

PARAMOUNT SCIENCE NOTES

PRIMARY FIVE

TERM ONE

THEME: SCIENCE IN HUMAN ACTIVITIES AND OCCUPATIONS

TOPIC: KEEPING OF POULTRY AND BEES

POULTRY KEEPING

- This is the rearing of domestic birds

POULTRY

- These are domestic birds

Types/examples of poultry

- | | | |
|------------|-----------|----------------|
| ▪ Chickens | ▪ Turkeys | ▪ Guinea fowls |
| ▪ Ducks | ▪ Geese | ▪ Pigeons |

Examples of poultry products

- | | | |
|--------|---------------------|---------|
| ▪ Eggs | ▪ Feathers | ▪ Bones |
| ▪ Meat | ▪ Poultry droppings | |

Reasons for rearing poultry (Why do farmers keep domestic birds?)

- | | |
|-----------------------------------|--|
| ▪ For egg production/to get eggs | ▪ For income after sale/to sell them for money |
| ▪ For meat production/to get meat | |

Importance (uses) of poultry to people

- | | |
|--------------------------------------|--|
| ▪ They provide eggs | ▪ Their feathers are used for decoration |
| ▪ They provide meat | ▪ Their feathers are used to make pillows |
| ▪ They are sold for money | ▪ Their feathers are used to make costumes |
| ▪ They are used to pay bride price | |
| ▪ Their droppings are used as manure | |
| ▪ Their bones are used to make glue | |

TERMS USED IN POULTRY KEEPING

TERMS	DESCRIPTION
Poultry (fowls)	▪ Domestic birds
Hen	▪ Adult female chicken
Cock	▪ Adult male chicken
Pullet	▪ Young female chicken
Cockerel	▪ Young male chicken
Capon	▪ Castrated male chicken
Chick	▪ Young bird
Incubation	▪ Providing of necessary conditions to a fertile egg to hatch
Incubation period	▪ Time taken by a fertilized egg to hatch
Incubator	▪ Machine used to hatch eggs
Layers	▪ Type of chickens kept for egg production
Broilers	▪ Type of chickens kept for meat production
Dual purpose chickens	▪ Type of chickens kept for both eggs and meat
Brooding	▪ Giving of special care to chicks below 8 weeks

Broody hen	▪ Hen incubating eggs to hatch them
Brooder	▪ Special structure in which chicks are cared for
Culling	▪ Removal of unproductive birds from the flock
Moultling	▪ Shedding of old feathers in birds

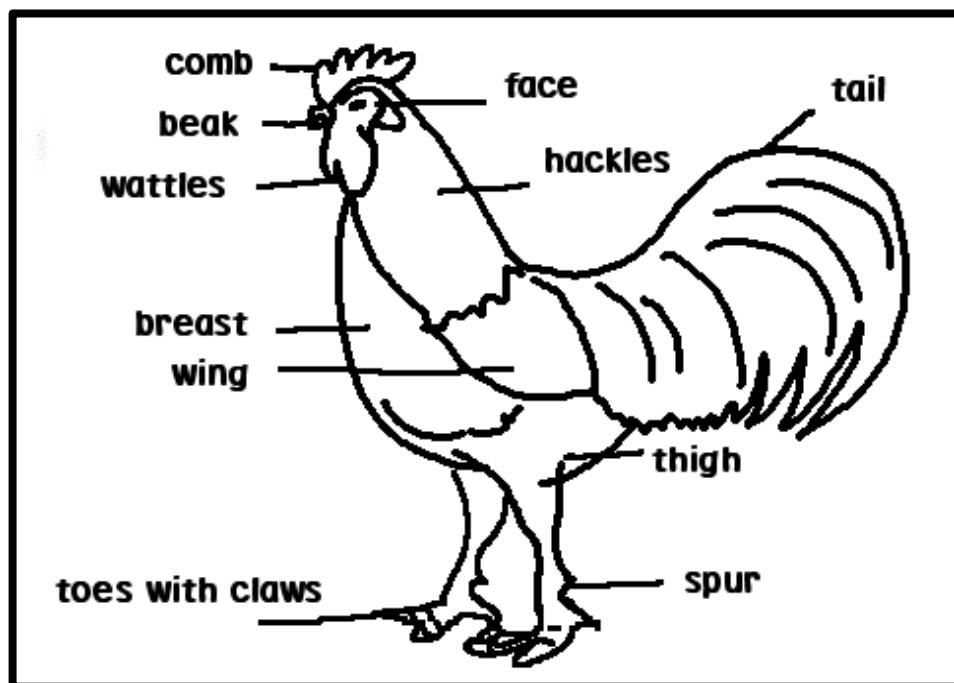
STRUCTURAL DIFFERENCES BETWEEN A HEN AND A COCK

- A hen has a small comb while a cock has a big comb
- A hen has a small wattle while a cock has a big wattle
- A hen has a short spur but a cock has a long spur
- A hen has dull feathers but a cock has bright feathers
- A hen has short hackle and tail feathers while a cock has long hackle and tail feathers

Why do cocks have brightly coloured feathers?

- To attract hens for mating

EXTERNAL PARTS OF A DOMESTIC BIRD



FUNCTIONS OF EACH PART

PARTS OF THE BIRD	FUNCTIONS
Eyes	For sight
Beak	For feeding (for picking up food) For protection For egg turning during incubation
Spur	For protection
Nostril	For smelling food
Legs	For walking
Toes with claws	For scratching
Wattle and comb	For temperature regulation

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

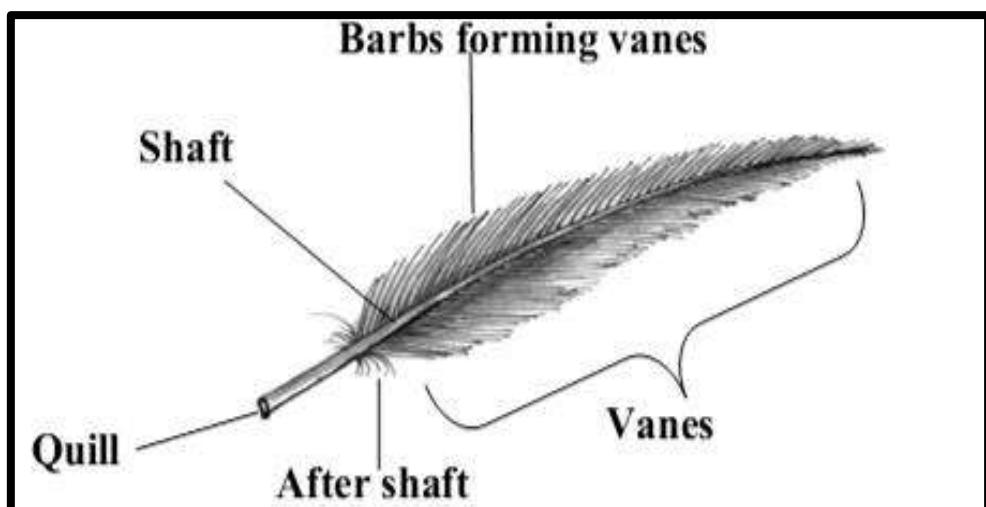
QUILL FEATHERS (FLIGHT FEATHERS)

- 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

- 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

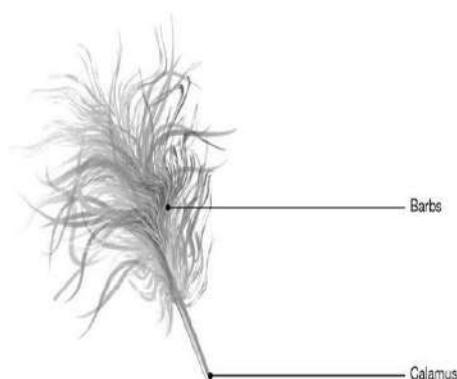
DOWN FEATHERS

- 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

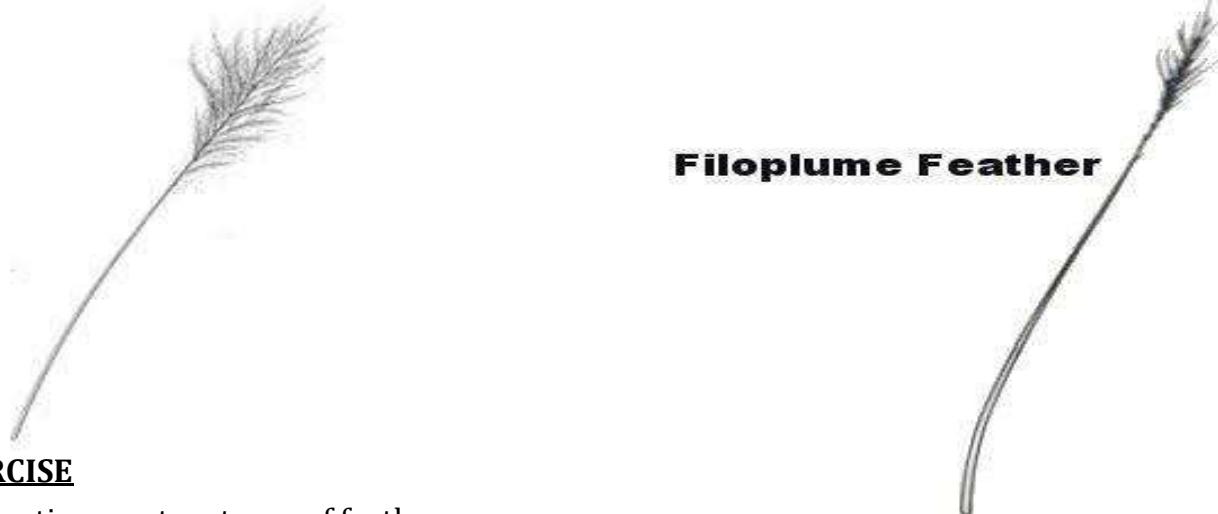


FILOPLUME FEATHERS

- 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



Filoplume Feather

EXERCISE

1. Mention any two types of feathers.
2. Give any two uses of feathers to a bird.
3. State any two ways people can make use of feathers.
4. Give the function of the following parts to a bird
 - i) Spur
 - ii) Beak
5. Name any one part of a bird where quill feathers are found.
6. Why do birds moult?
7. What type of feathers is shown below?



TYPES OF CHICKEN

- A type of bird is a group of chicken kept for a specific purpose.

There are three main types of chicken, namely:

- Broilers
- Layers
- Dual purpose chicken

BROILERS (HEAVY BREEDS OF CHICKEN/TABLE BIRDS/ROASTERS)

- These are chicken kept mainly for meat production.

Examples of broilers

- Light Sussex
- Plymouth Rock
- Jersey Giant

- Orpington

- Cornish white

- Sykes

LAYERS (LIGHT BREEDS OF CHICKEN)

- These are chicken kept mainly for egg production

Examples of layers

- White leghorn
- Brown egger

- Ancona
- Minorca

DUAL PURPOSE CHICKEN

- These are chicken kept for both egg and meat production.

Examples of dual purpose chicken

- | | | |
|--------------------|-----------------------|-----------------|
| ▪ Rhode island red | ▪ Turken (Naked Neck) | ▪ Brown leghorn |
| ▪ New Hampshire | ▪ Black Australorp | ▪ Buckeye |
| ▪ Malines | ▪ Speckled Sussex | |
| ▪ Kuroiler | | |

ACTIVITY

1. Give the meaning of the following terms.
 - i) Layers.
 - ii) Broilers.
2. Why do farmers keep table birds?
3. Give one example of layer birds commonly kept in Uganda.
4. How are Rhode Island Red chicken similar to Kuroilers?
5. Which food value do we get from eggs and meat of birds?
6. Give major reason why farmers keep dual purpose chicken on the farm.
7. Besides Light Sussex, give two other broilers kept in Uganda.
8. Suggest one way one can improve the production birds on the farm?
9. Which type of chicken would you keep for constant supply of eggs at the market?

BREEDS OF CHICKEN

- A breed of chicken is a group of chicken with similar characteristics.

Examples of breeds of chicken.

- | | | |
|-----------------|--------------------|-----------------------|
| ▪ Light Sussex | ❖ Brown egger | ✓ Turken (Naked Neck) |
| ▪ Plymouth Rock | ❖ Ancona | ✓ Black Australorp |
| ▪ Jersey Giant | ❖ Minorca | ✓ Speckled Sussex |
| ▪ Orpington | ✓ Rhode Island Red | ✓ Brown leghorn |
| ▪ Cornish white | ✓ New Hampshire | ✓ Buckeye |
| ▪ Sykes | ✓ Malines | |
| ▪ White leghorn | ✓ Kuroiler | |

TYPES OF BREEDS OF CHICKEN

✓ Local breeds

✓ Exotic breeds

✓ Cross breeds

LOCAL BREEDS

- These are breeds which have existed in Uganda for a very long time e.g. Nganda, Nsoga and Nteso.
- They are also called **native** or **indigenous breeds**.

Characteristics local breeds

- They are resistant to bad weather conditions.
- They are resistant to diseases and parasites.
- They need less care
- They have mature slowly
- They lay few eggs.
- They produce less meat.
- They have different colours
- They can eat a variety of feeds

ADVANTAGES OF LOCAL BREEDS OVER EXOTIC BREEDS

- Local breeds are more resistant to diseases than exotic breeds.
- Local breeds are more resistant to bad weather than exotic breeds.
- Local breeds are need less care than exotic breeds.

WAYS OF IMPROVING THE LOCAL BREEDS OF POULTRY

- By cross breeding
- By regular vaccination
- By proper feeding

How to best can poultry farmers improve on their local breeds?

- By carrying out cross breeding

EXOTIC BREEDS

- These are breeds which were imported from other countries e.g. White leghorn, Plymouth Rock and Light Sussex.

Characteristics of exotic breeds

- They are vulnerable to bad weather conditions.
- They are vulnerable to diseases and parasites.
- They need much care.
- They have mature quickly.
- They lay many eggs.
- They produce a lot of meat.
- They produce good quality meat.
- They have the same colour.

ADVANTAGES OF EXOTIC BREEDS OVER LOCAL BREEDS

- They mature faster than local breeds.
- They lay more eggs than local breeds.
- They produce more meat than the local breeds.

CROSS BREEDS (HYBRIDS)

- These are breeds got when a local breed mates with an exotic breed.

Advantages of cross breeds over local breeds.

- They mature faster than the local breeds.
- They produce more meat than the local breeds.
- They lay more eggs than local breeds.

Advantages of cross breeds over exotic breeds.

- They are more resistant to diseases than the exotic diseases.
- They are more resistant to bad weather conditions than the exotic diseases.

CROSS BREEDING

- This is the mating of a local breed with an exotic breed.

Why do farmers carry out cross breeding among chicken?

- To improve the quality of their breeds

EXERCISE

1. a) What do you understand by the term '**a breed of chicken'**?
b) Besides local breeds, name any other two types of breeds of chicken.
c) State any one breed of chicken commonly kept in your locality.
2. a) Mention any two characteristics of local breeds of chicken.
b) Why do you think farmers who rear local breeds of chicken should carry out crossbreeding?
c) Give any one advantage of keeping local breeds of chicken.
3. a) Point out any two characteristics of exotic breeds of chicken.
b) Name any one exotic breed of chicken you know.
c) Why do most farmers prefer keeping exotic breeds of chicken to local ones?

SYSTEMS OF POULTRY KEEPING

- Free range system
- Deep litter systems
- Battery system/cage system
- Pen system/fold system

FREE RANGE SYSTEM

- This is when birds are left to move freely looking for their own food.
- In the evening, they come back for shelter

Why is free range system common in rural areas?

- There is enough land

Why is free range system not used in urban areas?

- There is inadequate/limited land
- It needs a big piece of land

Simple diagram to illustrate a free range system



Advantages of free range system

- It is cheap to manage
- It saves time
- Birds get balanced diet
- Birds make enough body exercise
- Birds need little care
- It controls poultry vices

Why is free range system regarded as the cheapest system of poultry keeping?

- The farmer doesn't buy poultry feeds

Disadvantages of free-range system

- It needs a big piece of land
- Birds can easily be stolen
- Birds can easily be killed by predators/vermins/wild animals
- Birds can easily get diseases/there is easy spread of poultry diseases
- Birds can easily destroy crops
- Birds can easily be poisoned
- Eggs can easily get lost
- It is difficult to keep farm records
- It is difficult to cull birds/culling is difficult

What are vermins?

- These are wild animals that attack and harm domestic animals

Deep litter system

- This is when the birds are kept and fed indoors with a floor covered with litter

Simple diagram to illustrate

Advantages of deep litter system

- Many birds are kept in a small space

- Birds are protected from bad weather
- Birds are protected from predators
- Birds are protected from thieves
- Culling is easy
- It is easy to collect manure
- It is easy to collect eggs
- It is easy to keep farm records

Why is deep litter system regarded as a commercial system of poultry keeping?

- Many birds are kept in a small space

Why do poultry farmers in urban areas always use deep litter system?

- Due to limited land/there is shortage of land

Disadvantages of deep litter system

- | | |
|--|---|
| <ul style="list-style-type: none"> ▪ It is expensive to manage ▪ Birds do not make enough body exercises ▪ Birds do not get balanced diet | <ul style="list-style-type: none"> ▪ It needs much attention ▪ Poultry vices are common ▪ There is easy spread of diseases due to overcrowding |
|--|---|

LITTER

- Litter are soft materials put on the floor of a poultry house.

Examples of materials commonly used as litter

- | | |
|--|--|
| <ul style="list-style-type: none"> ▪ Coffee husks ▪ Wood shavings. | <ul style="list-style-type: none"> ▪ Crushed maize cobs. ▪ Crushed groundnut shells. |
|--|--|

Why is saw dust not recommended to be used as litter?

- It is poisonous to birds when eaten.

IMPORTANCE OF LITTER

- It prevents dampness in the poultry house (it keeps the poultry house dry)

By absorbing moisture from poultry droppings

- It prevents breaking of eggs

By absorbing shock

- It keeps the floor of a poultry house warm

By reducing heat loss

DISADVANTAGES OF LITTER

- It hides parasites
- Some litter is poisonous to birds when eaten

QUALITIES OF GOOD LITTER

- It should be clean
- It should be dry
- It should not be poisonous to birds

NOTE

- Litter should be kept dry and turned regularly

To prevent dampness in the poultry house

- Old litter should be removed from the poultry house

To prevent ectoparasites like chicken mites

Give two importance of old litter collected from a deep litter house.

- It is used as manure in crop gardens.
- It is used in biogas production

BATTERY SYSTEM (CAGE SYSTEM)

- This is when birds are kept in small cages
- 1 to 3 birds are always kept in each cage
- The cage has a slightly sloping floor to allow rolling of the eggs into the wire trough

ADVANTAGES OF BATTERY SYSTEM (CAGE SYSTEM)

- It prevents contamination of poultry feeds
- It reduces poultry vices
- It reduces loss of eggs
- Eggs laid remain clean (Clean eggs are collected)
- Culling is easy
- Many birds can be kept on a small land
- Birds are protected from predators/vermins/wild animals
- It is easy to collect manure
- It is easy to keep records of individual birds

How does battery cage system reduce loss of eggs?

