blood cells and platelets are suspended
- It consists of 90 percent water
- Plasma holds all the other blood cells

CONSTITUENTS (COMPONENTS) OF BLOOD PLASMA

- Water
- Hormones
- Antibodies
- Digested food (e.g glucose, amino acids, mineral salts and lipids)
- Urea
- Carbon dioxide

} Excretory wastes

FUNCTIONS OF BLOOD PLASMA

- It transports hormones in the body
- It distributes heat in the body
- It transports blood cells
- It transports digested food in the body (e.g glucose, lipids and amino acids)
- It transports water and mineral salts in the body
- It transports metabolic wastes to the excretory organs
- It transports antibodies in the body

GENERAL FUNCTIONS OF BLOOD

1. **TRANSPORT FUNCTIONS:**
   - It transports digested food in the body
   - It transports oxygen in the body
   - It transports hormones in the body
   - It transports metabolic wastes to excretory organs.
2. **PROTECTIVE FUNCTIONS:**
   - It protects the body against diseases
   - It prevents bleeding by clotting on cuts and wounds
3. **REGULATIVE FUNCTION:**
   - It distributes heat in the body

How does blood help in body temperature regulation?

- It distributes heat in the body

BLOOD GROUPS (BLOOD TYPES)

- Group A
- Group B
- Group AB
- Group O

Blood groups were discovered by a Scientist called **Sir Karl Landsteiner**

How are blood groups formed?

- According to the antigens in red blood cells

BLOOD DONOR

- This is a person who gives blood

BLOOD RECIPIENT

- This is a person who receives blood

BLOOD RECIPIENT	BLOOD DONOR
A	A and O
B	B and O
AB	A, B, AB and O
O	O

- **Universal recipient** is a person who receives blood from all blood groups
- **Group AB** is a universal recipient
- **Universal donor** is a person who gives blood to all blood groups
- **Group O** is a universal donor

WAYS OF INCREASING THE VOLUME OF BLOOD IN THE BODY

- Feeding on food rich in iron
- Taking iron tablets
- Through blood transfusion
- Drinking plenty of fruit juices

BLOOD TRANSFUSION

- This is the transfer of screened blood from one person to another as long as blood groups agree.

Give one reason why blood should be screened before transfusion

- To prevent the spread of diseases in infected blood

BLOOD SCREENING

- This is the examining of blood under a microscope

IMPORTANCE OF SCREENING BLOOD

- It helps to discover the germs in blood
- It helps to discover blood groups
- It promotes safe blood transfusion

DISEASES OF CIRCULATORY SYSTEM

1. **BLOOD DISEASES**
   - ✓ These are diseases that affect blood components
   - Malaria
   - HIV/AIDS
   - Sickle cell anaemia
   - Anaemia
   - Leukemia (blood cancer)

2. **HEART DISEASES**
   - ✓ These are diseases that attack the heart
   - Heart attack (cardiac arrest)
   - Coronary heart disease (CHD)
   - Coronary thrombosis
   - Hypertension (high blood pressure)
   - Hypotension (low blood pressure)

3. **HEREDITARY DISEASES**
   - Haemophilia
   - Sickle cell anaemia

DISORDERS OF THE CIRCULATORY SYSTEM

- Heart failure
- Arteriosclerosis (hardening of the arteries)
- Defective cells
- Blood clot
- Cuts and wounds

PREVENTION AND CONTROL OF THE CIRCULATORY DISEASES

- Feeding on a balanced diet.
- Eat very low animal fats
- Perform regular body exercises
- Avoid much alcohol.
- Avoid smoking
- Have regular health checkups

Importance of physical exercises to the body

- It makes the heart muscles to grow stronger and larger
- It reduces body weight (it controls obesity)
- It prevents heart attack
- It makes the joints to become more flexible
- It makes the body physically fit
- It eases food digestion
- It helps the heart to pump more blood to the muscles
- It prevents sprains and strains
- It breaks fatigue (body weakness)

AIDS

- It is caused by a virus called **human immunodeficiency virus (HIV)**
- HIV affects the circulatory system, mainly the white blood cells
- HIV can only survive in the human body
- The incubation period of HIV is **1 to 4 weeks**

Write AIDS in full

- Acquired Immune Deficiency Syndrome

Give the meaning of each word in the full form of AIDS

- **Acquired:** got from (A person gets infected with it)
- **Immune Deficiency**: lack/weakness of immune system
- **Syndrome**: group/collection of signs and symptoms

OR

- **Acquired:** Got from
- **Immune**: Protected against
- **Deficiency**: Lack of
- **Syndrome**: group of signs and symptoms

Why can't HIV (AIDS virus) spread through mosquito bites?

- HIV is destroyed in the digestive system of a mosquito
- HIV is destroyed by the enzymes in the digestive system of a mosquito

Mode of transmission of HIV (how does AIDS spread?)

- Through playing unprotected sex with an infected person
- Through sharing sharp objects (e.g needles) with an infected person
- Through infected blood transfusion
- From an infected mother to the baby during birth or breastfeeding
- Through artificial insemination with semen from infected person
- Through a donated body organ from an infected donor

HIV STATUS

- A persons HIV status can either be **negative** or **positive**
- Antibody tests detect HIV in 3 months while rapid HIV tests detect HIV in about 20 minutes

HIV negative

- This means that a person does not have HIV

HIV positive

- This means that a person has HIV

How long does it take for most HIV tests to detect HIV?

- 3 months (90 days) after exposure

How does AIDS differ from HIV?

- AIDS is a disease while HIV is a germ

What is the difference between HIV positive person and HIV negative person?

- HIV positive person has HIV while HIV negative person does not have HIV

What is the difference between HIV positive person and AIDS patient?