- It prevents contact of birds with their eggs
- It separates eggs from birds

DISADVANTAGES OF BATTERY CAGE SYSTEM

- It is expensive to manage
- It needs a lot of labour
- Birds do not make enough body exercises
- Birds do not get balanced diet

A SIMPLE DIAGRAM SHOWING BATTERY SYSTEM/CAGE SYSTEM



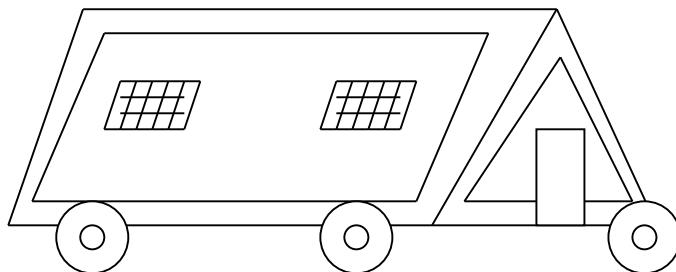
PEN SYSTEM (FOLD SYSTEM)

- This is when the birds are kept inside a small movable house
- The movable house used in this pen system is called pens, folds or arks
- The pen or fold is moved to a new place daily

Importance of a pen to the birds.

- It provides shade to the birds
- It protects birds from predators
- It protects birds from bad weather

A simple structure of fold / pen system



Advantages of pen system

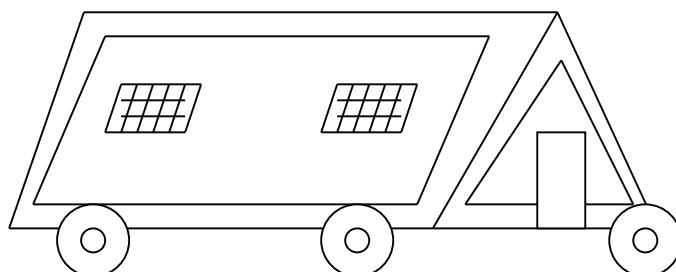
- Birds cannot destroy crops
- Birds are protected from predators
- Birds are protected from bad weather
- Poultry feeds are not wasted

Disadvantages of fold pen system

- Few birds are kept
- Birds do not make enough body exercises
- Folds get old quickly
- Much labour is needed to move the folds daily
- It is expensive to make the pen
- It needs big land since folds are moved to new places daily

Activity

1. a) Which system of keeping poultry minimizes fowl vices?
b) Besides minimizing fowl vices, mention any **two** other advantages of the above named poultry system.
c) Write down any **one** disadvantage of the poultry system named in 'a' above.
2. **The diagram below shows a structure used in a certain system of keeping poultry. Study it carefully and answer the questions that follow.**



- a) Name the system of keeping poultry shown in the diagram above.

- b) What scientific name is given to the above portable house shown above?
- c) Point out any one advantage and disadvantage of the above poultry system.
 - i) Advantage
 - ii) Disadvantage

POULTRY MANAGEMENT PRACTICES (daily/routine activities on a poultry farm)

- Debeaking
- Record keeping
- Vaccination
- Deworming
- Culling
- Dusting
- Egg collection
- Cross breeding
- Housing
- Feeding
- Regular cleaning

DEBEAKING

- This is the shortening of the upper beak of a bird

An illustration showing debeaking

Importance of Debeaking

- It controls poultry vices (egg eating, cannibalism and feather pecking)

How does debeaking control poultry vices?

- It makes the bird's beak blunt

Danger of debeaking to a bird

- It can damage the tongue of a bird

DEWORMING

- This is the giving of drugs to animals through the mouth to kill worms

Reasons / Importance of deworming

- It controls endoparasites in animals (it kills intestinal worms in animals)

METHODS OF DEWORMING

- Drenching
- Dosing

i) DRENCHING

- This is the giving of liquid drugs to animals through the mouth to kill worms
- It is done using a **drenching gun, syringe or bottle**

A drawing showing a drenching gun.



ii) DOSING

- This is the giving of solid drugs to animals through the mouth to kill worms
- It is done using a **bolus gun**

FEEDING POULTRY

- This is the providing of food to poultry

Reasons for proper feeding poultry

- To enable birds grow well
- To enable birds produce more eggs and meat
- To keep the birds healthy
- To enable the birds get energy

CHICKEN MASH

- These are chicken feeds crushed into small pieces

Components of chicken mash

- | | |
|--------------|-------------------|
| ▪ Maize bran | ▪ Sunflower seeds |
| ▪ Fish meal | ▪ Snail shells |
| ▪ Bone meal | ▪ Cotton seeds |

Why are poultry feeds always mixed with grit?

- For easy crushing of food in the gizzard

TYPES OF MASH (CHICKEN FEEDS)

MASH/CHICKEN FEEDS	CHICKENS	AGE
Chick mash/starter mash	chicks	1 day to 8 weeks
Growers mash	Growing layers	8 weeks to 16 weeks
Layers mash	Layers	16 weeks onwards
Broilers mash	Broilers	3 weeks onwards

CHICKEN AND DUCK MASH

- It is fed to a chick from 1 day to 8 weeks
- A chick needs about 40 grams per day of chick mash
- Chick mash has a lot of proteins **to give the chick a fast growth**

GROWERS MASH

- It is fed to growing layers from 8 weeks to about 16 weeks
- It contains less calcium than the layers mash

LAYERS MASH

- It is fed to layers at 16 weeks onwards
- It is introduced once the birds have started to lay eggs

Why are crushed snail shells always added to layer mash?

- To provide calcium to the birds

Why do layers sometimes lay soft shelled eggs?

- Due to lack of calcium in their diet

Why should layer mash contain a lot of calcium?

- To enable birds lay hard shelled eggs

BROILERS MASH

- It is fed to broilers at 3 weeks onwards
- It enables broilers to produce more meat

Reasons why birds should be fed on green vegetables?

- To provide vitamins and mineral salts to birds
- To keep the busy to prevent vices

Why is it not advisable to feed birds on vines and tobacco leaves?

- They are poisonous (toxic) to birds

FEEDING EQUIPMENT FOR BIRDS

- **Food trough**

It is where poultry feeds are put for the birds to eat

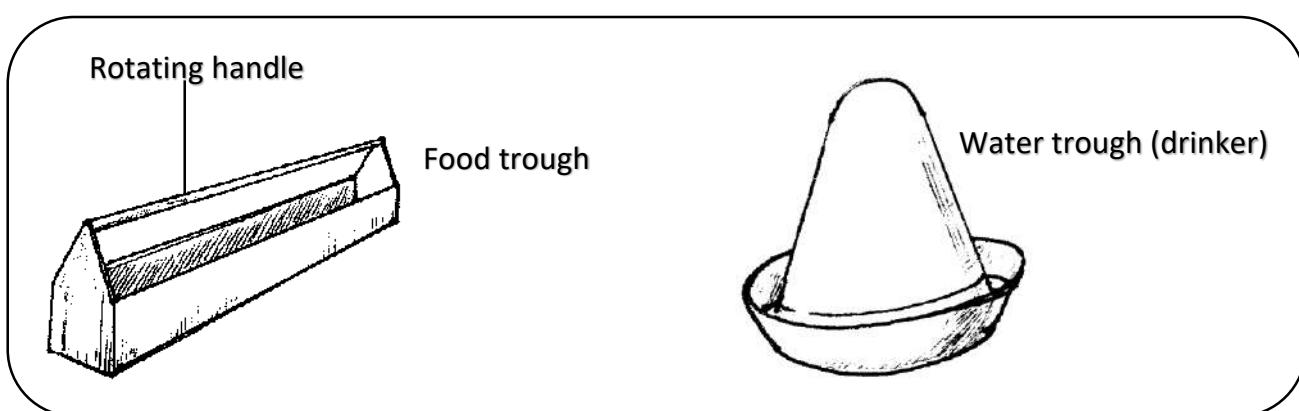
- **Water trough (drinker)**

It is where water is put for the birds to drink

NOTE

- A food trough has a spinning/rotating handle **to prevent food contamination by the birds**

DIAGRAMS SHOWING FEEDING EQUIPMENT FOR BIRDS



EXERCISE

1. Which routine activity helps to reduce egg eating on a poultry farm?
2. How is drenching different from dosing?
3. Give one reason why birds need to be fed properly.
4. What is chicken mash?

5. What type of feeds are suitable for the following:
 - a) Chicks
 - b) Broilers
 - c) Layers of 8-16 weeks
6. What is the danger of failure to include calcium in layer's mash?
7. How are vegetables hung in a poultry house useful?
8. How are the following containers important in a poultry house?
 - a) Drinker
 - b) Food trough

HOUSING POULTRY

- This is the providing of shelter to birds

REASONS FOR PROPER HOUSING POULTRY

- To protect birds from bad weather
- To protect birds from predators/vermins/wild animals
- To protect the birds from thieves
- To prevent eggs from getting lost

QUALITIES OF A GOOD POULTRY HOUSE

- It should be well ventilated
- ✓ To allow free air circulation
- It should have dim light
- ✓ To prevent egg eating among layers
- It should have enough space for the birds
- ✓ To prevent poultry vices
- It should have strong doors
- ✓ To prevent attack from predators
- It should be well roofed
- ✓ To prevent leaking of rain water
- It should be clean and dry
- ✓ To prevent easy spread of diseases

CULLING

- This is the removal of unproductive birds from the flock

Examples of unproductive birds that should be culled

- Sick birds
- Off layers
- Birds with vices

Ways of culling

- Slaughtering/killing
- Selling
- Isolation

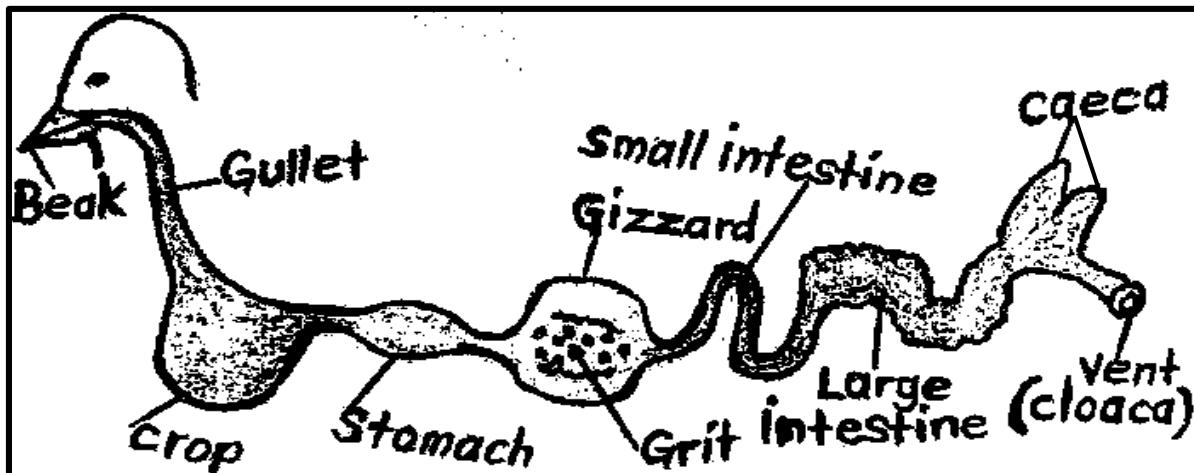
CROSS BREEDING

- This is the mating of a local breed with an exotic breed
- Local breed + Exotic breed = crossbreed (hybrid)

Why do poultry farmers carry out cross breeding?

- To improve the quality of their breeds

DIGESTIVE SYSTEM OF A 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

ACTIVITY

1. Give any one importance of proper housing to poultry.
2. State any two qualities of a good poultry house.
3. Why should a poultry house be well roofed?
4. What is culling as used in poultry management?
5. Write down any one method of culling.
6. What name is given to a breed got after mating a local breed with an exotic one?
7. Besides cross breeding, how else can poultry farmers improve the quality of their local breeds?
8. How is a crop useful to a bird during digestion?
9. What do we call the small stones found in the gizzard of a bird?
10. How are teeth in human beings similar to the gizzard in birds?

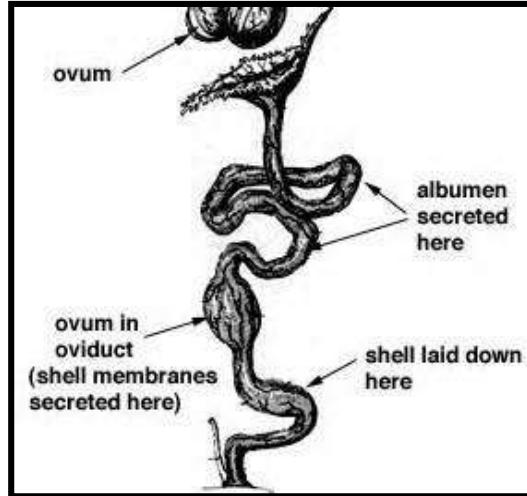
DEVELOPMENT OF AN EGG

- An oviduct of a hen contains thousands of ova (eggs)
- After fertilization the yolk, egg white or albumen develop
- The hen undergo internal fertilization

NOTE

- Eggs can only be fertilized before the formation of albumen (egg white)

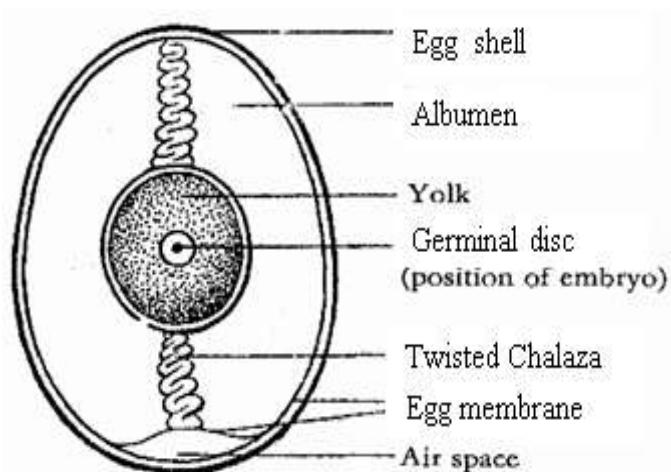
A SIMPLE STRUCTURE OF AN OVIDUCT OF A HEN



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

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

FUNCTIONS OF AN EGG TO THE EMBRYO

- It protects the embryo
- It provides food to the embryo

ABNORMALITIES IN BIRD'S EGGS

- Blood and meat spots
- Soft shells
- Double yolks
- Yolklessness

KINDS OF ABNORMAL EGGS OF BIRDS

- Blood stained eggs
- Soft shelled eggs
- Double yolked eggs
- Yolkless eggs

QUALITIES OF A GOOD EGG

- It should have an oval shape
- It should have a porous egg shell
- It should be hard shelled
- It should be clean

FACTORS THAT MAY MAKE AN INCUBATED FERTILE EGGS FAIL TO HATCH

- When the egg is soft shelled
- When the egg has two yolks
- When the egg has no yolk
- When the egg has meat spots/blood spots
- When the egg is very dirty
- When the egg has a crack
- When the egg is boiled

ACTIVITY

1. How do birds reproduce?
2. Which type of fertilization do birds undergo?
3. In the space below, draw an egg and show the following parts; **yolk, chalaza, albumen, and air space.**



4. Give any one function of the yolk to an embryo.
5. Which part of an egg grows into a chick?
6. State any one abnormality found in eggs.
7. Mention any one factor that can prevent an egg from hatching into chick.

INCUBATION PERIOD

- This is the provision of necessary conditions for a fertilized egg to hatch

INCUBATION PERIOD

- This is the time taken by a fertilized egg to hatch

INCUBATION OF DIFFERENT BIRDS

- Pigeons – 16 days (2 weeks, 2 days)
- Hens – 21 days (3 weeks)
- Turkeys – 28 days (4 weeks)
- Ducks – 28 days (4 weeks)
- Geese – 28 days (4 weeks)
- Guinea fowls – 28 days (4 weeks)

INCUBATION

- This is the providing of necessary conditions to a fertilized egg to hatch

Conditions necessary for incubation

- Warmth (optimum temperature)
- Moisture (Humidity of 60%)

To prevent eggs from drying up

- Egg turning

To prevent the embryo from sticking to the shell membrane

- Good oxygen supply

For respiration of the growing embryo inside an egg

TYPES OF INCUBATION

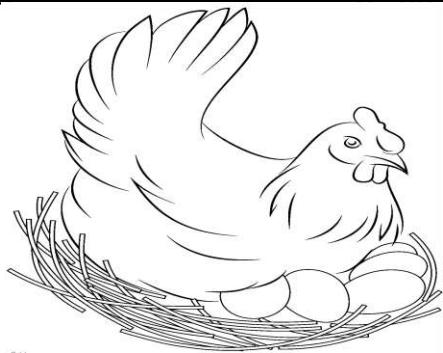
- Natural incubation
- Artificial incubation

NATURAL INCUBATION

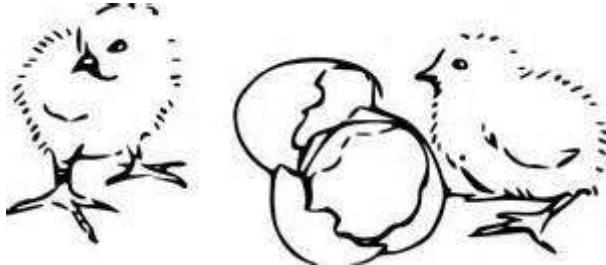
- This is when a hen sits on the eggs to hatch them

- **A broody hen** is a hen incubating the eggs
- The broody hen usually comes off to feed and gets little exercise

Diagram of a hen incubating eggs



A chick hatching from an egg



WAYS OF CARING FOR A BROODY HEN

- Provision of clean dry nest
- Provision of food to a broody hen
- Provision of shelter to a broody hen
- Protection of the broody from vermins (rats and snakes)
- Provision of dim light in the place

ADVANTAGES OF NATURAL INCUBATION

- It is cheap and easy to manage
- Chicks get extra care from the mother hen
- Chicks get protection from the mother hen

DISADVANTAGES OF NATURAL INCUBATION

- Few chicks are hatched at a time
- Some eggs are not hatched
- The mother hen may eat the eggs
- The mother hen may not be good at incubation
- Eggs are not tested for their fertility
- In case the broody hen dies, the eggs may not hatch

Why is natural incubation not good for commercial farmers?