- HIV positive person has not yet developed signs and symptoms while AIDS patient has signs and symptoms

Note

- Both AIDS patients and HIV positive persons can spread HIV

Why do people go for HIV test before marriage?

- To know their HIV status
- To prevent the spread of AIDS
- To prevent marriage in case one person is HIV positive

What does a red ribbon symbol mean about HIV/AIDS?

- For awareness and support to people living with HIV/AIDS (For the solidarity of people living with HIV/AIDS)

CONCORDANT COUPLE

- This is when both partners are HIV infected

DISCORDANT COUPLE

- This is when one partner is HIV infected and the other is not

How to prevent HIV transmission within a discordant couple

- Use condoms during sex
- HIV negative partner should use PrEP
- HIV positive partner must take ARVs daily

BODY FLUIDS IN WHICH HIV CAN SPREAD

- Blood
- Semen
- Vaginal fluids
- Breast milk

BODY FLUIDS IN WHICH HIV CANNOT SPREAD

- Tears
- Saliva
- Urine
- Sweat

SOCIAL PRACTICES THROUGH WHICH AIDS VIRUS (HIV) CANNOT SPREAD

- Hugging AIDS patient
- Shaking hands with AIDS patient
- Sharing latrines with AIDS patient
- Sharing utensils with AIDS patient
- Sharing bedding with AIDS patient
- Touching AIDS patient
- Sitting close to AIDS patients
- Washing clothes of AIDS patient
- Normal kissing AIDS patient

Why can't HIV/AIDS spread through the practices mentioned above?

- There is no mixing of blood

Practices that lead to easy spread of AIDS (habits that increase risks of HIV transmission)

- Sharing wives
- Inheriting widows
- Unscreened/Infected blood transfusion
- Massive circumcision with one knife
- Tribal tattooing
- Blood pacts
- Polygamy
- Prostitution
- Extra marital sex
- Premarital sex
- Unprotected casual sex
- Tribal tooth extraction
- Communal jigger extraction
- Ear and nose piercing

SIGNS AND SYMPTOMS OF AIDS

Signs of AIDS

- Skin rash/herpes zoster
- Rapid weight loss
- Severe night sweats
- Oral thrush (white coating in mouth)
- Chronic dry cough
- Chronic diarrhoea
- Sores on the mouth

Symptoms of AIDS

- General body weakness (tiredness)
- Chronic fever
- Loss of appetite

Conditions mistaken for AIDS

- Alcoholism
- Malnutrition

Diseases mistaken for AIDS

- Tuberculosis
- Typhoid
- Measles
- Skin cancer

EFFECTS OF HIV/AIDS TO;

An Individual

- It leads to loss of immunity
- It leads to loss of jobs (income)
- It leads to restricted movement to some countries
- It leads to much worry
- It leads to death

Family

- It leads to poverty in a family
- It leads to divorce
- It leads to stigma towards family members
- It reduces family labour force
- It increases orphans

Community

- It leads to loss of important people
- It leads to labour force
- It increases child headed families
- It reduces the population

PREVENTION AND CONTROL OF HIV/AIDS

- Abstain from sex
- Avoid sharing sharp objects with an infected person
- Be faithful to your sexual partner
- Use condoms during sex
- Taking PrEP or PEP to prevent getting HIV
- AIDS patients should take ARVs
- HIV positive women should not breastfeed
- Only screened blood should be used for transfusion
- HIV positive person should not donate blood
- Sterilize sharp medical instruments before use
- Consider male circumcision to reduce the risk of getting HIV

Mention two medicines given to HIV negative people to prevent getting HIV

- PrEP (pre-exposure prophylaxis)
- PEP (post-exposure prophylaxis)

PrEP is recommended for people with a high risk of getting HIV before exposure
PEP is recommended within 72 hours after exposure

Why are HIV negative people sometimes given PrEP or PEP?

- To prevent getting HIV

Write the following abbreviations in full

- **EMTCT:** Elimination of mother to Child Transmission of HIV
- **PMTCT**: Prevention of mother to Child Transmission of HIV
- **ARVs**: antiretrovirals
- **ART**: antiretroviral therapy
- **VHT**: Village Health Team
- **VCT**: Voluntary Counselling and Testing
- **HCT**: HIV Counselling and Testing

Why are AIDS patients advised to take ARVs?

- To reduce the risks of HIV transmission(to prevent them from spreading AIDS)
- To enable them live longer

How to prevent mother to child transmission of HIV

- Infected women should take ARVs during pregnancy
- Infected women should give birth from hospitals
- Infected women should practise bottle feeding

Importance of EMTCT and PMTCT program

- It prevents the infected mother from transmitting HIV to her babies
- EMTCT also prevents the transmission of syphilis from infected mother to the baby

GROUPS OF PEOPLE WITH A HIGH RISK OF GETTING HIV/AIDS

GROUP OF PEOPLE	REASON
Commercial sex workers (prostitutes)	They have many sexual partners They use sex to get money They are unable to have regular condom use

Barmaids	They can be forced into sex by drunkards They use sex to get money
Long distance truck drivers	They play casual sex to overcome lust They get female company to reduce stress while travelling
Health workers who care for AIDS patients	They can be stuck with contaminated needles
Alcoholics	They have unplanned and unprotected sex
Injection drug abusers	They share contaminated needles
Adolescent girls	They are sexually attractive They are vulnerable to rape They have peer groups

Why are the groups of people mentioned above recommended to take PrEP?

- To prevent them from getting AIDS

Reason why women are at a high risk of getting AIDS than men?

- They are sexually more attractive than men
- They are more vulnerable to rape than men
- They have more greed for material things (money) than men

WAYS OF CARING FOR AIDS PATIENTS

- Advising them to take ARVs
- Feeding them on a balanced diet
- Advising them to promote personal hygiene
- Counselling them
- Giving them company

HIV COUNSELLING

- This is the advice given to a person before or after HIV test by a trained person

Groups of trained people who provide HIV counselling

- Teachers
- Health workers
- Community leaders
- Religious leaders

Types of HIV counselling

- Pre-test HIV counselling
- Post-test HIV counselling

Importance of HIV counselling (importance of counselling AIDS patients)

- It prevents suicide
- It enables a person to live longer and useful with HIV
- It enables a person to prevent spreading HIV/AIDS to others
- It enables a person to overcome fear

ORGANIZATIONS IN UGANDA THAT HELP AIDS PATIENTS

Organization	Responsibilities
TASO (The AIDS Support Organization)	▪ It provides voluntary counselling and testing (VCT) ▪ It provides food supplements
AIC (AIDS Information Centre)	▪ It provides counselling
ACP (AIDS Control Program)	▪ It provides counselling ▪ It provides HIV testing
Uganda Cares	▪ It provides counselling ▪ It provides HIV testing
National AIDS Control Organization (NACO)	▪ It provides counselling ▪ It provides HIV testing

AIDS does not kill. What kills?

- Opportunistic infections (secondary infections)

SECONDARY INFECTIONS (OPPORTUNISTIC INOFECTIONS)

- These are infections that attack the body due to weak immune system

Examples of opportunistic (secondary) infections associated with HIV/AIDS

- Tuberculosis
- Pneumonia
- Candidiasis
- Meningitis

Ways of controlling opportunistic/secondary infections associated with HIV/AIDS

- Abstain from sex until marriage
- Be faithful to your sexual partner
- Use condoms during sex
- Avoid sharing sharp objects with infected person
- Avoid extra marital sex
- Learning more facts about HIV

URINARY TRACT INFECTIONS (UTIs)

- These are infections of the urinary system
- They are caused by bacteria called **E. coli** normally found in the intestines
- They usually occur in the urinary bladder and urethra
- They occur when bacteria from anus enter the urethra during sex

Why are UTIs very common in women?

- Their urethra is closer to the anus

Examples of Urinary Tract Infections (UTIs)

- Urethritis
- Cystitis

Signs of UTIs

- Smelly urine
- Bloody urine or cloudy urine
- Frequent urination
- Pus discharge from penis and vagina

Symptoms of UTIs

- Painful urination
- Pain in lower abdomen
- Pain during sex
- Fever

Effect of untreated UTIs

- They cause kidney infections

PELVIC INFLAMMATORY DISEASE (PID)

- This is an infection of the female reproductive organs

Causes of PID

- Untreated bacterial STDs (untreated gonorrhoea or chlamydia)
- Multiple sex partners

Signs of PID

- Abnormal bleeding after sex
- Smelly vaginal discharge
- Abnormal menstrual bleeding

Symptoms of PID

- Pain in lower abdomen
- Pain during sex
- Painful urination
- Fever

Dangers of untreated PID (effects of untreated STDs)

- Ectopic pregnancy
- Infertility (sterility/barrenness)
- Painful menstruation

How does untreated PID lead to infertility?

- It blocks the oviducts

GENERAL PREVENTION AND CONTROL OF STDs/STIs/VDs

- Abstain from sex until marriage
- Be faithful to your sexual partner
- Condom use during sex
- Avoid sex when under the influence of drugs
- Always have along with your partner before sex
- Keep the genital parts clean
- Keep latrines clean
- Immunisation with HPV vaccine

LIFE SKILLS TO SAFEGUARD AGAINST STDS

- Peer resistance
- Self-awareness
- Self esteem
- Assertiveness
- Critical and creative thinking
- Good decision making

PIASCY MESSAGES ABOUT ADOLESCENCE AND REPRODUCTIVE HEALTH

PIASCY

- This is a program that provides information on HIV/AIDS to school children and teachers

What does "PIASCY" stand for?

- Presidential Initiative on AIDS Strategy for Communication to Youth

Who initiated PIASCY program in Uganda?

- H.E Yoweri Kaguta Museveni (in 2002)

Objectives (aims) of PIASCY program

- To prevent the spread of HIV/AIDS
- To promote AIDS awareness

Importance of PIASCY messages

- They promote AIDS awareness
- They promote reproductive health
- They prevent the spread of HIV/AIDS
- They promote care for AIDS patients
- They prevent early pregnancy/teenage pregnancy (adolescent pregnancy)

EXAMPLES OF PIASCY MESSAGES FOR ADOLESCENTS

- Say no to sex (abstain from sex)
- Say no to early marriage
- Avoid gifts for sex
- Stay Virgin
- AIDS kills
- AIDS has no cure
- Choose to delay sex
- Virginity is healthy
- Early sex affects reproductive system
- HIV damages the immune system
- Avoid risks to stay safe
- Avoid bad touches
- Premarital sex is risky
- Follow your religion to stay safe
- Using violence to get sex is wrong
- Body changes at puberty are not signs to start sex
- Learn how AIDS is transmitted
- Avoid dark corners
- AIDS patients need care and support

TOPIC: ALCOHOL, SMOKING AND DRUGS IN THE SOCIETY

ALCOHOL

- This is a liquid substance that makes people drunk when taken in the body in excess

TYPES OF ALCOHOL

- Methanol (Methyl alcohol)
- Ethanol (Ethyl alcohol)

METHANOL

Methanol is made by **distillation**

- It is found mostly in home distilled alcohol.
- It is very dangerous and poisonous **because** it can cause blindness or death.
- It is always used in hospitals and industries
- It is used as fuel in cars and boats
- It is used to kill germs on (sterilize) medical instruments.
- It is used to clean wounds
- It is used to mix some drugs
- It is used to make paint remover

ETHANOL

- It is the main alcohol present in alcoholic beverages
- It is an addictive content in alcoholic drinks/beverages

METHODS OF MAKING/PRODUCING ALCOHOL

- Fermentation
- Distillation

FERMENTATION

- This is the use of yeast to turn sugary juice into alcohol
- ✓ Fermented juice of fruits is used to make wine
- ✓ Fermented cereal grains are used to make beer

Products during fermentation of alcohol

- Ethanol
- Carbon dioxide

Name the catalyst used during fermentation of alcohol

- Yeast

State the importance of yeast during fermentation

- Yeast contains an enzyme that speeds up fermentation of alcohol.