- Few chicks are hatched at a time

ARTIFICIAL INCUBATION

- This is when an incubator is used to hatch eggs

INCUBATOR

- This is a machine used to hatch eggs

Types of incubators

- | | |
|-----------------------|-----------------------|
| ▪ Electric incubators | ▪ Kerosene incubators |
|-----------------------|-----------------------|

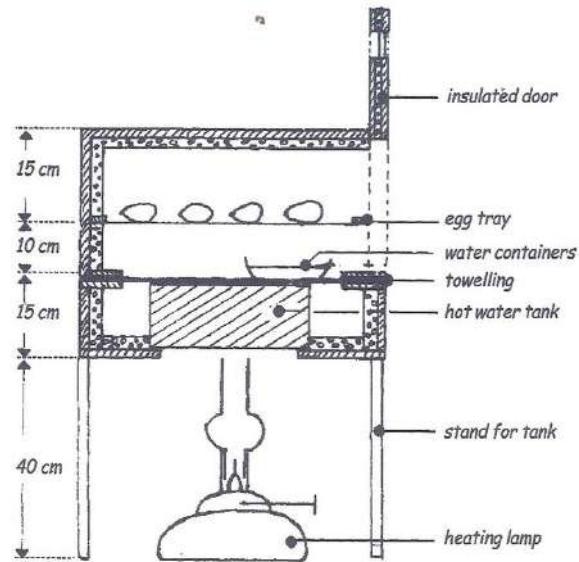
Electric incubators

- These are incubators that use electricity to provide warmth

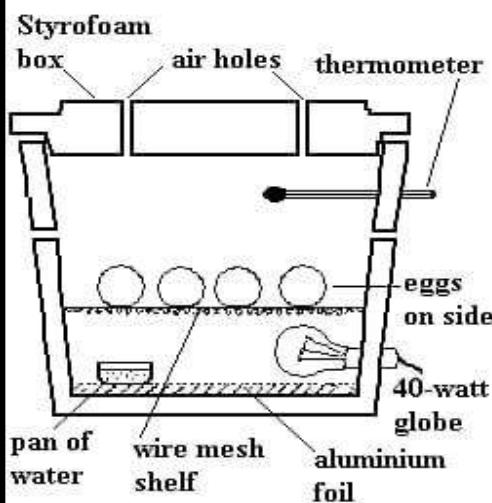
Kerosene incubators

- These are incubators that use kerosene to provide warmth

A diagram showing an incubator



50.3.6.4 Electric incubator



A clutch:

- This is a group of eggs in a nest or incubator

How are the following important in an incubator?

Thermometer

- ✓ It helps to regulate temperature in an incubator

Heater (Heating lamp/infrared bulb)

- ✓ It provides warmth to the eggs

ADVANTAGES OF ARTIFICIAL INCUBATION

- Very many eggs are hatched at a time
- Eggs are tested for their fertility
- All eggs are hatched

Why is artificial incubation good for commercial farmers?

- Very many eggs are hatched at once

DISADVANTAGES OF ARTIFICIAL INCUBATION

- It is expensive
- It needs much attention
- It needs skilled labour
- It is tiring
- Eggs can be affected in case of frequent black out or load shedding

BROODING

- This is the giving special care to chicks below 8 weeks

Examples of special care given to chicks

- Food
- Warmth
- Shelter

WAYS OF CARING FOR CHICKS BELOW 8 WEEKS

- By giving them food
- By giving them warmth
- By giving them shelter

How is shelter important to chicks?

- It protects them from bad weather
- It protects them from predators

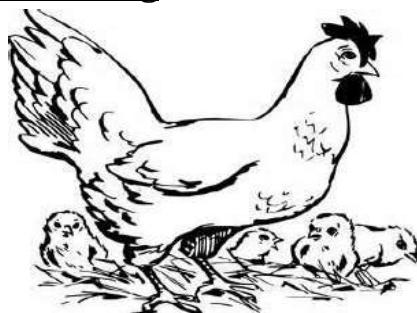
TYPES OF BROODING

- Natural brooding
- Artificial brooding

NATURAL BROODING

- This is the type of brooding where a mother hen takes more care of her chicks.
- Farmers may also provide more food and security to the mother hen and chicks.

A diagram showing natural brooding



ADVANTAGES OF NATURAL BROODING

- It is cheap
- It reduces poultry vices among chicks
- The chicks get security from the mother hen

DISADVANTAGES OF NATURAL BROODING

- Chicks can be killed by bad weather
- Chicks can be eaten by predators
- Few chicks are cared for
- It gives little profits
- In case the hen dies, chicks are left without care

ARTIFICIAL BROODING

- This is the type of brooding where chicks are kept in a brooder.

BROODER

- This is a special structure in which chicks are cared for

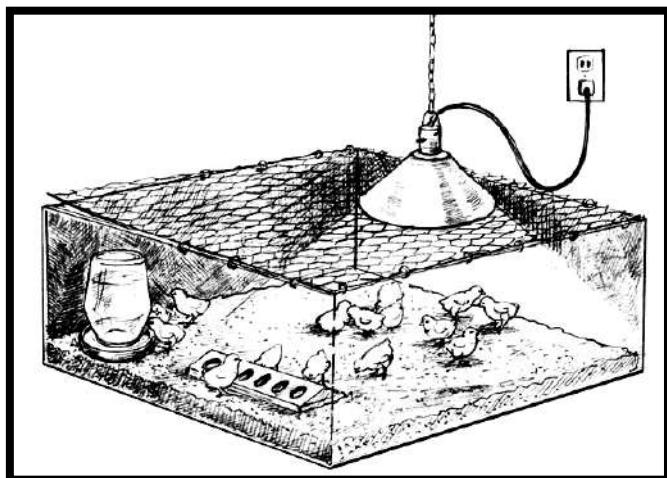
TYPES OF BROODERS

- Infrared brooder
- Kerosene brooder
- Charcoal brooder

INFRARED BROODER

- This is the type of brooder which uses electricity as a source of heat.

A simple diagram of infrared brooder



- The infrared lamp is raised to prevent the chicks from being burnt

Importance of infrared lamp

- It provides light
- It provides warmth

Advantages of using an infrared brooder

- It does not produce soot
- It is easy to use

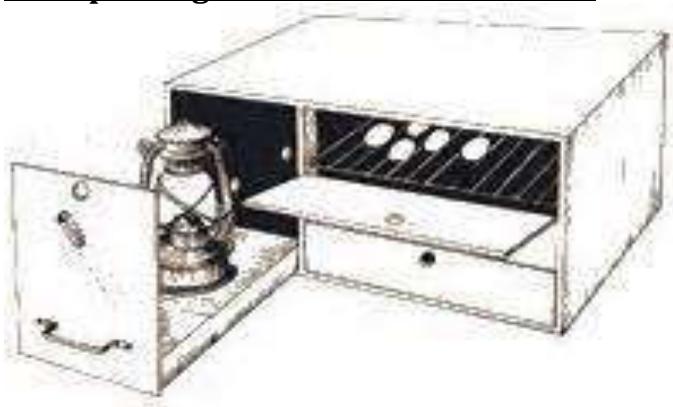
Disadvantages of using an infrared brooder

- It is expensive to manage
- It cannot be used in areas without electricity

KEROSENE BROODER

- This is the type of brooder which uses kerosene as a source of heat

A simple diagram of Kerosene brooder



- The kerosene lamp has guards to prevent chicks from being burnt

DANGERS OF A KEROSENE LAMP IN A BROODER

- It may burn the chicks
- It leads to accumulation of soot

CHARCOAL BROODER

- This is the type of brooder which uses charcoal as a source of heat

A simple diagram of charcoal brooder



- The charcoal stove has guards/charcoal is put in a pot **to prevent chicks from being burnt**

DANGERS OF A CHARCOAL STOVE IN A BROODER

- It may burn the chicks
- It produces smoke that can suffocate the chicks

ACTIVITY

1. How is brooding different from incubation?
2. Give any one condition necessary for eggs to hatch.
3. How is egg turning important during incubation?

Study the diagram below carefully and answer questions 4 - 6.



4. What type of incubation is shown in the diagram above?
5. Give any one disadvantage of the above type?
6. How can a farmer care for the above broody hen?
7. Mention any one type of incubators.
8. Why do commercial farmers prefer artificial incubation?
9. Give any one care chicks get from mother hens.
10. State any one advantage of natural brooding.
11. What is a brooder?
12. Write down any two types of brooders?
13. How is a lamp important in a brooder?

POULTRY VICES (FOWL VICES)

- These are bad habits in poultry

EXAMPLES OF POULTRY VICES

- Egg eating
- Feather pecking
- Toe pecking
- Cannibalism

Cannibalism

- This is when a bird eats flesh of other bird

Egg eating

- This is when layers eat their eggs

Feather pecking

- This is when a bird uses a beak to pull off feathers of other bird

CAUSES OF POULTRY VICES

- Overcrowding of birds
- Boredom among birds
- Too much light around laying nests
- Lack of poultry feeds
- Failure to collect eggs in time
- Failure to provide enough poultry feeds
- Failure to remove broken eggs from poultry house

CONTROL OF POULTRY VICES

- By Debeaking
- By culling
- By putting perches in the poultry house
- By providing enough space for the birds
- By providing enough food to poultry
- By collecting eggs in time
- By providing dim light in layers' house
- By putting laying nests in dark corners
- By removing broken eggs as soon as possible
- By providing green vegetables to birds

EFFECTS OF POULTRY VICES

- Death of poultry
- Retarded growth
- Loss of eggs
- Poor quality meat

POULTRY DISEASES

- These are diseases that affect domestic birds.

Causative agents of poultry diseases (types of germs that cause poultry diseases)

- Virus
- Bacteria
- Protozoa

EXAMPLES OF POULTRY DISEASES

Viral poultry diseases

- Fowl pox
- Avian leucosis
- Newcastle disease
- Gumboro disease
- Marek's disease

SIGNS OF NEWCASTLE DISEASE

- ✓ Greenish diarrhoea
- ✓ Drooping wings
- ✓ Sneezing
- ✓ Nasal discharge

Protozoan poultry diseases

- Coccidiosis
- Blackhead

Bacterial poultry diseases

- Fowl typhoid
- Pneumonia

SIGNS OF COCCIDIOSIS

- ✓ Bloody diarrhoea
- ✓ Ruffled feathers
- ✓ Coughing
- ✓ Rapid weight loss
- ✓ Drooping wings

GENERAL CAUSES OF POULTRY DISEASES

- Poor sanitation in the poultry house
- Poor feeding of poultry
- Poor housing of poultry
- Poor ventilation of the poultry house

CONTROL OF POULTRY DISEASES

- Regular vaccination
- Regular cleaning of the poultry house
- Culling
- Proper ventilation of the poultry house
- Proper housing of poultry

EFFECTS OF DISEASES IN POULTRY

- Death of poultry
- Poor growth of poultry
- Drop in egg production
- Poor quality eggs and meat

PARASITES OF POULTRY

- **A parasite** is an organism that depends on host for survival (food and shelter)
- **A host** is an organism from which a parasite gets food and shelter
- A parasite depends on a host for **food** and **shelter**.

TYPES OF PARASITES OF POULTRY

- Ectoparasites (External parasites)
- Endoparasites (Internal parasites)

1. ECTOPARASITES

- These are parasites that live on the body of a host

EXAMPLES OF ECTOPARASITES IN POULTRY

- Lice
- Chicken mites
- Fleas
- Fowl ticks

2. ENDOPARASITES

- These are parasites that live inside the body of a host.
- They are found in the intestines affecting the process of food digestion

EXAMPLES OF ENDOPARASITES IN POULTRY

- Tapeworm
- Hookworm
- Threadworm (pinworm)

GENERAL CAUSES OF POULTRY PARASITES

- Keeping poultry in dirty houses
- Feeding poultry in dirty equipment
- Providing dirty feeds to poultry
- Irregular deworming

EFFECTS (DANGERS) OF PARASITES ON POULTRY

- They suck blood which leads to anaemia
- They create wounds on skin of birds
- They lead to reduction in egg production
- Some ectoparasites cause diseases (chicken mites cause Mange)
- They lead to stunted or poor growth of birds
- They may lead to death of poultry

CONTROL OF PARASITES IN POULTRY

- Regular deworming
- Use of pesticides to kill external parasites
- Regular cleaning of the poultry house
- Providing clean feeds to poultry
- Feeding poultry in clean equipment
- Applying Vaseline or paraffin to kill ectoparasites

FARM RECORDS

- These are written information about different activities done on a farm

TYPES OF FARM RECORDS

- Production records
- Health records
- Labour records
- Sales and expenses records
- Feeding records
- Inventory records
- Breeding records

REASONS FOR KEEPING FARM RECORDS

- To know the profits or losses
- To be taxed fairly
- To get loans easily
- To plan for the farm
- To know the farm history
- To make proper decision

AN EXAMPLE OF PRODUCTION RECORD

Paramount Poultry Farm

P.O. Box 711

Wakiso

(a) Month: November 2021

(b) Breeds of chicken: White Leghorn

(c) Age of the flock: 18 weeks

(d) Number of birds: 1000

Number of broken eggs	Date	Morning	Afternoon	Total	Remarks
50	24.11.21	650	300	950	Egg eating
-	25.11.21	680	320	1000	Debeaking was done

SOCIAL INSECTS

- These are insects that live and work together

EXAMPLES OF SOCIAL INSECTS

- Some bees e.g honeybees and bumblebees
- Wasps
- Termites
- Ants e.g white ants, red ants, black ants and safari ants

GROUPS OF BEES

- Solitary bees
- Social bees

1. SOLITARY BEES

- This is a group of bees that live and work alone

EXAMPLES OF SOLITARY BEES

- Mason bees
- Leafcutter bees
- Mining bees
- Carpenter bees
- Sweat bees

2. SOCIAL BEES

- These are bees that live and work together

EXAMPLES OF SOCIAL BEES

- Honeybees
- Bumblebees

APICULTURE

- This is the keeping of honey bees
- ✓ A group of bees is called a **bee colony**
- ✓ A group of bees in motion is called a **bee swarm**
- ✓ A person who rears honeybees is called an **apiarist**
- ✓ A place where many bee hive are kept is called an **apiary**
- ✓ A habitat for bees is called a **bee hive**

IMPORTANCE OF BEES TO PLANTS AND PEOPLE

PEOPLE

- Bees provide honey
- Bees provide beeswax
- Bees provide pollen and propolis
- Apiculture project is a source of employment

PLANTS

- Bees pollinate flowers on crops

DANGER OF BEES IN THE ENVIRONMENT

- They sting people and animals

FACTORS THAT LEAD TO BEE STINGS (WHAT CAUSES BEES TO STING?)

- | | |
|--|---|
| <ul style="list-style-type: none">▪ Honey harvesting during day time▪ Honey harvesting without a smoker▪ Using cosmetics made from beeswax▪ Making a lot of noise near the hive | <ul style="list-style-type: none">▪ Standing in path of bee swarm▪ Playing near the hive▪ Crushing a bee near a hive▪ Chasing away bees with naked hands |
|--|---|

FIRST AID FOR BEE STINGS

- Apply ice pack to reduce pain and swelling
- Use your fingernail to remove the stinger from the skin
- Wash the sting area with water and soap remove residual bee venom
- Apply a paste of baking soda and water to reduce pain and swelling

MAIN BEE PRODUCTS (MAIN PRODUCTS GOT FROM HONEY BEES)

- Honey
- Beeswax
- ✓ Honey is kept in **honey combs**

Other bee products

- **Propolis:** It is used to heal cuts and wounds
It is used to make office glue
- **Bee pollen:** It is rich in proteins
- **Bee venom:** It is used to make antivenin for bee stings
- **Royal jelly:** It is rich in vitamin B

USES OF HONEY TO PEOPLE

- It is used as food
- It is used to sweeten tea
- It is used as medicine for burns and cough
- It is used to make alcohol
- It is used in baking (to make breads)
- It is a source of income when sold

Why does honey take long to get spoilt?

- It is acidic and contains little moisture

Which food values do we get from the following bee products?

- **Honey:** Carbohydrates
- **Pollen:** Proteins
- **Royal jelly:** Vitamins

BEESWAX

- It is produced by wax glands inside the body of a honey bee
- Beeswax is used by bees to build honey combs

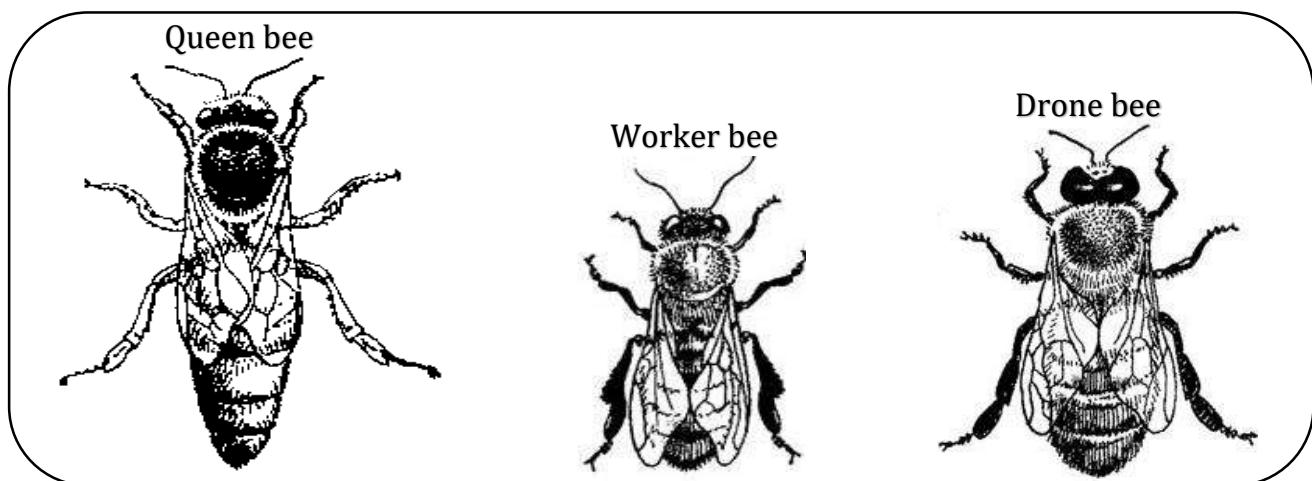
PRODUCTS FROM BEESWAX

- | | |
|---|--|
| <ul style="list-style-type: none">▪ Wax candles▪ Shoe polish▪ Lip balm▪ Skin cream | <ul style="list-style-type: none">▪ Chewing gum▪ Aftershave▪ Cosmetics▪ Crayons |
|---|--|

TYPES OF BEES IN A BEE HIVE (CASTES OF HONEYBEE)

- Worker bees
- Drone bees
- Queen bees

DRAWINGS SHOWING THE TYPES (CASTES) OF HONEYBEES



1. QUEEN BEE

- It is the mother bee in the bee hive
- It is head of the colony
- It develops from a fertilized egg
- Its main function is **to lay eggs** (She lays up to 1500 eggs a day)
- It is a fertile female bee **because** it has an ovipositor for laying eggs
- It is the largest bee in the hive
- Her abdomen and legs are longer than for others
- It has an **ovipositor** for laying eggs
- It is fed on special food called **royal jelly** by worker bees
- ✓ Royal jelly is produced by the salivary glands of worker bees
- The queen bee mate once in her life time and the sperms are stored in the sperm sac in her abdomen
- **Mating flight (nuptial flight)** is the flight in which the drone bee mates with the queen bee.
- There is only one queen bee in each hive/colony
- As soon as a new queen is hatched, swarming occurs (the old queen leaves the hive with some worker bees)

2. WORKER BEES

- Worker bees are sterile female bees **because** they lack an ovipositor
- They develop from fertile eggs
- They are the smallest bees in size
- They have a stinger **for protection**
- Worker bees die after stinging **because** its abdomen is damaged when the stinger is lost
- Worker bees form the biggest number in the hive **because** they perform all the duties in the hive
- They have a pollen basket **for carrying pollen and propolis**
- They use a proboscis **to suck nectar**
- They use a nectar sac inside their abdomen **to carry nectar**

ROLES OF A WORKER BEES IN THE HIVE

- They feed the queen, drone and grubs
- ✓ Worker bees which feed the queen are called **nurse bees**
- They guard the hive
- ✓ By stinging enemies
- They collect nectar, pollen, propolis and water
- They make honey
- ✓ Honey is made from water, nectar and pollen
- They clean the hive
- ✓ By removing the bodies of killed drone bees
- They repair the hive
- They build honey combs and brood combs
- ✓ They use wax to build combs
- They regulate temperature inside the hive
- ✓ By fanning the hive
- They look for a new site

PROPOLIS

- This is a mixture of wax, saliva and sap
- This is a sticky substance collected by worker bees from plants.

USES OF PROPOLIS TO BEES

- For repairing the hive
- For smoothing the hive
- For trapping dust and germs
- For making the hive water proof

USES OF PROPOLIS TO PEOPLE

- It is used to heal cuts and wounds
- It is used to make office glue

3. DRONE BEE

- It is a male bee in the hive
- It develops from **unfertilized eggs**
- It has a stout shape
- It is the second biggest in the hive
- Its main role in the colony is **to mate with the queen bee**
- It has a broad blunt (round bottomed) abdomen
- It has no stinger
- It makes a buzzing sound when flying
- It dies after mating **because** its male organs break off during mating hence damaging the abdomen
- Drones are rarely found in the hive **because** they are stung to death by worker bees during food shortage

ACTIVITY

1. Give the meaning of the following terms as used in keeping honey bees.
 - a) Apiculture
 - b) Apiary
 - c) Apiarist
 - d) Bee colony
 - e) Bee swarm
2. Why are honeybees called social insects?
3. Name any one product got from bees
4. Why do bees visit flowers?
5. How do people make use of honey?
6. How do crops benefit from the act of bees visiting them?
7. Name the special food on which the queen bee feeds?
8. How is an ovipositor important to queen bees?
9. Name the female sterile bee in the hive
10. Give any two characteristics of worker bees.
11. Why does a worker bee die soon after stinging?
12. State any one structural difference between a drone bee and a queen bee.
13. Mention any two roles of worker bees in the hive.
14. Which type of bees make a buzzing sound?

THE LIFE CYCLE OF A HONEY BEE

- Honey bees undergo **complete life cycle** (4 stages of development)
- The queen bee lays eggs
- Eggs develop into larvae
- Bee larvae are called **grubs**
- **Grubs** are fed by worker bees
- Larvae develop into pupae
- Larvae and pupae are found in **brood combs**
- The pupae neither feed nor move
- Pupae develop into adult bees

TYPES OF EGGS LAID BY QUEEN BEE

- Fertilized eggs
- Unfertilized eggs

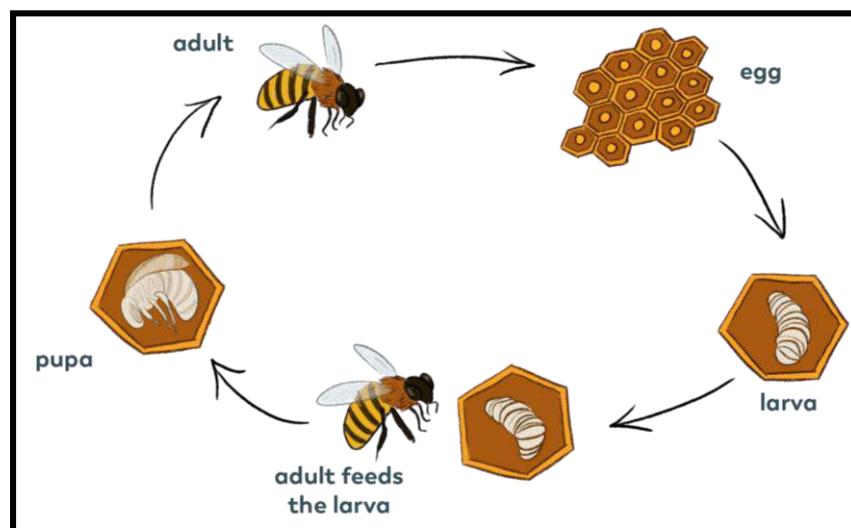
Note:

- ✓ Fertilized eggs develop into **queens** and **worker bees**
- ✓ Unfertilized eggs develop into **drone bees**
- ✓ The adult stage in the life cycle of insects is called **imago**

What makes fertile eggs to either develop into a queen or worker bee?

- The change of food during the larva stage
- ✓ Larvae to develop into worker bees are fed on **honey** and **pollen**
- ✓ Larvae to develop into queen bees are fed on **royal jelly**

A diagram showing the life cycle of bees



SWARMING IN BEES

- ✓ This is when a portion of a bee colony leaves the hive looking for a new hive
- ✓ This is the massive movement of bees from one place to another looking for a new hive.

ABSCONDING IN BEES

- ✓ This is when all bees leave the hive.
- ✓ This is when bees completely abandon the hive.
- They leave behind pollen, unhatched eggs and young bees that cannot fly.

REASONS FOR SWARMING IN BEES (CAUSES OF SWARMING IN BEES)

- Overcrowding of bees in the hive
- When the hive is damaged (leaking)
- Attack from enemies of bees
- When a new queen bee develops
- Old queen/infertile queen
- When bees have been attacked by a certain disease
- Bad smell around the hive
- A lot of noise around the hive+
- Direct smoke into the hive
- Direct sunshine into the hive
- Lack of flowering plants and water in an area
- Dampness of the bee hive

REASONS FOR ABSCONDING IN BEES (CAUSES OF ABSCONDING IN BEES)

- Attack from enemies of bees
- Overcrowding of bees in the hive
- Drought conditions (Lack of flowering plants and water in an area)
- Direct sunshine into the hive

HOW TO PREVENT SWARMING AND ABSCONDING IN BEES

- Siting a beehive near flowering plants
- Siting a beehive near open water sources
- Keeping agrochemicals away from the hive
- Feeding bees during drought conditions
- Siting a beehive in a quiet place / noise free place
- Protecting the beehive from direct sunshine
- Protecting bees from their enemies
- Protecting the hive from strong wind

BEE HIVE

- This is a habitat for bees
- This is a structure in which bees are kept

TYPES OF BEEHIVES

- Traditional (local) beehive
- Modern beehive

i) **TRADITIONAL BEEHIVES**

- These are bee hives made out of local materials e.g. hollow logs, grass, woven sticks, cow dung and reeds.

EXAMPLES OF TRADITIONAL (LOCAL) BEEHIVES

- Kigezi beehive
- Dug out log hive
- Tin hive

DRAWINGS SHOWING TRADITIONAL BEEHIVES

ADVANTAGES OF TRADITIONAL (LOCAL) BEE HIVE

- It is cheap to buy
- The colony is not always disturbed by a bee keeper
- It is easy to make

Why?

- Materials are locally available

DISADVANTAGES OF LOCAL BEE HIVE

- Honey is always mixed with eggs
- The hive is damaged during honey harvesting
- It is difficult to inspect honey combs
- It is difficult to prevent swarming
- The brood is disturbed during honey harvesting
- It is wasteful

ii) MODERN BEEHIVES

- These are hives made from modern materials e.g. tins, wire mesh and iron sheets

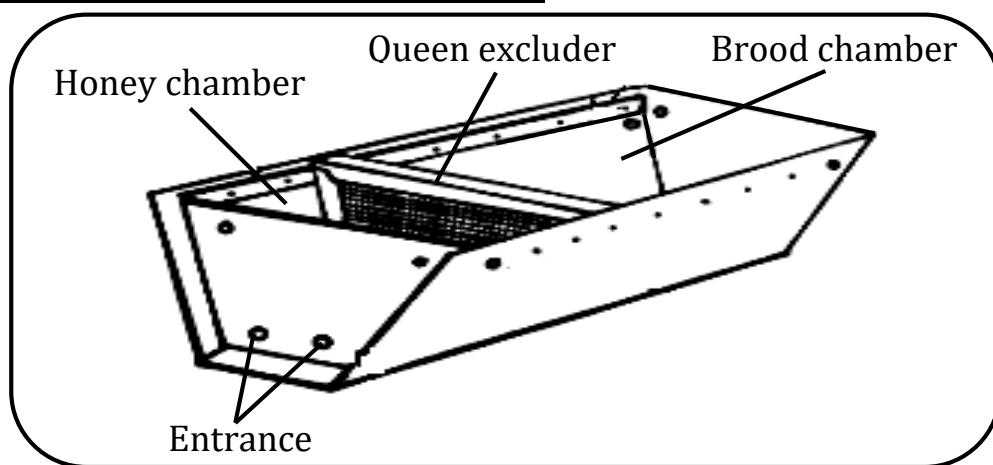
EXAMPLES OF MODERN BEE HIVES

- Top bar hive
- Box hive

CHAMBERS OF MODERN BEE HIVES

- Brood chamber
- Honey chamber

INTERNAL STRUCTURE OF A MODERN BEE-HIVE



IMPORTANCE OF EACH PART OF A MODERN BEEHIVE

ENTRANCE

- It is the passage of worker bees in and out of the hive

BROOD CHAMBER

- It is where honey is kept

HONEY CHAMBER

- It is where the queen, drone and the brood are found

QUEEN EXCLUDER

- This is the structure that separates the brood chamber and the honey chamber
- It has small holes to allow only the worker bees to pass through and feed the queen
- The queen cannot move to the honey chamber **because** it is too big to pass through the small holes in the queen excluder

IMPORTANCE OF QUEEN EXCLUDER IN A MODERN BEEHIVE

- It prevents the queen from laying eggs in honey
- It prevents the mixing of honey and eggs

ADVANTAGES OF MODERN BEEHIVES

- Clean honey is harvested
- They are durable (long lasting)
- The hive are not damaged during honey harvesting
- They are easy to inspect honey combs

DISADVANTAGES OF MODERN BEEHIVE

- It is expensive to make

ACTIVITY:

1. What name is given to the structure in which honey bees are kept?
2. Name any two materials from which traditional bee hives are made.
3. Point out any one example of local hives.
4. State any one advantage of using traditional bee hives.
5. Mention any one example of modern bee hives.
6. How is a queen excluder useful in a box hive?
7. Why do most bee keepers prefer modern bee hives to local ones?

HARVESTING HONEY

- This is the removal of honey combs from the bee hive
- ✓ Honey should be harvested in the evening **because** all the bees are inside the hive and calm

DISADVANTAGES OF HARVESTING HONEY AT NIGHT

- The brood may be crushed and contaminate honey

- It is difficult to separate brood combs and honeycombs

EQUIPMENT NECESSARY DURING HARVESTING HONEY AND THEIR IMPORTANCE

EQUIPMENT	IMPORTANCE
Bucket	To put in honey combs / for collection of honeycombs
Bee veil	To prevent worker bees from stinging the face of a honey harvester
Bee keeper's gloves	To prevent worker bees from stinging the hands of a honey harvester
Gumboots	To prevent worker bees from stinging the feet of the honey harvester
Protective clothing (Overall)	To prevent worker bees from stinging the body of a honey harvester
Smoker	To puff smoke that calms (tames) bees
Knife	To cut honey combs

STEPS FOLLOWED WHEN HARVESTING HONEY

1. Puff smoke into the hive
- ✓ To tame/calm the bees
2. Lower the hive
- ✓ To prevent damaging the honey combs
3. Open the hive
4. Cut the honey combs

NOTE:

- ✓ Some honey combs should be left in the hive **for the worker bees to get food as they build new ones**

A simple drawing showing an apiarist ready to harvest honey



FACTORS TO CONSIDER WHEN HARVESTING HONEY

- Don't frighten the bees while harvesting
- Don't kill bees while harvesting
- Dress properly in suitable clothes
- Use a smoker
- Bees should not be crushed while harvesting honey
- Only remove combs capped with honey
- Don't remove any honey combs containing brood

HONEY EXTRACTION

- This is the removal of honey from honey combs.

METHODS OF EXTRACTING HONEY

- Floating the wax
- Centrifuging method
- Pressing honey method
- Solar melter method

Of what use is a strainer during honey extraction?

- It is used to remove impurities from honey

SITING THE BEE HIVE (SETTING A BEE HIVE)

- This is the selecting of a suitable place where to put a bee hive

APIARY

- This is a place where many bee hives are kept or set

FACTORS TO CONSIDER WHEN SITING HIVES

- Bee hives should be kept in quiet places (bees don't like noisy places)
- Bee hives should be protected from direct sunshine and wind
- Bee hives should be in places near water source
- Bee hives should be in places near flowering plants
- Bee hives should not be near a school
- Bee hives should not be near farm animals
- Bee hives should not be near market place
- Bee hives should not be near main road and houses
- Bee hives should be in places with short grass

STOCKING THE HIVE

- This is the act of putting bees in an empty hive
- This is the act of encouraging bees to occupy an empty hive

WAYS OF STOCKING THE HIVE

- Use of a catcher box
- Use of a swarm catching net
- Smearing beeswax inside the new hive

DIAGRAMS SHOWING CATCHER BOX AND SWARM CATCHING NET

Note

- ✓ A swarm catching net has a longer handle to catch a higher swarm

BAITS IN BEE KEEPING

- These are things used to attract honeybees into a new hive

Examples of baits in bee keeping

- Beeswax
- Syrup (sugar solution)
- Lime juice
- Granulated sugar

FEEDING BEES

- Bees naturally feed on **nectar** from flowers

CONDITIONS THAT MAKE FARMERS PROVIDE SUPPLEMENTARY FEEDS TO BEES

- When the colony is new in a hive
- During the drought conditions
- To encourage multiplication

EXAMPLES OF SUPPLEMENTARY FEEDS FOR BEES

- Syrup (ordinary sugar mixed with water)
- Ordinary water put in a container at a distance of 10m from the hive

HANDLING OF BEES BY A BEE KEEPER (OCCASIONS WHEN A BEE FARMER HANDLES BEES)

- When harvesting honey
- When inspecting honey combs
- When stocking the hive

ENEMIES OF BEES (BEE PESTS)

- Safari ants **and** Red ants
- Hive beetles
- Wax moths
- Bee-killer wasps / beewolves
- Bee-eater birds
- Honey Badgers: These spoil the hives, kill bees and eat honey
- Termites
- Mice
- Moles
- Shrews

WAYS OF PROTECTING BEES FROM ENEMIES (BEE PESTS)

- Hang the hive between poles/ Raise the hive above the ground
- ✓ To prevent ants and termites from destroying the hive
- Smear oil at the bases of poles
- ✓ To prevent termites from destroying the poles holding the hives
- Put grease on the wires
- ✓ To prevent ants and termites from reaching the hive
- Repair broken hives
- ✓ To prevent honey badgers

DISEASES OF HONEY BEES

- American foulbrood
- Chalkbrood
- Nosema disease
- Sacbrood

CONTROL OF DISEASES IN HONEYBEES

- Keep the hive free from dampness
- Disinfect a hive where bees have died
- Burn all infected combs
- Maintain a strong healthy colony

TOPIC: MEASURES

REGULAR OBJECTS

- These are objects with definite shapes

EXAMPLES OF REGULAR OBJECTS.

- Cube e.g dice
- Cuboid e.g brick, box and block.
- Cylinders e.g chalk, pipe etc.
- Cone
- Sphere e.g basket ball
- Circle
- Triangle
- Square
- Rectangle
- Trapezium
- Kite

MEASURING REGULAR OBJECTS.

LENGTH

- This is the distance between points
- The standard unit of length / SI unit / base unit of length is **metre**

Other units for measuring length

- | | |
|--------------------|--------------------|
| ▪ Kilometres (Km) | ▪ decimetres (dm) |
| ▪ Hectometres (Hm) | ▪ centimetres (cm) |
| ▪ Decametres (Dm) | ▪ millimetres (mm) |

CAPACITY

- This is the amount of liquid a container can hold
- The SI base unit of capacity is **litres (L)**

Other units for measuring capacity

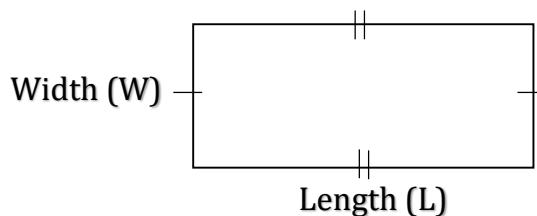
- millilitre (mL)

AREA

- Area is the amount of space occupied by a two-dimensional object
- Area is measured in **square units**
- The standard unit of area is **square metre (m^2)**

Examples of square units (units for measuring area)

- | | |
|---|---------------------------------|
| ▪ Square Kilometres (Km^2) | ▪ Square decimetres (dm^2) |
| ▪ Square Hectometres (Hm^2) | ▪ Square centimetres (cm^2) |
| ▪ Square Decametres (Dm^2) | ▪ Square millimetres (mm^2) |
| ▪ In two dimensional objects e.g squares and rectangles, the longer side is the length while the shorter side is the width. | |



VOLUME

- Volume is the amount of space occupied by a three-dimensional object.
- Volume is measured in **cubic units**
- The standard unit of volume is **cubic metre (m^3)**

Examples of cubic units (units for measuring volume)

- Cubic metres (m^3)
- Cubic centimetres (cc)
- Cubic millimetres (mm^3)

Why is it easier to transport a kilogram of stones than a kilogram of feathers?

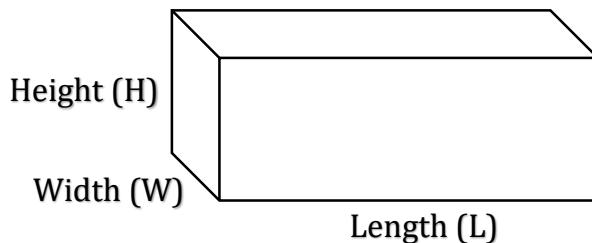
- A kilogram of stones occupies less space than a kilogram of feathers.
- A kilogram of stones has less volume than a kilogram of feathers.

Why does a kilogram of feathers take up more space than a kilogram of stones?

- A feather is less dense than a stone.

FINDING VOLUME OF REGULAR SHAPED OBJECTS

The volume of regular objects like cuboids e.g. boxes, blocks and bricks can be found after knowing their length, width and height.

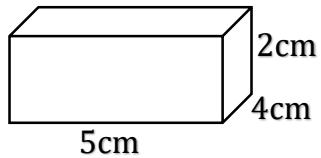


$$\text{Volume} = \text{Length} \times \text{width} \times \text{Height}$$

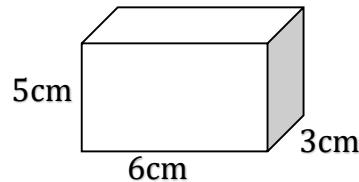
EXERCISE

1. Find the volume of the figures.

(a)



(b)



2. Find the volume of a brick of length 6cm width 4cm and height 3cm.

3. Find the volume of a cube whose side is 3cm.

IRREGULAR OBJECTS

- These are objects with indefinite shapes.