Name the enzyme in yeast that speeds up (catalyzes) fermentation

- Zymase enzyme

Besides yeast, name other organisms that help in fermentation

- Bacteria (e.g in fermentation of milk)

RAW MATERIALS USED TO MAKE FERMENTED ALCOHOLIC DRINKS

FERMENTED ALCOHOLIC DRINKS	RAW MATERIALS
Beer	Barley, water
Wine	Grapes, gooseberry
Tonto	Ripe bananas
Hard cider	Apple juice
Kwete	Sorghum, millet, maize, malt and boiled water
Malwa	Maize flour, millet, sorghum, water
Omuramba	Sorghum, water

- **Wineries** ferment grapes to make wine
- **Breweries** ferment barley, wheat and other grains to make beer

Why do most fermented drinks contain low level of alcohol?

- They have a lot of water

DISTILLATION

- This is the process of evaporating crude alcohol and condensing its vapour to obtain pure alcohol

Physical processes involved in distillation

- Evaporation
- Condensation

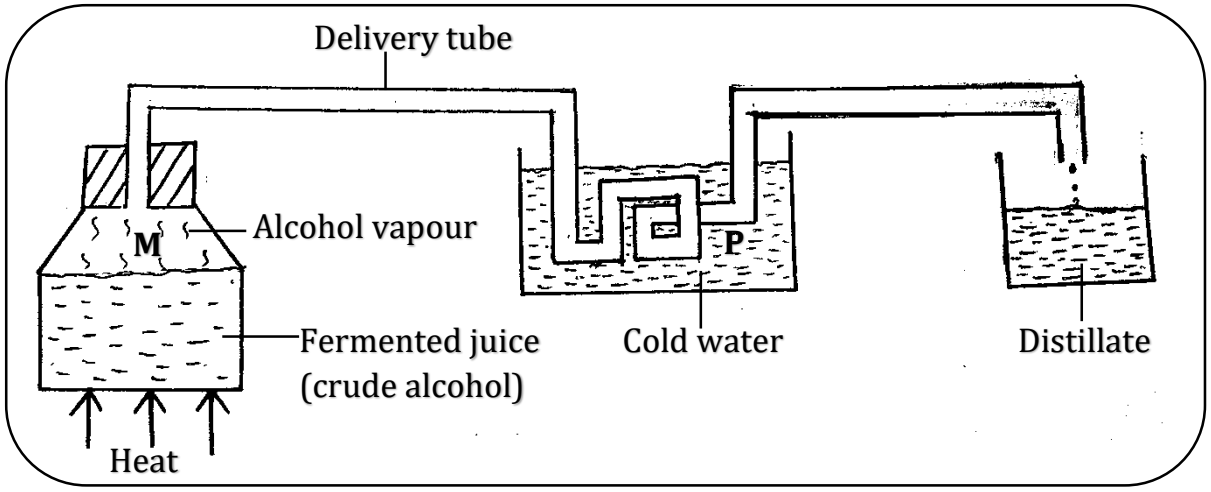
Besides evaporation and condensation, name other process involved in distillation

- Heating

Name the type of alcohol made by distillation

- Methanol (methyl alcohol)

A DIAGRAM SHOWING DISTILLATION METHOD OF MAKING ALCOHOL (METHANOL)



Name the physical processes M and P

- M is evaporation
- P is condensation

<u>State the importance of the cold water and heat in the process above</u>

Cold water

- To condense alcohol vapour

Heat (fire)

- To cause evaporation

Name the natural process that is similar to distillation

- Water cycle

In which way is distillation similar to water cycle?

- Both involve heating, evaporation and condensation

Name two materials always used to make the delivery tube

- Copper
- Aluminium
- Stainless steel

Why is the delivery tube always made out of copper and aluminium?

- They do not rust

What substance is contained in the delivery tube before it reaches cold water?

- Alcohol vapour

Why is the delivery tube passed through cold water?

- To condense alcohol vapour

Why is the delivery tube coiled as it is passed in cold water?

- To increase the surface area for condensation of alcohol vapour

What scientific name is given to the liquid substance collected by distillation?

- Distillate

Why does the first drop of drink collected contain more alcohol than water?

- Alcohol has lower boiling point than water

Give two medical uses of the distillate

- It is used to clean wounds
- It is used to kill germs on (sterilize) medical instruments
- It is used to clean the skin before an injection

<u>NOTE</u>

- The boiling point of alcohol is 78^0C
- The boiling point of alcohol is 100^0C

<u>EXAMPLES OF DISTILLED ALCOHOLIC DRINKS</u>

- Gin
- Whisky
- Waragi
- Vodka
- Brandy
- Rum
- Tequila

Advantage of distillation

- Alcohol collected is very concentrated

Disadvantages of distillation

- It can lead to burns and scalds.
- It is expensive to manage
- It needs much attention

Why is alcohol collected by distillation very concentrated?

- It does not contain water

<u>USES OF ALCOHOL</u>

- It is used as fuel in cars and boats
- It is used to kill germs on wounds
- It is sold for money
- It is used to mix some paints
- It is used as a drink on parties
- It is used to clean (sterilize) clinical thermometers
- It is used in hand sanitizers to kill germs on hands
- It is used in six's thermometers.
- It is used to pay dowry.
- It is used to make paint remover
- It is used to light pressure lamps
- It is used to mix some drugs in hospitals

State the importance of alcohol in six's thermometer

- It is used to measure the lowest temperature of the day

Why is alcohol used in six's thermometer?