EXAMPLES OF IRREGULAR OBJECTS

- | | |
|----------------|------------|
| ▪ Stones | ▪ Mango |
| ▪ Keys | ▪ Padlock |
| ▪ Needles | ▪ Scissors |
| ▪ Broken glass | ▪ Pens |
| ▪ Orange | |

FINDING VOLUME OF IRREGULAR OBJECTS

- The volume of irregular objects is measured using **displacement method**.

EQUIPMENT USED IN DISPLACEMENT METHOD

- Water
- **Measuring cylinder**
- ✓ To measure the volume of displaced water
- **Overflow can (eureka can)**
- ✓ To pour displaced water into the measuring cylinder
- **String (thread)**

- ✓ To lower the irregular object gently into the container

CONTAINERS USED IN DISPLACEMENT METHOD

- Measuring cylinder
- Over flow can (Eureka can)

How are the containers above adapted to their functions?

- **Measuring cylinder:** It has a measuring scale
- **Over flow can :**It has a spout which directs displaced water into the measuring cylinder

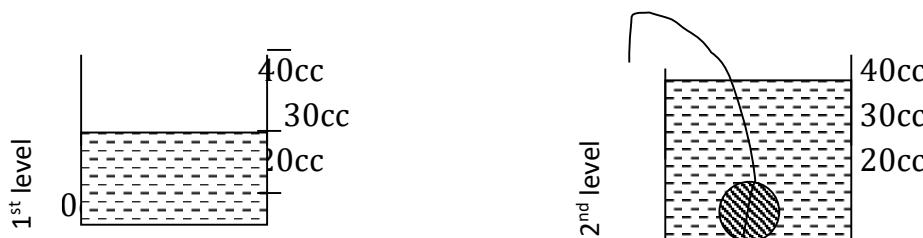
Why is displacement method called so?

- It involves measuring the volume of displaced water

EXPERIMENTS TO SHOW DISPLACEMENT METHOD

1. Using a measuring cylinder

- Put water into a measuring cylinder and record its volume
- Tie a thread on an irregular object and lower it into the measuring cylinder
- Record the new volume of water
- The difference between the volumes of water is the volume of the stone



$$\begin{aligned}\text{Volume of the stone} &= 2^{\text{nd}} \text{ level} - 1^{\text{st}} \text{ lever} \\ &= 35\text{cc} - 30\text{cc} \\ &= 5\text{cc}\end{aligned}$$

The volume of the stone is 5cc

Why is the volume of an irregular object in the above diagram 5cc?

- The volume of displaced water is 5cc.

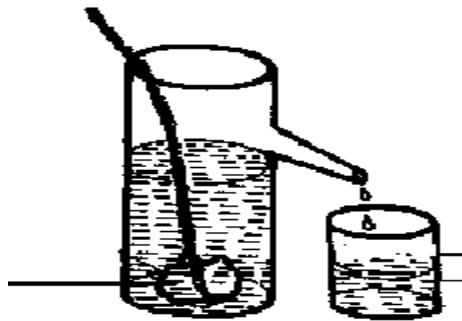
Why is the volume of an irregular object equal to the volume of displaced water in displacement method?

- A sinking object displaces water (liquid) equal to its volume.

2. Using an overflow can and measuring cylinder

- Fill the overflow can with water up to the level of spout
- Use a thread to gently place an irregular object into the overflow
- Water will overflow and the spout will direct it to the measuring cylinder
- The volume of the irregular object is equal to the volume of displaced water in the measuring cylinder

Find the volume of the stone by reading the level of water in the cylinder.



The volume of the irregular object is 10cc.

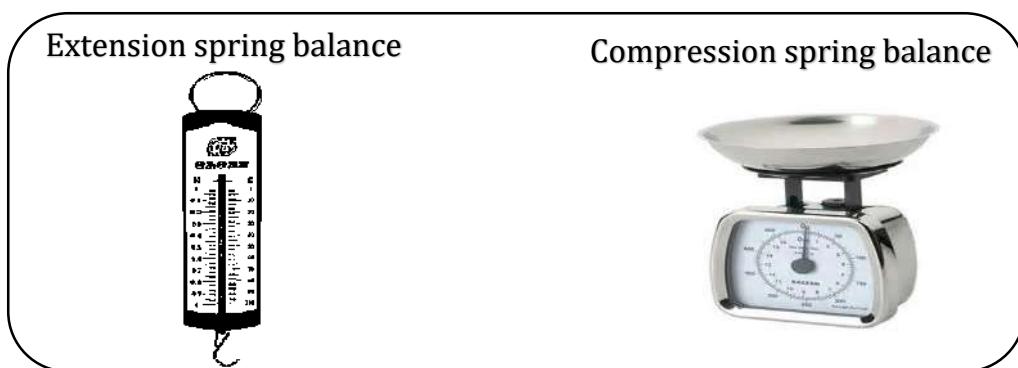
EXAMPLES OF CONTAINERS USED TO MEASURE VOLUME OF LIQUIDS

- Measuring cylinder
- Beaker
- Burette
- Conical flask
- Pipette

WEIGHT

- Weight is the force of gravity acting on an object
- ✓ Weight is measured in **Newton's (N)**
- ✓ Weight is measured by an instrument called **spring balance**
- ✓ Weight is changes

DIAGRAMS SHOWING SPRING BALANCES



FACTORS THAT DETERMINE WEIGHT OF AN OBJECT

- Size of the object
- Nature of the object
- Upthrust force (buoyancy)
- Force of gravity (gravitational force)

NOTE:

- Objects weigh less on the moon than on earth **because** there is less force of gravity on the moon than on earth
- Objects weigh less in water than in air **because** there is more buoyancy in water than in air
- When an object is lifted up, it overcomes the **force of gravity**.
- It is difficult to push a wheel barrow uphill **because** we are opposing the force of gravity.
- It is easier to push a wheel barrow downhill **because** we are helped by the force of gravity.

MASS

- This is the amount of matter in an object
- Mass is constant **because** it doesn't depend on the force of gravity
- The SI unit / standard unit / base unit of mass is **kilogram (Kg)**

Examples of instruments used for measuring mass

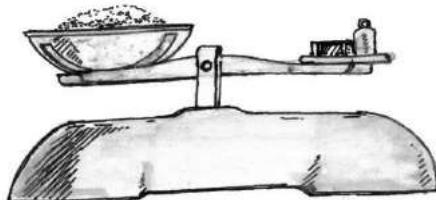
- | | |
|---|--|
| <ul style="list-style-type: none"> ▪ Beam balance ▪ Set of scales | <ul style="list-style-type: none"> ▪ Scale balance ▪ Lever balance |
|---|--|

DIAGRAMS SHOWING WEIGHING SCALES

Beam balance



Set of scales



DIFFERENCES BETWEEN MASS AND WEIGHT

MASS	WEIGHT
Mass is the amount of matter in an object	Weight is the force of gravity acting on an object
Mass is constant	Weight changes (it is variable)
Mass is measured in grams and kilograms	Weight is measured in Newtons
Mass can never be zero	Weight can be zero if no gravity acts upon an object
Mass is a scalar quantity	Weight is a vector quantity

DENSITY

- This is the mass of an object per unit volume
- The SI unit of density is **kilogram per cubic metre (kg/cm³)**

$$D = \frac{M}{V}$$

IMPORTANCE OF DENSITY

- It enables us to identify floating and sinking objects
- It enables us to identify pure and impure substances
- It enables us to find mass of an object
- It enables engineers to use strong but light metals to make bodies of aeroplanes

FINDING DENSITY

Example I

Find the density of an object of mass 150g and volume 3cc.

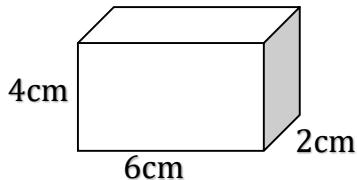
$$D = \frac{M}{V}$$

$$D = \frac{150\text{g}}{3\text{cc}}$$

$$D = 50\text{g/cc}$$

Example 2

If the mass of the cuboid below is 48g. Find its density



$$V = L \times W \times H$$

$$= 6\text{cm} \times 2\text{cm} \times 4\text{cm}$$

$$= 48\text{cm}^3$$

$$D = \frac{M}{V}$$

$$D = \frac{150\text{g}}{3\text{cc}}$$

$$D = 50\text{g/cc}$$

Example 3

Calculate the volume of a stone whose mass is 48g and density 6g/cc

$$D = \frac{M}{V}$$

$$6\text{g/cc} = \frac{48\text{g}}{V}$$

$$\frac{6}{1} = \frac{48}{V}$$

$$\frac{6V}{6} = \frac{48}{6}$$

$$V = 8\text{cc}$$

DENSITIES OF SOME SUBSTANCES

Substance	Density (g/cc)
Gold	19.3
Mercury	13.6
Lead	11.3
Silver	10.5
Copper	8.9
Brass	8.3
Iron	7.8
Tin	7.3
Aluminium	2.7
Glass	2.7
Rubber	1.3

Salt solution	1.2
Water at 4°C	1.0
Ice	0.92
Methylated spirit	0.83
Kerosene	0.8
Alcohol	0.8
Petrol	0.7
Cork	0.25
Air	0.0012
hydrogen	0.00009

- Aluminum is used to make bodies of aeroplanes because it is a strong metal with low density (It is strong and light)

HYDROMETER

- It is used to measure densities of liquids e.g. milk, beer and wine
- A special hydrometer used to measure density of milk is called **lactometer**

FLOATING OBJECTS

- These are objects that remain on water surface.
- ✓ The density of pure water is 1 g/cc
- ✓ Objects with density less than 1 g/cc (less dense than water), **float on water**
- ✓ Most objects float **because** they are less dense than water

CHARACTERISTICS OF FLOATING OBJECTS

- Some objects are less dense than water
- Some objects are exactly the same density as water

EXAMPLES OF FLOATING OBJECTS

i) Objects that float because they are less dense than water

- | | |
|-------------------|------------|
| ▪ Cork | ▪ Sponge |
| ▪ Plastic | ▪ Leaf |
| ▪ Ice cubes | ▪ Feathers |
| ▪ Dry wood | |
| ✓ Kerosene | |
| ✓ Petrol | |
| ✓ Diesel | |
| ✓ Cooking oil | |
| ✓ Lubricating oil | |
- } Floating liquids

ii) Objects that float due to upthrust force (buoyancy)

- | | |
|---------|--------|
| ▪ Boat | ▪ Ship |
| ▪ Ferry | ▪ Dhow |

How does upthrust force (buoyancy) enable a boat to float on water?

- It reduces the weight of a boat (makes a boat to weigh less)

iii) OBJECTS THAT FLOAT DUE TO SURFACE TENSION

- Water striders
- Paper clips

Why do objects such as paper clips and razorblades sometimes tend to float on water?

- Due to high surface tension of water

Name the force in liquids that are responsible for surface tension.

- Cohesion (cohesive forces)

SINKING OBJECTS

- These are objects that go to the bottom of water.
- Objects whose density is more than 1g/cc (denser than water), **sink in water**.
- Objects sink in water **because** they are denser than that water.

EXAMPLES OF SINKING OBJECTS

- | | |
|-------------|-------------|
| ▪ Stone | ▪ Glass |
| ▪ Sand | ▪ Iron nail |
| ▪ Steel bar | ▪ Mercury |

NOTE:

- A sinking object displaces water equal to its volume
- A floating object displaces water equal to its weight.

BEHAVIOUR OF OBJECTS WHEN PUT IN WATER

- Floating
- Sinking

SINKING

- This is when an object goes to the bottom of water.

FLOATING

- This is when an object remains on water surface

LAW OF FLOTATION

- A floating body displaces its own weight of the liquid in which it floats.

FACTORS THAT AFFECT FLOATING

- Density of an object
- Upthrust force (buoyancy)
- Surface tension of water

BUOYANCY (UPTHRUST)

- This is the upward force that acts on an object put in a fluid (liquid or gas)
- Buoyancy is measured in Newton (N)

Why do objects weigh less when put (immersed) in water or other fluids?

- Due to upthrust (buoyancy)

How is buoyancy important to sailors?

- It enables their boats to float on water

Examples of objects that float due to upthrust (buoyancy)

- Boat

SURFACE TENSION

- This is the property that allows a liquid surface to resist an external force
- It is caused by **cohesive force on the liquid surface**

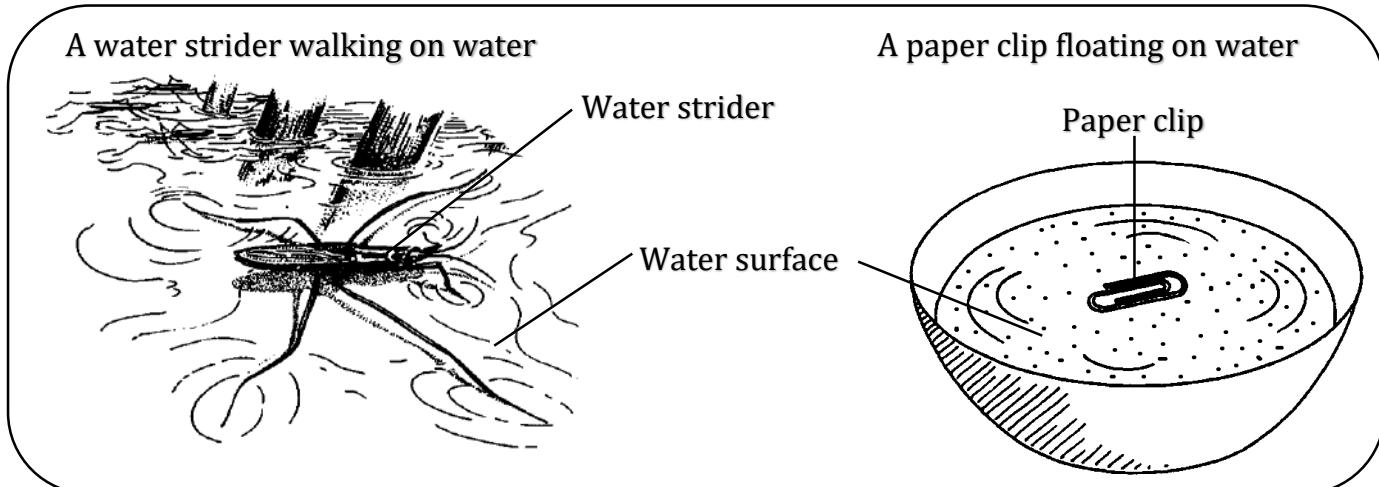
EXAMPLES OF SURFACE TENSION

- A paper clip, razor blade or needle floating on water
- Mosquito eggs floating on water
- A water strider walking on water

FACTORS THAT AFFECT SURFACE TENSION

- Temperature
- ✓ Surface tension decreases with an increase in temperature.
- **Impurities in the liquid**
- ✓ More impurities in the liquid reduce its surface tension.

DIAGRAMS OF OBJECTS THAT FLOAT DUE TO SURFACE TENSION OF WATER



What enables paper clips and small insects (e.g water striders) to float on water?

- Surface tension of water

APPLICATION OF SURFACE TENSION

- It helps small insects (water striders) to walk on water
- It allows small objects which are denser than water to float on water e.g paper clips, coins, needles, mosquito eggs and razorblades

MISCELLY AND IMMISCIBLE LIQUIDS

MISCELLY LIQUIDS

- These are any two liquids which can mix completely.
- Miscible liquids **have different boiling points**

EXAMPLES OF MISCELLANEOUS LIQUIDS

- Water and alcohol (water and ethanol)
- Water and milk
- Petrol and diesel
- Water and vinegar
- Water and lemon juice

METHOD OF SEPARATING MISCELLANEOUS LIQUIDS

- Fractional distillation

IMMISCIBLE LIQUIDS

- These are any two liquids that cannot mix
- They cannot form a uniform mixture.

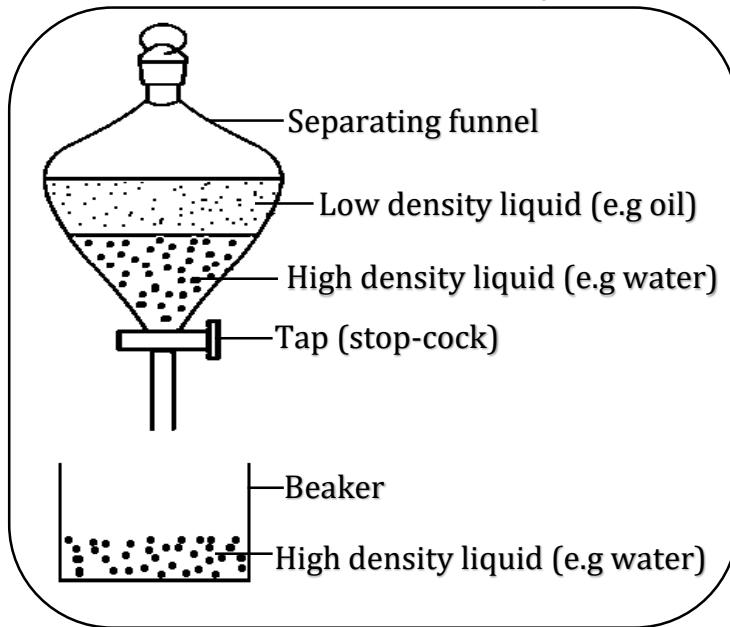
EXAMPLES OF IMMISCIBLE LIQUIDS

- Water and petrol
- Water and oil
- Water and diesel
- Water and benzene

METHODS OF SEPARATING IMMISCIBLE LIQUIDS

- Using a separating funnel
- Decantation

A DIAGRAM SHOWING SEPARATION OF IMMISCIBLE LIQUIDS USING A SEPARATING FUNNEL



TOPIC: IMMUNIZATION

IMMUNIZATION

- This is the introduction of vaccines into the human body to boost immunity

TYPES OF IMMUNIZATION

- Primary immunization
- Mass immunization
- Booster immunization

PRIMARY IMMUNIZATION

- This is done to all children below the age of 5 years

MASS IMMUNIZATION

- This is done to all people in case there is a disease outbreak in an area

BOOSTER IMMUNIZATION

- This is done to maintain the required amount of antibodies in the human body

IMPORTANCE OF IMMUNIZATION

- It prevents immunizable diseases
- It boosts immunity
- It reduces infant mortality rate

IMMUNITY

- This is the ability of the body to resist diseases

TYPES OF IMMUNITY

- Natural immunity
- Artificial immunity

NATURAL IMMUNITY

- This is the type of immunity that does not involve use of vaccines

WAYS OF ACQUIRING NATURAL IMMUNITY

- Through breastfeeding (through suckling breast milk)
- After recovering from sickness (illness)

Why is it dangerous to acquire immunity after recovering from illness?

- It may lead to death

ARTIFICIAL IMMUNITY

- This is the type of immunity that involves the use of vaccines

How does the body acquire artificial immunity?

- By immunization
- ✓ This is the best way of acquiring immunity
- Through injection of prepared antibodies (serum) into the body

VACCINES

- These are medical drugs used for immunization

IMPORTANCE OF VACCINES

- They boost immunity

How do vaccines boost immunity?