- It has a very low freezing point

REASONS WHY PEOPLE DRINK ALCOHOL

- To pass time
- To quench thirst
- To fit in peer groups of alcoholics
- To celebrate their success
- Young people drink to show that they are mature
- To break boredom
- To show that they are rich.
- To be brave

Misconceptions (myths) about alcohol

- Alcohol improves mental performance
- Alcohol solves social problems

Alcoholism

Alcoholism is a condition where a person totally depends on alcohol.

OR.

Alcoholism is a condition that results from prolonged use of alcohol.

Who is an alcoholic?

This is a person addicted to alcohol.

Addiction

Addiction is a condition in which a person has a very strong desire to take alcohol every day.

A drawing showing alcoholics

Factors that lead to alcoholism

- Peer pressure
- Frustration
- Family back ground
- Seductive advertisements
- Social environment
- Idleness
- Stress

EFFECTS OF ALCOHOLISM TO AN INDIVIDUAL

- It leads to brain damage.
- Loss of appetite for food
- It leads liver cirrhosis (damages the liver)
- It worsens stomach ulcers
- Loss of jobs
- Self-neglect

Body organs affected by alcohol

- Brain
- Liver
- Stomach
- Pancreas
- Kidney
- Heart

How does alcohol damage the liver?

- It causes liver cirrhosis

How does alcohol worsen stomach ulcers?

- It leads to loss of appetite for food

EFFECTS OF ALCOHOLISM TO A FAMILY

- Family neglect
- It leads to poverty in a family
- It leads to antisocial behaviour among children
- It leads to domestic violence (child and spouse abuse)
- It leads to sex deviation like incest
- It leads to broken marriages.

EFFECTS OF ALCOHOLISM ON THE COMMUNITY

- It leads to truancy
- It increases road accidents.
- Ii increases the spread of HIV/AIDS
- It leads to high crime rates (e.g rape, defilement and robbery)
- It leads to verbal and physical abuse (e.g quarrels and disagreements)
- It leads to loss of important people
- Alcoholics become public nuisance

WAYS THROUGH WHICH THE BODY CAN REMOVE (GET RID) OF ALCOHOL

- Through urinating
- Through sweating
- It can be burnt up by the liver

Effects of alcohol to pregnant women

- Low birth weight
- Premature birth
- Miscarriage
- Still birth

Immediate effects of alcohol on people

- Slows down the action of the brain.
- Mumbling
- Double vision
- Forgetfulness
- Loss of respect for laws.
- Loss of body balance

Long term effects of alcohol

- Loss of appetite
- Stomach ulcers
- Liver cirrhosis
- Self-neglect
- Loss of jobs
- Swollen pancreas.
- Hand tremors (Shaking hands)

WAYS OF AVOIDING ALCOHOLISM/HEALTH LIFESTYLES TO AVOID ALCOHOLISM

- Avoid peer groups alcoholics
- Decide never to drink alcohol.
- Never believe in adverts that praise alcohol
- Join good social clubs (e.g sports clubs and church choir)
- Never drink alcohol to solve a problem.
- Learn more facts about dangers of alcohol.
- Take warnings about the dangers of alcohol seriously.

LIFE SKILLS TO SAFE GUARD AGAINST ALCOHOL

- Self-awareness
- Self esteem
- Assertiveness
- Peer resistance
- Proper decision making
- Critical thinking

LAWS GOVERNING ALCOHOL IN UGANDA

- All people below 18 years of age are not allowed to drink or sell alcohol in public places
- Drivers are not allowed to drink and drive: This is the **traffic law** on alcohol

To prevent road accidents

- All bars must be licensed
- Home distillation of alcohol is not allowed

It produces methanol which is poisonous (toxic)

- No one is allowed to transport or sell home distilled alcohol.

SMOKING

- This is the inhaling of tobacco smoke

A smoker is a person who smokes tobacco frequently.

Types of smoking

- Active smoking
- Passive smoking

Active smoking

- This is where a person inhales smoke directly from burning cigarette or smoking pipe.

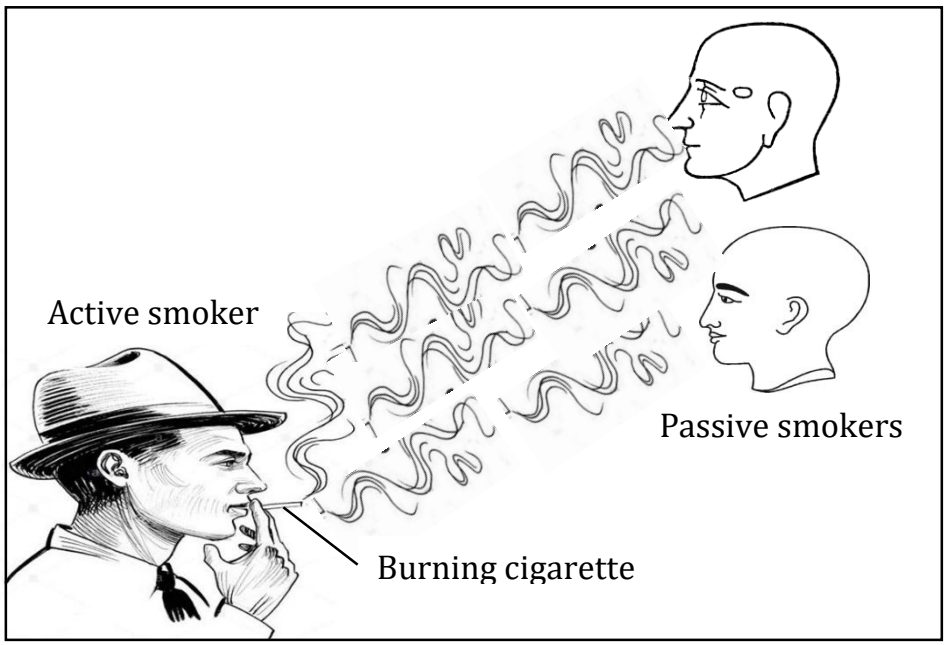
Passive smoking

- This is where a person inhales tobacco smoke from an active smoker.

Note

- **Active smoker** is a person who inhales smoke directly from burning cigarette or smoking pipe.
- **Passive Smoker** is a person who inhales tobacco smoke from an active smoker.

A diagram showing active and passive smokers



Dangerous drugs contained in tobacco

- Nicotine
- Tar

Poisonous chemicals contained in tobacco

- Tar

Addictive drug (substance) found in tobacco smoke

- Nicotine

Poisonous gases in tobacco smoke

- Carbon monoxide
- Hydrogen cyanide

Body organs damaged by smoking

- Lungs
- Mouth
- Brain
- Throat

How does nicotine affect human health?

- It rises blood pressure
- It constricts blood vessels

How does tar affect human health?

- It causes lung cancer
- It causes cancer of mouth lips and throat
- It makes stains teeth

Reasons why people smoke

- To pass time/ to relax
- To fit in groups of smokers (peer influence)
- To concentrate on work
- To feel warm
- To feel confident

- To look mature
- To look attractive
- Due to attractive advertisements on radios and televisions.

Conditions which may lead to smoking and alcoholism

- Boredom
- Stress
- Being idle

Factors which lead to smoking and alcoholism

- Ignorance
- Seductive advertisements
- Family background
- Peer pressure

<u>Effects of smoking to an individual (to the human body)</u>

- It causes some respiratory diseases
- It worsens some respiratory diseases
- It shortens one's lifespan
- It causes cancer of the mouth (lips) and throat
- It increases the risk of getting some circulatory diseases (heart attack and hypertension)
- It spoils the colour of teeth
- It worsens stomach ulcers

<u>Respiratory diseases caused by smoking</u>

- Lung cancer
- Emphysema
- Chronic bronchitis

<u>Respiratory diseases not caused by smoking</u>

- Asthma
- Pneumonia
- Tuberculosis

<u>Effects of smoking to pregnant women</u>

- Leads to premature births
- Leads to low birth weights
- Leads to miscarriages
- Leads to stillbirths

<u>Effects of smoking to the family</u>

- Leads to family neglect
- Family members may become passive smokers
- Leads to poverty at home
- Children may copy the habit
- Careless smokers can burn house property

<u>Effects of smoking to the community</u>

- Tobacco smoke causes discomfort to other people
- It leads to truancy among school children
- It leads to death of skilled people
- It leads to respiratory diseases among people

<u>How to avoid smoking</u>

- Do not believe in advertisements which praise cigarette smoking.
- Know that there is no good reason for smoking
- Keep away from smokers.
- Decide never to be an active smoker.
- Join good social groups like sports clubs.
- Keep yourself busy for example by reading novels.
- Destroy all things connected to smoking like cigarettes, lighter and ash trays.

How the ministry of health helps to reduce the increased number of smokers

- Putting a high tax on the sale of cigarettes
- Enforcing strict laws against smoking in public places
- Putting health warnings on cigarette packets.

Lifestyles to safeguard against smoking

- Keep away from people who smoke
- Never allow any body to convince you to smoke.

- Gather more information on dangers of smoking from health workers.
- Report your friends who smoke to the teachers or their parents for advice.
- Like games and sports during your free time.
- Never use your money to buy cigarettes.

Withdrawal effects of nicotine (smoking)

Qn. Mention two symptoms of an ex-smoker.

- Depression
- Severe sweating
- Convulsions
- Anxiety
- Restless
- Poor concentration on work
- Irritability

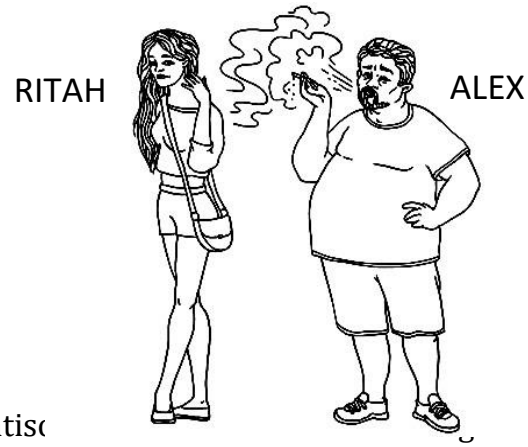
Note. The irritant substance in cigarettes is called Carcinogen.

Ways through which people use tobacco.

- By active smoking
- By passive smoking
- By sniffing tobacco powder in the nose
- By chewing tobacco leaves

ACTIVITY

1. (a) Explain the meaning of the term smoking.
   (b) Write down two types of smoking.
   (c) Which human body system is mainly affected by smoking?
2. (a) Identify the part of tobacco plant which is used in making of cigarettes.
   (b) Besides smoking, give other two ways people use tobacco.
   (c) Differentiate between active smoking and passive smoking.
3. ***Study the diagram below and use it to answer questions.***



   (a) Which antisc)ove?
   (b) Name the human body organ which is greatly affected by the habit above.
   (c) Which type of smoker is;
   (i) RITAH (ii) ALEX
4. (a) Why are tuberculosis patients discouraged from smoking?
   (b) Give two diseases caused by smoking.
   (c) Why does an active smoker find it difficult to stop his/her habit?
5. (a) Besides tuberculosis, name other disease worsened by smoking.
   (b) Name the two harmful substances found in tobacco.
   (c) Give any one factor that can lead to smoking.