- They stimulate the production of antibodies (they enable the body to produce antibodies)

What are antibodies?

- These are chemical substances produced in the body to fight against diseases

METHODS OF ADMINISTERING VACCINES (METHODS OF IMMUNIZATION)

- Oral method
- Injection method

TYPES OF VACCINES

- Killed vaccines
- Live-attenuated vaccines
- Toxoid vaccines
- Viral vector vaccines

LIVE-ATTENUATED VACCINES

- These are vaccines made from weakened germs
- ✓ They provide strong and long-lasting immunity against diseases

Examples of live-attenuated vaccines

- | | |
|---|-----------------------|
| ▪ Yellow fever vaccine | ▪ BCG vaccine |
| ▪ Rotavirus vaccine (for diarrhoea) | ▪ Chicken pox vaccine |
| ▪ MMR vaccine (for Measles, mumps and rubella) | |
| ▪ Oral polio vaccine (OPV) or Sabin polio vaccine | |
| ▪ Measles vaccine | |
| ▪ Mumps vaccine | |
| ▪ Rubella vaccine | |

KILLED (INACTIVATED) VACCINES

- These are vaccines made from killed germs

Examples of killed (inactivated) vaccines

- IPV (inactivated polio vaccine) or Salk polio vaccine
- Rabies vaccine
- Cholera vaccine
- DPT vaccine (DTaP vaccine) for pertussis
- Hep A vaccine

TOXOID VACCINES

- These are vaccines made from toxins produced by germs

What are toxins?

- These are poisonous substances produced by germs

EXAMPLES OF TOXOID VACCINES

- TT vaccine (Tetanus toxoid vaccine)
- DPT vaccine for diphtheria and tetanus

VIRAL VECTOR VACCINES

- These are vaccines that use a modified version of a virus to protect against certain diseases.

Examples of viral vector vaccines

- COVID-19 vaccines (e.g AstraZeneca vaccine **and** Johnson & Johnson vaccine)
- Ebola vaccines (e.g rVSV-ZEBOV vaccine)

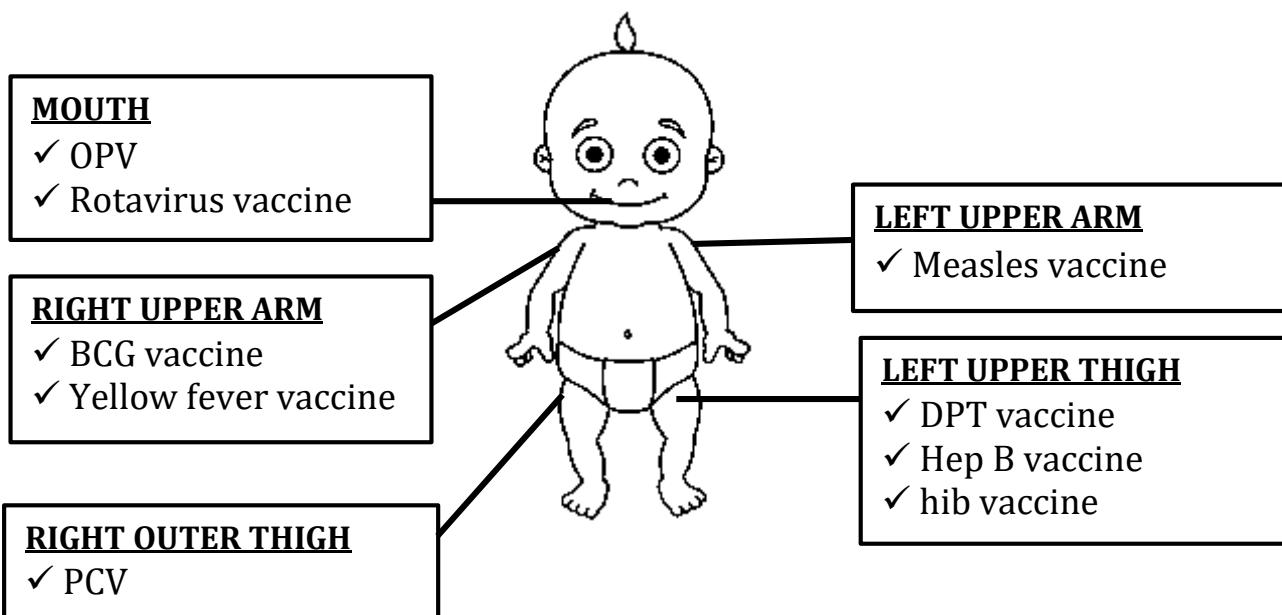
ACTIVITY:

1. What do you understand by the term immunization?
2. Which type of immunization is done to all children below 5 years?
3. Give any one reason why parents should take their children for immunization
4. What is immunity?
5. Which type of immunity is acquired through breast feeding?
6. How best can babies acquire artificial immunity?
7. What name is given to medical substances used during immunization?
8. State any one way of administering vaccines.
9. How are vaccines useful in our bodies?
10. Which type of vaccines are made from killed germs?

IMMUNISATION SITE

- This is the part of the human body where a vaccine is administered

IMMUNISATION SITES ON HUMAN BODY



Why are vaccines injected at different parts of the body?

- For easy identification of the disease immunized

EXAMPLES OF VACCINES, METHOD OF ADMINISTRATION, IMMUNISATION SITES AND DISEASE

Vaccine	Method of administration	Immunization site	Disease
BCG vaccine	Injection method	Right upper arm	Tuberculosis (TB)
DPT (DTaP) vaccine	Injection method	Left upper thigh	Diphtheria, Pertussis, Tetanus
Measles vaccine	Injection method	Left upper arm	Measles
OPV	Oral method	Mouth	Poliomyelitis (polio)
PCV	Injection method	Right outer thigh	Pneumonia
Rotavirus Vaccine	Oral method	Mouth	Diarrhoea
HPV vaccine	Injection method	Left upper arm	Cervical cancer
Yellow fever vaccine	Injection method	Right upper arm	
Hep B vaccine	Injection method	Left upper thigh	Hepatitis B
hib vaccine	Injection method	Left upper thigh	Haemophilus influenza type B

Why are babies given BCG and polio vaccines at birth?

- Babies are born without immunity against Tuberculosis (TB) and polio

Why is measles vaccine given at the age of 9 months?

- Babies are born with immunity against measles which lasts for 9 months

Why was DPT replaced with DTaP?

- DTaP has fewer side effects than DPT

Why DPT (DTaP) is called a triple vaccine?

- It prevents three immunizable disease

Why is DPT - Hep B + Hib vaccine called a pentavalent vaccine?

- It prevents five immunizable diseases

Why is polio vaccine given very many times?

- Polio virus is very resistant to vaccines
- To build a stronger immunity against polio virus since it is very resistant to vaccines

Why is Polio vaccine always given orally?

- It is very effective when given orally than injection

Write the following vaccines in full

- OPV: Oral Polio vaccine

- **IPV:** Inactivated Polio vaccine
- **BCG:** Bacille Calmette-Guerin (Bacillus of Calmette and Guerin)
- **DPT:** Diphtheria, Pertussis and Tetanus
- **DTaP:** Diphtheria, Tetanus and Pertussis
- **MMR:** Measles, Mumps and Rubella
- **HPV:** human papillomavirus vaccine
- **Hib:** Haemophilus influenza type B
- **PCV:** Pneumococcal Conjugate Vaccine

Mention any two of 5-in-1 vaccines

- DPT+ Hep B + Hib vaccine
- DTaP+ IPV + Hib vaccine

A TABLE SHOWING IMMUNISABLE DISEASES, VACCINES, MODE OF ADMINISTRATION, NUMBER OF DOSES AND AGE AT WHICH THEY ARE GIVEN.

DISEASE	VACCINE	HOW IT IS ADMINISTERED	DOSES	AT WHAT AGE
▪ Tuberculosis	BCG	Injection on upper right arm	1	At birth
▪ Poliomyelitis	Polio vaccine (OPV)	Drops in the mouth	4	At birth 6 weeks 10 weeks 14 weeks
▪ Diphtheria ▪ Whooping cough ▪ Tetanus ▪ Hepatitis B ▪ Haemophilus influenza type B	DPT + Hep B + Hib vaccine	Injection on the left thigh	3	6 weeks 10 weeks 14 weeks
Measles	Measles vaccines	Injection on the left upper arm	1	9 months (36 weeks)

How many times should a baby be taken for immunization before his/her first birthday?

- 5 times

IMMUNISABLE DISEASES

- These are diseases that can be prevented by immunization

CHILDHOOD IMMUNISABLE DISEASES

- These are immunizable diseases common in children below the age of 5 years

EXAMPLES OF CHILDHOOD IMMUNIZABLE DISEASES

- | | |
|----------------|------------------|
| ▪ Measles | ▪ Polio |
| ▪ Tuberculosis | ▪ Whooping cough |

- Hepatitis B
- Haemophilus influenza B

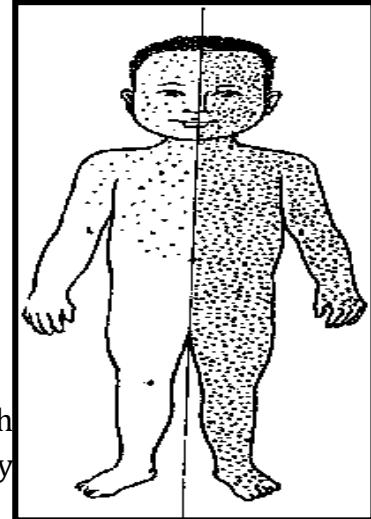
- Diphtheria
- Tetanus

MEASLES (RUBEOLA)

- It is caused by a virus
- It is an air borne disease
- It affects the skin and lungs

How does measles spreads?

- Through inhaling contaminated air
- Through body contact with sick person
- Through sharing dirty clothes with sick person



Signs of measles

- Runny nose
- Skin rash

- Dry cough
- Watery eye

Symptoms of measles

- Fever
- Sore throat

- Loss of appetite
- Body weakness

PREVENTION OF MEASLES

- Isolate and treat infected ones
- Immunize children against measles

POLIOMYELITIS (POLIO)

- It is an immunizable waterborne disease
- It is caused by a virus
- It affects the skeleton (bones) especially the limbs and the muscles

Signs of poliomyelitis

- Paralysis of the limb
- Stiffness of the neck

- Stiffness of the back
- Vomiting

Symptoms of poliomyelitis

- Muscle weakness
- Headache
- Sore throat

- Fever
- Neck pain
- Back pain

Effect of poliomyelitis to an individual

- It leads to lameness

WAYS OF PREVENTING AND CONTROLLING POLIOMYELITIS

- Immunization using polio vaccines (IPV & OPV)
- Drinking boiled water
- Proper use of latrines (proper disposal of human wastes)

- Wash hands with clean water and soap before eating food

How are crutches useful to a polio victim?

- Crutches help the polio victim to move

TUBERCULOSIS

- It is an immunizable airborne disease (droplet infection)
- It mainly affects the lungs and spine (backbone)
- It affects the respiratory system and skeletal system
- It is caused by a bacterium

Name the germ (bacterium) that causes tuberculosis

- Mycobacterium tuberculosis

How does tuberculosis spread?

- Through inhaling contaminated air
- Through drinking contaminated milk from tubercular (infected) cows
- Through sharing forks, cups and plates with an infected person

Signs of tuberculosis

- Chronic cough
- Loss of weight
- Severe sweating at night (severe night sweats)
- Thick sputum with blood

Symptoms of tuberculosis

- | | |
|-------------------------|--------------|
| ▪ General body weakness | ▪ Mild fever |
| ▪ Backache | |

Ways of preventing and controlling tuberculosis

- Immunization using BCG vaccine
- Isolate and treat the infected persons
- Drink boiled or pasteurized milk
- Don't share forks, cups and plates with sick person

How is smoking related to TB?

- Smoking worsens tuberculosis

Name the Sexually Transmitted Disease always mistaken for Tuberculosis (TB)

- AIDS

Why is tuberculosis common among AIDS patients?

- They have weak immunity (due to loss of immunity)

Signs common in both tuberculosis and AIDS patients

- Chronic cough
- Loss of weight
- Severe sweating at night (severe night sweats)

TETANUS

- It is caused by bacteria found in the soil
- It affects the muscles
- The bacteria enters the body through fresh cuts or dirty wounds.
- In new born babies, it can enter through the umbilical cord if it is cut with a dirty instrument like a razor blade or knife

Signs of tuberculosis

- Stiffness of the muscles
- Stiffness of the jaw / Lockjaw
- The baby stops breast feeding

Symptoms of tuberculosis

- Fever
- Difficulty in swallowing
- Fast pulse

Why is tetanus called LOCK JAW disease?

- It makes the jaws of the baby to become stiff

PREVENTION AND CONTROL OF TETANUS

- Immunize children against tetanus (using DPT vaccine)
- Keep the wounds clean all the time.
- Immunize expectant mothers (pregnant women) with TT vaccine
 - ✓ To protect them and the unborn babies from tetanus infection
 - ✓ To enable the unborn baby get immunity against tetanus
- Immunize teenage girls with TT vaccine
- ✓ To prevent them from getting tetanus

GROUPS OF PEOPLE WHO ARE GIVEN TT VACCINE

- Teenage girls
- Pregnant women
- Accident victims

Why is DPT vaccine given to babies at 6 weeks?

- Babies are born with maternal immunity that lasts six weeks.

WHOOPING COUGH (PERTUSSIS)

- It is an airborne disease (droplet infection)
- It affects the respiratory system
- It mainly affects the lungs
- It is caused by a bacterium

How does pertussis (whooping cough) spread?

- Through inhaling contaminated air

Signs of whooping cough (pertussis)

- | | |
|---|----------------------------|
| ▪ Chronic cough (coughing spells)
▪ A pause in breathing (Apnea) | ▪ Runny nose
▪ Vomiting |
|---|----------------------------|

Symptoms of whooping cough (pertussis)

- Fatigue (General body weakness)
- Fever

Prevention and control of whooping cough (pertussis)

- Immunize babies using DPT vaccine
- Isolate and treat the infected ones

DIPHTHERIA

- It is an airborne disease (droplet infection)
- It affects the respiratory system
- It mainly affects the throat and nose
- It is caused by a bacterium

How does diphtheria spread?

- Through inhaling contaminated air
- Through touching open sores on person with diphtheria skin infection

Signs of diphtheria

- | | |
|---|---|
| ▪ Swollen neck
▪ Sore throat
▪ Swollen palate (swollen roof of the mouth) | ▪ Difficulty in breathing
▪ Increased heart beat |
|---|---|

Symptoms of diphtheria

- Fatigue (General body weakness)
- Fever

Prevention and control of whooping cough (pertussis)

- Immunize babies using DPT vaccine
- Isolate and treat the infected ones

HAEMOPHILUS INFLUENZA TYPE B

- This disease is caused by a virus
- It is prevented using Hib vaccine.

HEPATITIS B

- It is caused by a virus
- It affects the liver

Name the virus (germ) that causes hepatitis B.

- Hepatitis B virus

How does hepatitis B spread?

- Through sharing blood contaminated needles with infected person
- From an infected mother to the baby during child birth
- Through playing unprotected sex with infected person

Signs of hepatitis B

- Dark urine
- Vomiting
- Jaundice (yellowing of the eyes and skin)

Symptoms of hepatitis B

- | | |
|--|--|
| <ul style="list-style-type: none">▪ Joint pain▪ Loss of appetite▪ Abdominal pain in the upper right side | <ul style="list-style-type: none">▪ Joint pain▪ General body weakness |
|--|--|

Prevention of hepatitis B

- Immunize with Hep B vaccine
- Avoid playing unprotected sex with infected person
- Avoid sharing needles with infected person

OTHER IMMUNIZABLE DISEASES

- | | |
|--|---|
| <ul style="list-style-type: none">▪ Cholera▪ COVID-19▪ Meningitis▪ Yellow fever▪ Diarrhoea▪ Pneumonia | <ul style="list-style-type: none">▪ Cervical cancer▪ German measles (rubella)▪ Rabies▪ Small pox▪ Mumps |
|--|---|

EFFECTS OF IMMUNISABLE DISEASES

- Increased death rate of infants
- Lameness
- Mental disabilities

ROLES OF INDIVIDUALS, FAMILIES AND COMMUNITIES IN IMMUNIZATION

1. PARENTS

- Taking their children for immunization.
- Participating in community immunization activities and programme
- Assisting schools to identify children who are not immunised

2. CHILDREN

- Taking their siblings (young brothers and sisters) for immunization
- Informing parents about the day for immunization

- Reciting songs and plays on immunization
- Helping to identify children who have not been immunized in the community

3. GOVERNMENT

- Announcing immunization centres
- Announcing outbreak of immunisable disease
- Announcing immunisation days
- Educating people about immunization
- Funding immunization programs
- Distributing vaccines to health centres

4. COMMUNITY LEADERS

- Inviting health workers to educate members about immunisation
- Encouraging members to organize immunisation centres
- Encouraging members to take their children for immunisation
- Reporting immunisable disease outbreak

Child health card (Immunisation card)

- This is a document that contains child's health information

INFORMATION ON THE CHILD HEALTH CARD

- | | |
|------------------------------|-----------------------|
| ▪ Child's birth weight | ▪ Diseases immunized |
| ▪ Child's name | ▪ Mother's name |
| ▪ Child's date of birth | ▪ Father's name |
| ▪ Growth graph of a child | ▪ Parents' occupation |
| ▪ Sex of the child | ▪ Place of residence |
| ▪ Next date for immunisation | |

IMPORTANCE OF CHILD HEALTH CARD

- It helps a parent to monitor the child's growth
- It helps the parent to know the next date for immunisation.
- It helps the doctor to know diseases immunized
- It helps the doctor to know the remaining dose for the child.

WAYS OF IDENTIFYING A CHILD WHO WAS IMMUNIZED AGAINST TB

- Checking the child health card
- Checking the injection scar on the right upper arm

ORGANIZATIONS THAT CARRY OUT IMMUNISATION ACTIVITIES IN UGANDA

- **WHO:** World Health Organization
- **UNICEF:** United Nations Children's Fund
- **UNEPI:** Uganda National Expanded Program on Immunization

UNEPI:

- UNEPI stands for Uganda National Expanded Program on Immunization

- It is under Ministry of Health

TARGET GROUPS FOR UNEPI

- Infants
- Women of child bearing age

ROLES OF UNEPI

- ✓ It organises National Immunisation Days
- ✓ It provides immunisation equipment
- ✓ It distributes vaccines to health centres
- ✓ It educates people about immunisation

NID stands for National Immunisation Days

Other organizations that support UNEPI in immunisation

- | | |
|------------|----------------------------------|
| ▪ Churches | ▪ Rotary clubs |
| ▪ Schools | ▪ Save the Children's Fund (SCF) |

Why has the government of Uganda made immunisation free of charge?

- For all ugandans to be immunised

Reasons why children in some families are not immunised.

- Ignorance of immunisation
- Cultural beliefs in some families
- Limited access to immunisation services

Name the vaccine that prevents Neonatal tetanus

- Tetanus Toxoid vaccine

Activity

1. What is immunization?
2. Define the following terms
 - a) Immunity
 - b) Antibodies
 - c) Immunisation site
 - d) vaccines
3. Name the two types of immunisation
4. What type of immunity does a baby acquire through breast feeding?
5. Give the meaning of artificial immunity.
6. State two ways the body may acquire natural immunity
7. How does the body acquire artificial immunity?
8. State two methods of administering vaccines in the body
9. Name the vaccine given to children to prevent diarrhoea.
10. How is polio vaccine administered?
11. Name vaccine administered to babies at the age of 36 weeks.
12. Name the vaccine that provides immunity against Diphtheria, whooping and Tetanus.

13. Why is DPT (DTaP) vaccine called triple vaccine?
14. State any two importance of a child health card.
15. Write UNEPI in full.
16. Name two immunizable diseases that can spread from infected domestic animals to people.
17. State two reasons why parents take their children for immunization.
18. Why are expectant mothers given Tetanus Toxoid vaccine?
19. State one vaccine that is given as single dose to a baby at birth only.
20. Name one vaccine that is administered orally besides polio vaccine
21. Why is polio vaccine given to a child at birth?
22. Why is measles vaccine given after nine months?
23. How can a P.5 pupil participate in immunization campaign?
24. Name one type of vaccine
25. Why do some families fail to take children for immunization?

TOPIC: DIGESTION

BODY SYSTEMS

- A system is a group of organs that perform the same function
- An organ is a group of tissues that perform the same function
- A tissue is a group of cells that perform the same function
- A cell is the smallest unit of life

DIGESTIVE SYSTEM

- This is the body system that breaks down food into small soluble particles that can be absorbed into the body

DIGESTION

- This is a process by which food is broken down into soluble particles that can be absorbed into the body
- It begins in the **mouth** and ends in the **ileum**

IMPORTANCE OF FOOD DIGESTION

- It breaks down food for easy absorption of nutrients

TYPES OF FOOD DIGESTION

- Mechanical digestion
- Chemical digestion

MECHANICAL DIGESTION

- This is the physical breakdown of food into smaller particles
- It is done by the teeth and stomach walls

EXAMPLES OF MECHANICAL DIGESTION

- Chewing of food
- Churning of food

CHEMICAL DIGESTION

- This is the breakdown of food into soluble particles by the help of enzymes

How does chemical digestion depend on mechanical digestion?

- Mechanical digestion increases the surface area of food for the action of enzymes

ENZYMES

- These are chemical substances that speed up chemical digestion

IMPORTANCE OF ENZYMES

- They speed up chemical reactions/digestion
- Enzymes act as catalysts in chemical reactions

CHARACTERISTICS OF ENZYMES

- They are specific in action
- They work at specific pH
- They are destroyed (denatured) by heat
- They work under narrow temperature range
- They are needed in minute amounts

Why are enzymes denatured (destroyed) by heat?

- They are proteins in nature

TYPES OF ENZYMES

- Amylase
- Lipase
- Protease

CONDITIONS UNDER WHICH ENZYMES WORK

- Alkaline conditions
- Acidic conditions

EXAMPLES OF ENZYMES AND THE MEDIUM (pH) IN WHICH THEY WORK BEST

ENZYME (S)	MEDIUM OF ACTION (pH)
▪ Pepsin ▪ Rennin	▪ Acidic medium
▪ Salivary amylase ▪ Lipase ▪ Trypsin ▪ Peptidase (erepsin) ▪ Sucrase	▪ Alkaline medium

What is meant by pH?

- This is the degree of acidity or alkalinity

ALIMENTARY CANAL

- This is the long muscular tube that runs from the mouth to the anus
- It is up to 10 metres long.

How does food move in the alimentary canal?

- By peristalsis

What is peristalsis?

- This is the wave-like movement of food through the alimentary canal

PARTS OF THE HUMAN DIGESTIVE SYSTEM

- | | |
|-----------------------|---------------------------|
| ▪ gullet (oesophagus) | ▪ Duodenum |
| ▪ liver | ▪ ileum |
| ▪ stomach | ▪ large intestine (colon) |
| ▪ pancreas | ▪ appendix |
| ▪ gall bladder | ▪ rectum |
| ▪ bile duct | ▪ Anus |

PARTS OF THE ALIMENTARY CANAL

- | | |
|---------------------------|----------|
| ▪ Gullet (oesophagus) | ▪ ileum |
| ▪ stomach | ▪ rectum |
| ▪ duodenum | ▪ anus |
| ▪ colon (large intestine) | |

Parts of the digestive system besides the alimentary canal

- Liver
- Pancreas
- Gall bladder

Name the three major glands of the digestive system

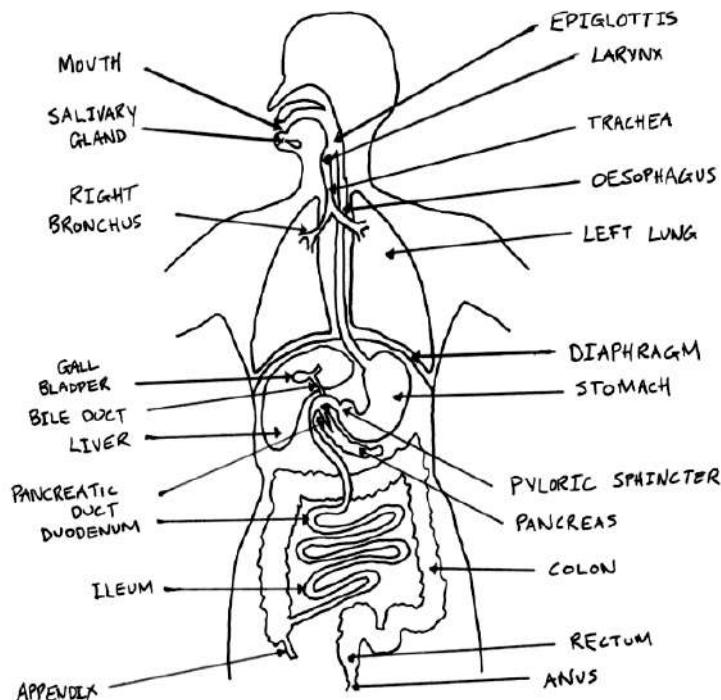
- Salivary glands
- Liver
- Pancreas

ACTIVITY

1. How does digestion differ from digestive system?
2. Where does digestion of food
 - i) Begin?
 - ii) End?
3. Name the two types of digestion
4. Mention any one example of mechanical digestion
5. State the role of enzymes in chemical digestion.

6. Name any two enzymes that work under acidic pH
7. How does eating hot food affect the chemical digestion?

THE STRUCTURE OF THE HUMAN DIGESTIVE SYSTEM



DIGESTION OF FOOD IN THE MOUTH

- The teeth break down food
- Chewing increases the surface area of food for the action of enzymes

SALIVA (SALIVARY JUICE)

- This is the digestive juice found in mouth
- It is produced by **salivary glands**
- It contains an enzyme called **salivary amylase (ptyalin)**
- Salivary amylase works in alkaline conditions
- Salivary amylase works on carbohydrates
- Salivary amylase changes cooked starch to maltose
- Digestion of carbohydrates begins in the mouth

IMPORTANCE OF SALIVA

- It moistens and softens food
- It lubricates food for easy swallowing
- It contains salivary amylase that acts on cooked starch
- It cools hot food

Why does the action of salivary amylase (ptyalin) stop when food reaches the stomach?

- Salivary amylase cannot work under acidic conditions in the stomach
- There are no alkaline conditions for salivary amylase to work

IMPORTANCE OF THE TONGUE

- It rolls food into bolus (small ball)
- It mixes food with saliva
- It pushes food to gullet

What prevents food from entering the wind pipe (trachea) during swallowing?

- Epiglottis

FOOD IN THE GULLET (OESOPHAGUS)

- Gullet is the tube that directs food from the mouth to the stomach
- Food moves from the gullet to the stomach by **peristalsis**

Importance of the gullet

- It passes (directs) food to the stomach

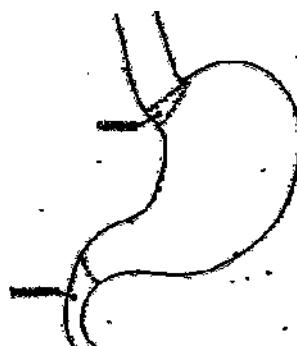
A diagram showing peristalsis in the gullet



FOOD DIGESTION IN THE STOMACH

- Stomach is a muscular bag that stores food for some time
- Food stays in the stomach for about 3 hours
- **Cardiac muscles** allow food into the stomach
- The stomach walls mixes food with digestive juices to form a chyme
- **Chyme** is the mixture of partly digested food and digestive juices in the stomach
- **Pyloric sphincter muscles** allow chyme into the duodenum
- The stomach has acidic conditions
- Chemical digestion of proteins begins in the stomach

Simple diagram to illustrate (The stomach)



IMPORTANCE OF STOMACH

- It stores eaten food for some time
- It churns food
- It is where digestion of proteins begins

SUBSTANCES THAT ARE ABSORBED IN THE STOMACH

- Simple sugars
- Common salt
- Medicines
- Alcohol

THINGS PRODUCED BY THE STOMACH WALLS

- Gastric juice
- Hydrochloric acid
- Mucus

1. GASTRIC JUICE

- This is the digestive juice found in the stomach

Name the two digestive enzymes in gastric juice

- Pepsin
- Rennin (chymosin)

Pepsin and Rennin work in acidic conditions

IMPORTANCE OF PEPSIN AND RENNIN

Pepsin

- It works on proteins

Rennin (chymosin)

- It clots milk proteins in the stomach of infants
- It curdles (coagulates) milk in the stomach of infants

How important is clotting of milk proteins in babies?

- It allows proper digestion of proteins
- It helps to separate proteins from fats
- It extends the period at which milk is retained in the stomach

2. HYDROCHLORIC ACID

- It kills germs taken in with food
- It provides acidic conditions for pepsin to digest proteins
- It activates pepsin

3. MUCUS

- It protects stomach walls from hydrochloric acid and enzymes

THE SMALL INTESTINES (SMALL BOWEL)

- It lies between the stomach and the large intestines

PARTS OF THE SMALL INTESTINES

- **Duodenum:** it is the upper part
- **Jejunum:** it is the middle part
- **Ileum:** it is the lower part

FOOD IN THE DUODENUM

- The duodenum is the first part of the small intestines
- It is U-shaped and about 25cm long
- It is where digestion of fats begins
- No food absorption occurs in the duodenum
- It contains pancreatic juice and bile juice (bile)
- It receives bile juice through the bile duct
- It receives pancreatic juice through the pancreatic duct

DIGESTIVE JUICES FOUND IN THE DUODENUM

- Pancreatic juice
- Bile juice (bile)

PANCREAS

- This is a digestive organ/gland below the stomach

Functions of pancreas

- It produces pancreatic enzymes
- It produces insulin hormone

Enzymes found in pancreatic juice (duodenum)

- Pancreatic amylase
- Lipase
- Trypsin
- ✓ Enzymes in pancreatic juice work under **alkaline condition**

Pancreatic amylase

- It changes starch to maltose

Lipase

- It changes fats and oils (lipids) to fatty acids and glycerol

Trypsin

- It changes peptides to amino acids

Importance of the pancreas

- It produces pancreatic juice

BILE JUICE (BILE)

- This is a digestive juice which has no enzymes
- It is produced by the liver and stored in the gall bladder
- It does not contain any enzyme

FUNCTIONS OF BILE DURING FOOD DIGESTION

- To breakdown (emulsify) fats in the duodenum
- To neutralize acidic chyme from the stomach
- To provide alkaline conditions in duodenum

GALL BLADDER

- This is a small pouch that sits under the liver
- The gall bladder is full of bile before a meal and it empty after a meal

IMPORTANCE OF GALL BLADDER

- To store bile juice (bile)
- To control the flow of bile juice into the duodenum

FOOD IN THE ILEUM

- The ileum is the lowest part of the small intestines
- The ileum is about 6 metres long
- Food digestion ends in the ileum
- Food absorption occurs in the ileum
- The ileum has finger-like structures/projections called **villi** that absorb digested food
- The walls of the small intestines produce (secrete) a digestive juice called **intestinal juice (succus entericus)**

Digestive enzymes found in intestinal juice (succus entericus)

- | | |
|-----------|-----------------------|
| ▪ Maltase | ▪ Lipase |
| ▪ Lactase | ▪ Peptidase (erepsin) |
| ▪ Sucrose | |

Processes that occur in the ileum

- Food digestion
- Food absorption (it is the main process)

Main material absorbed in the ileum

- Digested food (food)

Food absorption

- This is the process by which digested food is taken into the blood stream.

ADAPTATIONS OF THE ILEUM TO ITS FUNCTIONS

- It is long

To increase surface area for food absorption

- It has many villi

To increase surface area for food absorption

- It has thin walls (thin epithelium)

For easy diffusion of digested food

- It has a dense network of blood capillaries

For easy diffusion of digested food

- It is coiled

To increase surface area for food absorption

- It has narrow lumen

To slow food movement that allows proper absorption

Why does digestion of food end in the ileum?

- It has many enzymes to complete food digestion
- It has villi to absorb digested food

HEPATIC PORTAL VEIN

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

Why does blood with digested food (blood from the ileum) go to the liver?

- For the blood to be detoxified (for the liver to remove toxic substances)
- For the liver to store excess nutrients

THE LIVER

- This is a reddish brown organ in the abdominal cavity below the diaphragm
- It is the largest organ in the human body

Write down the functions of the liver.

- It produces bile juice (bile)
- It detoxicates blood (removes toxic substances from blood)
- It helps in deamination (converts excess amino acids into urea)
- It regulates blood sugar level
- It produces body heat
- It stores some **vitamins** (A, D, E and K) and **mineral salts** (iron and potassium)

Why does a dead body (corpse) feel cold?

- The liver that produces heat has stopped working

Why is a liver called a storage organ?

- It stores some vitamins and mineral salts

Name three toxic (harmful) substances removed from blood by the liver

- Alcohol
- Urea
- Expired drugs

A TABLE SHOWING FOOD VALUES AND THEIR END PRODUCTS

Food value	End products
▪ Carbohydrates	Glucose
▪ Proteins	Amino acids
▪ Fats and oils	Fatty acids and glycerol

USES OF EACH FOOD VALUE (CLASS OF FOOD) IN OUR BODIES

- Carbohydrates provide energy to the body
- Proteins build the body tissues/help in proper growth of the body
- Proteins repair worn out body tissues
- Proteins help in making of enzymes
- Fats and oils (lipids) keep the body warm
- Fats and oils (lipids) provide energy to the body

THE LARGE INTESTINES (LARGE BOWEL)

- It is about 1.5 metres long

PARTS OF THE LARGE INTESTINES

- | | |
|----------|----------|
| ▪ Caecum | ▪ Rectum |
| ▪ Colon | ▪ Anus |

CAECUM

- It connects the small intestines to the colon

COLON

- It absorbs water and salts

Main process that place in the colon

- Absorption of water

Materials absorbed in the large intestines (colon)

- Water
- Mineral salts (Sodium and potassium)
- Vitamin K

Apart from the colon (large intestines), where else does water absorption take place?

- In the ileum

RECTUM

- The rectum stores undigested food before it is passed out
- It also stores worn out cells from the digestive tract.

ANUS

- It passes out faeces/stool/excrement

Egestion (defecation)

- This is the elimination (passing out) of faeces from the body

MATERIALS THAT MAKE UP FAECES (COMPONENTS OF FAECES)

- | | |
|------------------------------|-----------------|
| ▪ Roughages (Dietary fibres) | ▪ Dead bacteria |
| ▪ Water | ▪ Dead cells |

PARTS OF THE ALIMENTARY CANAL THAT CARRIES OUT ABSORPTION OF MATERIALS

- Ileum
- Colon
- Stomach

ACTIVITY

1. Explain the term absorption of food?
2. Where does absorption of food take place?
3. How is the ileum adapted to food absorption?
4. Where does absorption of the following foods take place?
 - i) Alcohol
 - ii) Water
5. Where does digestion of fats take place in the mouth?
6. Write down things that happen to food in the mouth?
7. By what process does food move down the gullet?
8. Identify the two enzymes produced in the stomach.
9. State the major function of the following parts of digestive system.
 - i) Gall bladder
 - ii) Liver
10. Name the enzyme that breaks down carbohydrates into maltose
11. What is the major role of bile produced by the liver in the digestive process?
12. Identify the major function of a spleen.
13. Identify the digestive juice produced by;
 - i) Pancreas
 - ii) Stomach

SUMMARY TABLE OF DIGESTIVE PROCESSES

Part	Gland	Digestive juice	Enzymes	Food changes
Mouth	Salivary glands	saliva	Salivary amylase (Ptyalin)	Starch to maltose
Stomach	Gastric glands	Gastric juice	pepsin	Proteins to peptides
			Rennin	clots milk proteins in the stomach of infants (curdles/coagulates milk the stomach of infants)
Duodenum	liver	bile	No enzyme	Emulsifies the fats
	pancreas	Pancreatic juice	Trypsin	Proteins to peptides Peptides to amino acids
			Pancreatic amylase	Starch to maltose
			Lipase	Lipids (fats) to fatty acids and glycerol

Ileum		Intestinal juice (succus entericus)	Lactase	Lactose to glucose/galactose
			Maltase	Maltose to glucose
			Sucrase	Sucrose to glucose/fructose
			Lipase	Fats to fatty acids and glycerol
			peptidase	Peptides to amino acids
Colon				Water absorption
Rectum				Storage of faeces

DIGESTIVE DISORDERS (disturbance to alimentary canal and make it fail to function properly)

- Constipation
- Diarrhoea
- Indigestion
- Vomiting
- Intestinal obstruction
- Heartburn

CONSTIPATION

- This is a condition where by a person finds it difficult to pass out faeces.
- The faeces are very hard and dry and do not come out easily.

Causes

- lack of roughages in one's diet
- having irregular meals
- drinking too little water
- lack of exercise to the body

INDIGESTION

- This happens when food is not properly digested
- A person feels stomach pains, heart burn (burning in the chest) and tiredness.

Causes

- No chewing food properly
- Eating so hurriedly
- Too much drinking of alcohol

INTESTINAL OBSTRUCTION

- Caused when intestine twist or fold themselves causing vomiting, thirsty and death if not reported immediately to the doctor.

VOMITING

- This is a sign of very many diseases.
- It disturbs the digestive system and forces the cardiac sphincter to open and the food in the stomach to be ejected through the mouth.
- Seek for medical attention.

HEARTBURN

- This is when the contents of the stomach back up into the gullet

DISEASES OF THE DIGESTIVE SYSTEM

- Appendicitis
- Peptic ulcer
- cholera
- Typhoid
- Diarrhoea
- Dysentery
- Hepatitis

Appendicitis

- This is the inflammation of the appendix.
- This may due to stones or other indigestible solids that get trapped in the appendix.
- See the doctor for medical attention.