6. (a) Write down two effects of smoking to a pregnant woman.
   (b) Why is it not advisable to sit near an active smoker?
   (c) How has the Ministry of Health helped to reduce the increased number of active smokers in Uganda?
7. (a) Identify the poisonous gas found in tobacco smoke.
   (b) Which components of tobacco cause the following effects?
   (i) Narrowing of blood vessels
   (ii) Staining of the teeth
   (c) Write down one lifeskill that can safeguard youth against tobacco smoking.
8. (a) Give two reasons why people smoke.
   (b) Besides tobacco, give one other drug commonly abused by youth.
   (c) Give any one way youth can protect themselves against smoking.

DRUGS

- A drug is a chemical substance which can affect physical and mental state of the body when taken
- It can either help or harm the body system.

Types of drugs

- Essential drugs
- Drugs of dependence

ESSENTIAL DRUGS

- These are drug which satisfy people's health needs when used properly.

<u>Examples of people's health needs</u>

- Relieving pain
- Preventing diseases
- Stopping conception
- Adding substances in the body
- Curing diseases

<u>Qualities/characteristics of essential drugs</u>

- Should be cheap
- Should be safe to use
- Should be effective
- Should be affordable
- Should be accessible
- Should be easy to administer
- Should have important curative value

<u>Examples of essential drugs</u>

- Aspirin
- Panadol
- Iodine; for wounds
- Paracetamol; for pain and headache
- Hedex
- Coartum
- Mexaquin
- Chloroquine; for malaria fever
- Mabendazole; for deworming
- Fancida
- BCG; for tuberculosis
- ORS; for dehydration
- Cough mixtures; for cough
- Tetracycline; for bacterial infections in eyes

- Penicillin; for fungal infections
- Iodine; for wounds
- Measles vaccine
- Paracetamol
- Mululuuza
- Lweza
- Nnalongo
- Enkejje

Groups or types of essential drugs

- Laboratory manufactured drugs
- Traditional (herbal) drugs

1. Laboratory manufactured drugs

- These are drugs which are manufactured and tested in laboratories.

Characteristics of laboratory manufactured drugs

- They are well tested.
- Their strength, stability and purity are known.
- They are the same for each quantity.
- Their effect on human health is known,
- They are well packaged.
- They are well sealed in water or air proof containers
- They are well labeled
- They have expiry and manufactured dates.

Examples of laboratory manufactured drugs

- Aspirin
- Chloroquine
- Quinine
- Fancida
- Hedex
- Panadol
- Coartem
- Mabendazole

GROUPS OF LABORATORY MANUFACTURED DRUGS

1. Preventive drugs
2. Curative drugs
3. Pain killer drugs
4. Contraceptive drugs

PREVENTIVE DRUGS

- These are drugs which prevent diseases.
- Preventive drugs are mainly vaccines

Examples of preventive drugs

- BCG vaccine
- Measles vaccine
- Polio vaccine

CURATIVE DRUGS

- These are drugs which cure diseases

Examples of curative drugs

- Chloroquine
- Quinine
- Mabendazole

PAIN KILLERS

- These are drugs which reduce or remove pain from the body.

Examples of pain killers

- Panadol
- Hedex
- Action
- Curamol

- Paracetamol

CONTRACEPTIVE DRUGS

- These are drugs which are used in family planning to avoid getting pregnancy.

Examples of contraceptive drugs

- Depo-Provera

TRADITIONAL DRUGS

- These are drugs which are locally made from raw plant and animal materials

Characteristics /qualities of traditional drugs

- They are made of raw plants and animals.
- Their strength, purity and stability changes
- They are of different quantities.
- Their effects on human health are not known.
- They are not well labeled.
- They are not well packaged.

EXAMPLES OF TRADITIONAL DRUGS

- Mululuuza
- Aleo vera
- Bombo
- Kakubasujja
- Kiffumufumu
- Enkejje

STORAGE OF DRUGS

- Drugs should be stored properly **to keep them safe.**

CONDITIONS UNDER WHICH DRUGS SHOULD BE STORED

1. **In a cool dry place**

✓ A cool place prevents the drug from being spoilt
✓ A dry place protects the drug from dampness

2. **In a dust free place**

✓ To prevent contamination

3. **Away from reach of children**

✓ To prevent poisoning among children

4. **Should not be exposed to direct sunlight**

✓ To prevent contamination of drugs

5. **Should be kept in well-sealed containers**

✓ To prevent contamination of drugs

DANGERS OF BUYING DRUGS FROM LOCAL SHOPS

- Drugs may be expired
- Drugs may be fake
- Drugs may not be prescribed
- Drugs may be contaminated

DRUG PRESCRIPTION

- This is the information written by a medical worker on how to use a drug.

FACTORS CONSIDERED WHEN PRESCRIBING DRUGS.

- Age of the patient

- Weight of the patient
- Type of the sickness
- Kind of previous drug
- Duration of sickness

CONTENT OF DRUG PRESCRIPTION

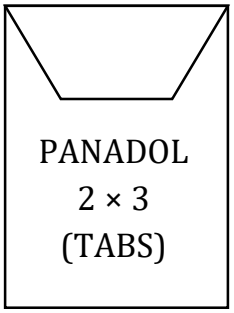
- **Name of the drug**
- **Dosage**

This is the amount of drug to take.

- **Duration of treatment**

This is the period we should take the drug

A DIAGRAM SHOWING DRUG PRESCRIPTION



- **Panadol** shows the name of the drug
- **2** shows the dosage
- **3** shows the duration of treatment

2 x 3 means "**take 2 tablets every after 8 hours**

ADVANTAGES OF DRUG PRESCRIPTIONS

- It prevents wrong dose (under dose and over dose)
- It prevents drug misuse
- It prevents poisoning
- It helps the patient to know the correct drug to use

OVERDOSE

- This is when a person takes more amount of drug than is required.

Causes of overdose

- Much fear for the disease
- Sweetness of some drugs
- Self-medication
- Drug misuse
- Keeping drugs in children's reach

Disadvantages of overdose

- It leads to poisoning
- It can lead to death
- It damages body organs

UNDERDOSE

- This is when a person takes fewer amounts of drugs than what is required.

Causes of underdose

- Much fear of the drugs
- Unpleasant smell of drugs

- Bitterness of some drugs
- Lack of money to buy a full dose
- Self-medication

Disadvantages of underdose

- The germs become more resistant to drugs.
- The disease is not likely to be cured.

INFORMATION MANUFACTURERS PUT ON A DRUG DURING PACKAGING AND BEFORE SELLING IT.

- Name of a drug
- Disease cured by a drug
- Dosage
- Duration of treatment
- Expiry date
- Manufactory date
- Composition of the drug
- Method of taking a drug e.g injection, swallowing or ointment

MANUFACTORY DATE OF A DRUG

- This is the date at which a drug was made.

EXPIRY DATE OF A DRUG

- This is the final date at which a drug is safe to use.

Dangers of taking expired drugs

- It leads to body poisoning
- It leads to death
- It damages body organs

Medical consultation

- This is when a patient goes to the medical worker to seek for help and advice.

Importance of medical consultation

- A patient gets prescribed drugs
- A patient knows the disease he/she is suffering from
- A patient gets counseling
- A patient gets advice on which drug to use.
- It prevents self-medication

SELF-MEDICATION

- This is the self-use of a drug without prescription

DANGERS OF SELF-MEDICATION

- It leads to drug misuse
- It leads to wrong dose
- It leads to poisoning

DRUG MISUSE

- This is the use of a drug without health worker's advice.

FACTORS THAT LEAD TO DRUG MISUSE

- Lack of money to buy a full dose of a drug
- Buying drugs from local shops
- Keeping drugs in children's reach
- Failure to follow drug prescription
- Self-medication
- Ignorance

How do people misuse drugs?

- Taking a drug when not sick
- Taking wrong dose (over dose or under dose)
- Sharing drugs for one patient

FORMS OF WRONG DOSE

- Over dose
- Under dose

DRUGS OF DEPENDENCE

- These are drugs which cause addiction after prolonged use.

An addiction to a drug

- This is a strong desire that makes a person feels uncomfortable when he or she does not use the drug.

DRUG DEPENDENCE

- This is the condition when the human body cannot function well without a particular drug.
- ✓ Drug dependence results from drug abuse

COMMON DRUGS OF DEPENDENCE

- Cocaine
- Caffeine
- Glue
- Aviation fuel
- Heroin
- Opium
- Shisha
- Alcohol
- Tobacco
- Marijuana (cannabis or bhang)
- Khat (miraa or mirungi)

GROUPS OR CLASSES OF DRUGS OF DEPENDENCE

- Narcotic drugs (Narcotics)
- Stimulants
- Sedative drugs (depressants)
- Hallucinogens

1. **Sedative drugs (depressants)** are drugs which slow down the activity of the brain.
They make a person feel drowsy and sleepy

- Alcohol
- Piriton
- Tranquilizers (calming drugs)

3. **Narcotic drugs** are drugs that dull the senses and relieve pain.

- Opium
- Morphine
- Heroin
- Codeine

4. **Hallucinogens** are drugs which make a person see, hear, feel or smell something which does not exist

- Cocaine
- Heroin

- Marijuana
- Peyote
- Mescaline

4. **Stimulants** are drugs which makes the brain more active.
They make a person feel lively.
- Caffeine
- Amphetamines
- Cocaine
- Tobacco

How do people abuse drugs? (How the drugs of dependence are taken in the body)?
- By sniffing e.g cocaine, heroin, glue and petrol
- By drinking e.g caffeine, alcohol
- By smoking e.g tobacco, opium, marijuana
- By chewing the leaves e.g heroine, miraa, tobacco
- By injecting into the body e.g heroin
- By swallowing e.g heroin

DRUG ABUSE
- This is the use of a drug in a way that is harmful to the body

Factors (conditions) that lead drug abuse
- Peer pressure
- Family back ground
- Ignorance
- Stress
- Frustration (many problems)
- To keep awake
- Much fear of the illness

Reasons why people abuse drugs/ take drugs of dependence
- To overcome fear
- To fit in peer groups of drug abusers
- To keep awake
- To reduce stress
- To forget problems
- Due to good advertisement
- To pass time
- To get sleep
- To get energy
- To concentrate on work

EFFECTS OF DRUGS OF DEPENDENCE/DRUG ABUSE TO;
1. An individual
- Brain damage
- Loss of appetite
- Insomnia (inability to sleep)
- Job neglect
- Self-neglect
- Low body immunity
- Imprisonment

2. The family

- Family neglect
- Child abuse
- Spouse abuse
- Broken homes
- Poverty in the family
- Children may become delinquents

3. The community

- It leads to increased accidents
- Criminal acts like rape
- Poor job performance
- Truancy: is the act of being absent from school without permission.
- Violence
- Impaired school performance

How can a school child avoid drugs of dependence/drug abuse?

- Avoid bad peer groups
- Learn more about dangers of drug abuse
- Join good social clubs like church choir
- Engage in games and sports during free time

LIFE SKILLS TO SAFE GUARD AGAINST ALCOHOL, SMOKING AND DRUG DEPENDENCE:

What are life skills?

- These are abilities and behaviour that help a person to effectively deal with the challenges of everyday life.

Examples of life skills

- Self-awareness
- Self esteem
- Assertiveness
- Peer resistance
- Responsible decision making
- Critical thinking
- Focus and self-control
- Empathy