Peptic ulcers

- These are sores in the stomach wall caused by too much acid.
- The victim experiences a chronic sharp pain in the stomach and frequent heart burn.

Dysentery

- It is caused by a bacterium or Amoebas got from uncooked food or dirty food or water.
- The victim visits the toilet very frequently, passing out watery stools with some blood.

Typhoid

- Caused by bacteria which cause inflammation of the intestine and easily lead to death.

Ways through which food is made dirty

- Handling food with dirty hands.
- House flies landing on food with their hairy bodies.
- Use of dirty containers to keep food.
- Using dirty utensils to handle food.
- Leaving food uncovered.
- Preparing food in dirty places.

Good eating habits

- Washing hands with soap before serving, handling or eating food.
To kill germs in hands
- Washing hands after visiting a latrine/Toilet.
- Chewing food properly before swallowing.

To prevent constipation

- Avoid talking while eating food

To prevent choking

- Feeding on a balanced diet.
- Wash hands after eating.
- Washing fruits/vegetables before eating them

To prevent hookworm infestations

To remove germs

- Eat well cooked food

To ease digestion

- Brush teeth every after a meal.
- Do not eat contaminated

To prevent food poisoning and diarrhoeal diseases

Bad eating habits

- Eating food with unwashed hands
- Opening the mouth while eating food
- Eating hurriedly
- Talking while eating
- Opening bottle tops using the teeth

How to improve on the working condition of digestive system

- Eat and serve food with clean hands.
- Have regular physical exercises.
- Avoid eating stale or rotten food.
- Having a balanced diet.
- Avoid drinking too much alcohol.
- Including enough roughages in the diet.
- Have regular meals.
- Always eat the right quantity of food.
- Avoid eating while talking.

Activity

1. Write down three diseases and three disorders of digestive system.
 - a. diseases
 - b. disorders
2. Suggest any two ways through which food we eat gets contaminated.
3. Write down at least two examples of good eating habits.
4. Why should food be covered immediately after being cooked?
5. How are house flies adapted to spreading of diseases?

TERM TWO

OUR ENVIRONMENT

- Environment refers to all things that surround an organism

Components of the environment

- Plants
- Animals
- Bacteria
- Fungi
- Protista
- Water
- Air
- Soil

SOIL

- Soil is the top layer of the earth's surface
- It supports both plant and animal life

TERMS USED IN SOIL

- **Soil texture** – This is the roughness or smoothness of soil particles.
- **Soil structure** – This is the arrangement of soil particles in an area.
- **Soil tone** - This is the colour of soil.
- **Soil sampling** – This is the taking of soil samples from an area with the aim of analyzing them in the laboratory
- **Irrigation** – This is the artificial method of providing water to crops in dry areas
- **Soil aeration** - This is the movement of air in the soil
- **Soil pH** - This is the degree of acidity or alkalinity of the soil
- **Soil drainage** -This is the downward movement of water in the soil
- **Soil capillarity**- This is the upward movement of water between small spaces in the soil
- **Soil profile**- This is the vertical arrangement of soil layers / Is the arrangement of soil layers from the top to the bottom
- **Soil Leaching** – Is the sinking of soil nutrients to deeper soil layers where plant roots cannot reach
- **Soil exhaustion**- Is the loss of soil fertility
- **Soil fertility** – Is the ability of the soil to support plant growth
- **Soil erosion**- Is the gradual removal of top soil by its agents

METHODS OF SOIL FORMATION (How soil is formed)

- Weathering
- Decomposition

WEATHERING

- This is the breakdown of rocks into smaller particles to form soil

TYPES OF WEATHERING

- Chemical weathering
- Biological weathering
- Physical weathering

FACTORS THAT CAUSE WEATHERING

- Earth quake
- Action of plant roots
- Acid rain
- Frost action
- Action of heat (temperature)
- Mining
- Road construction

How does temperature cause weathering?

- When temperatures are high, rocks expand and when temperatures are low, rocks contract and hence breaking.

How does acid rain cause weathering of rocks?

- It causes chemical reactions

Decomposition

- This is the breakdown of organic matter to form soil.
- **Bacteria and fungi** help in decomposition

Decomposition is a **chemical change**

How do bacteria help in decomposition?

- They breakdown organic matter

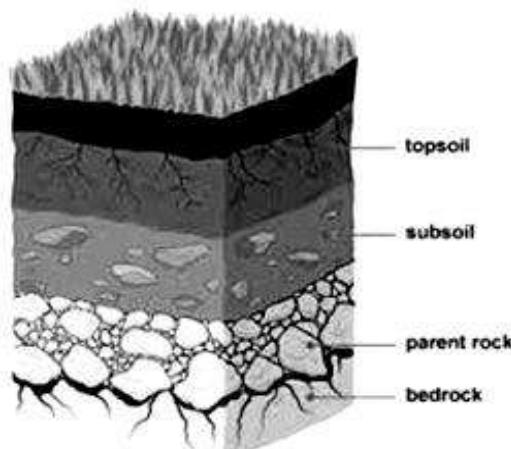
Importance of weathering and decomposition in the environment

- They help in soil formation

SOIL PROFILE

- Soil profile is the vertical arrangement of soil layers

Structure of soil profile



Layers of soil (soil horizons)

- Top soil (A horizon): it is the uppermost layer of the soil
- Sub soil (B horizon)
- Parent/bed rocks (C horizon) – provides materials for road construction

Why does subsoil sometimes tend to be rich in mineral salts?

- Due to leaching

Places where soil profile can clearly be seen

- Rubbish pit
- Pit latrine
- Mining sites

TYPES OF SOIL

- Loam soil
- Clay soil
- Sand soil

Diagrams showing the types of soil

LOAM SOIL

- It is the best soil for crop growing
- It is dark in colour
- It has a bad smell and produces smoke when burnt

Use of loam soil

- It is used for crop growing

Reasons why Loam soil is the best for crop farming

- It has a lot of humus
- It is moderately drained
- It is moderately aerated
- It has a good water holding capacity
- It has moderate soil texture

CLAY SOIL

- It has fine smooth particles (has smooth texture)
- It is sticky when wet
- It has very little humus
- It has compact particles
- It has poorly aerated
- It is poorly drained
- It has the highest water holding capacity (it retains water for a long time)

- It is water logged
- It has the highest capillarity

Uses of clay soil

- It is used for making ceramics (pottery)
- It is used for brick making
- It is used for building houses
- It is used for growing crops that need a lot of water

Why clay soil is used for brick making and ceramics

- It is sticky when wet

Why clay soil is poorly aerated and drained

- It has very small spaces between its particles

Why is waterlogging dangerous to plant roots and organisms in the soil?

- It leads to lack of oxygen for respiration

Examples of clay products

- | | |
|-----------|---------------|
| ▪ Pots | ▪ Clay stoves |
| ▪ Bricks | ▪ Statues |
| ▪ Teapots | ▪ Plates |

Crops that grow well in swamps/wetlands

- | | |
|------------------|-----------|
| ▪ Rice | ▪ Cabbage |
| ▪ Sweet potatoes | ▪ Yams |
| ▪ Sugarcanes | |

Why are some plants not able to grow in waterlogged areas?

- Due to lack fresh air around their roots

How can clay soil be improved?

- By adding humus and lime

SAND SOIL

- It has very big spaces between particles
- It has big rough particles (has coarse/rough texture)
- It has the lowest water holding capacity
- It has the lowest capillarity
- It lacks humus (it is not fertile)/it has low mineral content
- It is well drained
- It is well aerated

Uses of sand soil

- It is used for building houses

- It is used for making glasses
- It is used for making sandpapers
- It is used for washing saucepans
- It is used for putting out petrol fire

How can sandy soil be improved?

- By adding humus

Why is sand soil well drained?

- It has large spaces between its particles/has spaced soil particles

Why is sand soil the best for building houses?

- It dries up quickly

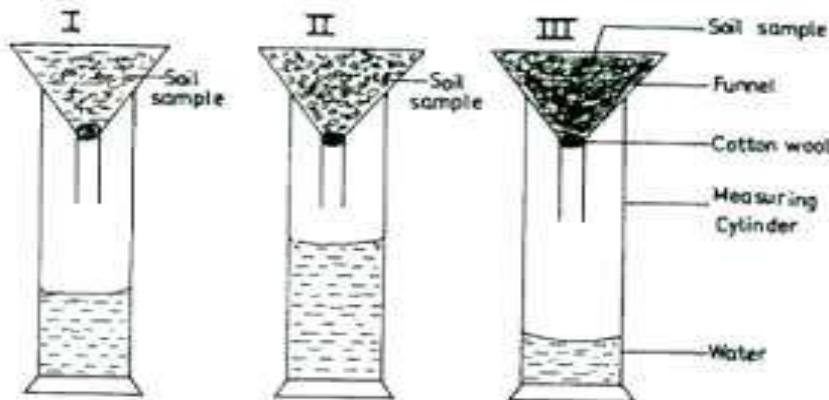
SOIL CAPILLARITY

- This is the upward movement of water between small spaces in the soil

Experiments to show soil capillarity

- Put equal volume of sand, loam or clay soil in glass tubes with open ends
- Stand the glass tubes in a beaker with water
- Observe for several days until the water has stopped rising

Illustration



Observation

- Water rises highest in clay soil
- Water rises moderate in loam soil
- Water rises lowest in sand soil

Conclusion

- Clay soil has the highest capillarity
- Sand soil has the lowest capillarity

Why does water rise highest in clay soil?

- Clay soil has the greatest capillarity than other soils
- Due to closeness of soil particles and small pore spaces

SOIL DRAINAGE (SOIL PERMEABILITY)

- This is the downward movement of water in the soil
- Sand soil has the highest drainage
- Clay soil has the least drainage

Experiment to show soil drainage/soil permeability/water percolation in soil

- Put cotton wool in each funnel

Why? Cotton wool allows water to drain slowly

- Put equal volume of clay, loam or sand soil on each cotton wool
- Place each funnel on a measuring cylinder (glass jar)
- Pour equal volume of water in each funnel

Illustration

Observation

- Much water is collected in a jar of sand soil
- Little water is collected in a jar of clay soil

Conclusion

- Sand soil has the best drainage (greatest permeability)

Why? It has very big spaces between its particles

- Clay soil has least drainage (lowest permeability)

Why? It has compact particles (its particles are closely packed together)

- Loam soil has the moderate drainage (moderate permeability)

COMPONENTS/ELEMENTS OF COMPONENTS (SOIL CONSTITUENTS)

- These are things that make up soil

They include:

- Humus
- Soil organisms
- Rock particles
- Water
- Mineral salts
- Air

Mineral salts occupy the greatest percentage in soil

How are the following components of soil formed?

- i) **Rock particles:** By weathering
- ii) **Humus:** By decomposition

Examples of soil components found in spaces between soil particles.

- Water
- Air

Organic components of soil

- Humus
- Soil organisms

Inorganic components of soil

- Rock particles
- Water
- Air
- Mineral salts

WATER AS A COMPONENT OF SOIL

- Water is found in spaces between soil particles
- Soil without water becomes dry, light and unproductive
- Soil water that is useful to plants is called **capillary water**

Functions of water in the soil

- It is used during photosynthesis
- It is a weathering agent
- It cools the soil
- It helps in seed germination
- It dissolves mineral salts in the soil
- It speeds up decomposition of organic matter
- It supports life of soil organisms

EXPERIMENT TO SHOW THAT SOIL CONTAINS WATER

- Put a lump of soil in a beaker
- Cover the beaker with a glass cover
- Heat the beaker for some time

Illustration

Observation

- Water droplets are seen on sides of the beaker and on glass cover

Conclusion:

- Water droplets show that soil contains water

State the importance of the following in the experiment shown above

Glass cover

- To trap and condense water vapour into water droplets

Heat /source of heat

- To evaporate water in the soil

AIR AS A COMPONENT OF SOIL

- Air is the mixture of gases
- Air is found in spaces between soil particles
- Air occupies spaces between soil particles unless when soil is waterlogged

Importance of air in the soil

- Nitrogen helps legumes to make plant proteins
- Oxygen helps in seed germination
- Oxygen helps in respiration of soil organisms and plant roots
- Carbon dioxide makes the soil acidic for proper growth of some plants

EXPERIMENT TO SHOW THAT SOIL CONTAINS AIR

- Put water in a beaker
- Add a lump of soil

Observation

- Air bubbles come out of the soil

Conclusion

- Air bubbles from the soil show that soil contains air

HUMUS AS A COMPONENT OF SOIL

- Humus is dark brown in colour
- It is formed **by decomposition of organic matter** (When dead plants and animals rot/decay)
- **Putrefying bacteria** help in decomposition/cause rotting of organic matter

Mention two groups of living things that help in decomposition

- Bacteria
- Fungi

Functions of humus in the soil

- It adds nutrients to the soil (it makes soil fertile)
- It improves water holding capacity of soil
- It binds/holds soil particles together
- It keeps warmth in the soil
- It balances soil temperature
- It prevents waterlogging in the soil

How does humus keep warmth in the soil?

- By absorbing sun's heat

EXPERIMENT TO SHOW THAT SOIL CONTAINS HUMUS

- Put a lump of soil in a beaker
- Strongly heat the soil

Illustration

Observation

- Smoke comes out of the soil
- Stench of burning rubbish will be smelt

Conclusion

- Smoke from the soil shows that soil contains humus

MINERAL SALTS AS COMPONENT OF SOIL

- Mineral salts take the greatest percentage in soil
- They are dissolved into mineral salt solution by water
- Plant roots absorb mineral salt solution (water and mineral salts) by a process called **osmosis**
- **Osmosis** is the movement of water molecules from an area of low salt concentration to an area of high salt concentration through a semi permeable membrane

EXAMPLES OF MINERAL SALTS IN THE SOIL

MINERAL SALTS	IMPORTANCE TO PLANTS
Nitrates and phosphates	<ul style="list-style-type: none">▪ They help legumes to make proteins
Phosphorus	<ul style="list-style-type: none">▪ It strengthens plant cell
Potassium	<ul style="list-style-type: none">▪ It forms the plant cell▪ It makes the plant resistant to diseases and drought
Iron and magnesium	<ul style="list-style-type: none">▪ They form chlorophyll
Calcium	<ul style="list-style-type: none">▪ It forms plant cell wall

EXPERIMENT TO SHOW THAT SOIL CONTAINS MINERAL SALTS

- Put water in the beaker and add soil
- Stir the mixture
- Filter to remove the residue
- Boil the filtrate to dryness (evaporate the filtrate)

Illustration

Observation

- Crusts of salt are seen in the beaker

SOIL ORGANISMS AS COMPONENT OF SOIL

- These are living things found in soil

EXAMPLES OF SOIL ORGANISMS

- | | |
|--|--|
| <ul style="list-style-type: none">▪ Earthworms▪ Termites▪ Crickets▪ Bacteria▪ Fungi▪ Centipedes | <ul style="list-style-type: none">▪ Millipedes▪ Beetles▪ Ants▪ Rats▪ Mice▪ Porcupines |
|--|--|

EXPERIMENT TO SHOW THAT SOIL CONTAINS ORGANISMS (EARTHWORMS)

- Prepare soapy water
- Pour it on garden soil
- Wait for a few minutes
- Any earthworms present will come

Functions of organisms in the soil

- They help improve soil aeration (they aerate the soil)
- Bacteria and fungi help in decomposition
- Nitrogen fixing bacteria fix nitrogen in the soil
- Termites and earthworms break down organic matter

How do earthworms and termites aerate the soil?

- By making channels (small holes) in the soil/by burrowing in the soil

State the importance of putrefying bacteria in the soil.

- They help in decomposition

ROCK PARTICLES AS COMPONENT OF SOIL

- Rock particles are inorganic components of soil
- They are formed by weathering

Importance of rock particles in the soil

- They provide mineral salts to the soil

- They hold plant roots firmly
- They form the frame work of the soil

SOIL EXHAUSTION (SOIL INFERTILITY)

- This is the loss of soil fertility

Causes of soil exhaustion

- Soil erosion
- Leaching
- Mono cropping (monoculture)
- Misuse of artificial fertilizers
- Over grazing
- Over cropping
- Poor disposal of non-biodegradable wastes e.g plastics and polythene

LEACHING

- This is the loss of mineral salts from the top soil to deeper soil layers
- This is the sinking of mineral salts to deeper soil layers where plant roots cannot reach

Causes of leaching

- Constant irrigation
- Heavy rainfall (floods)

Effects (dangers) of leaching

- It leads to soil infertility (soil exhaustion)
- It makes soil acidic
- It makes soil hard to dig

SOIL EROSION

- This is the removal of top soil by its agents

Agents of soil erosion

These are things that make soil erosion to take place

- Flowing water
- Strong wind
- Moving animals

Causes of soil erosion

These are factors that make it easy for agents to carry away top soil

- Mono cropping (monoculture)
- Overgrazing
- Over stocking
- Deforestation
- Bush burning
- Over cultivation (over cropping)
- Cultivation along river banks
- Landslides
- Floods

How does deforestation cause soil erosion?

- It leaves the soil bare exposing it to the agents of erosion

How does over stocking and over grazing cause soil erosion?

- Animals eat all vegetation and leave the soil bare
- Animals carry soil in their hooves

DEFORESTATION

- This is the massive cutting down of trees without replacement

Why do people practise deforestation?

- To get land for Settlement
- To get land for farming
- For road construction
- For industrialization
- Due to charcoal burning
- Due to lumbering

Effects of deforestation

- It causes soil erosion
- It causes to drought
- It causes global warming
- It destroys habitats for wildlife

WAYS (METHODS) OF CONTROLLING SOIL EROSION

- Afforestation: This is the planting of trees in an area
- Reforestation: This is the planting of trees to replace the cut ones
- Terracing
- Strip cropping
- Contour ploughing
- Mulching
- Strip cropping
- Bush fallowing
- Cover cropping
- Agroforestry
- Bundling: This is the making of embankments on river banks to control soil erosion

CONTROL OF SOIL EROSION IN SCHOOL COMPOUND

- Planting short grass (It is the best way)
- Planting trees

How do trees control soil erosion?

- Trees reduce the speed of wind (trees act as windbreaks)
- Trees leaves reduce the strength of raindrops that fall on soil
- Tree roots bind/hold soil particles together

METHODS OF CONTROLLING OF SOIL EROSION ON HILLY AREAS OR MOUNTAINOUS AREAS OR STEEP SLOPES

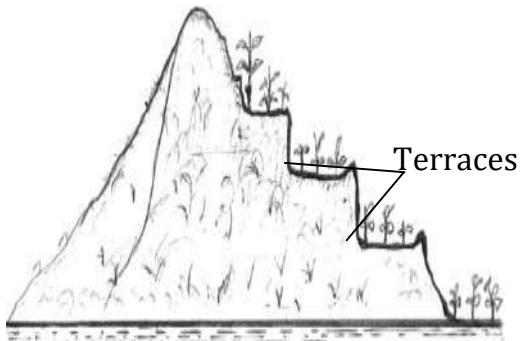
- Terracing

- Contour ploughing
 - Strip cropping

Terracing

- This is when a slope is cut into steps to reduce the speed of flowing water

A diagram showing terracing



How does terracing control soil erosion?

- Terraces reduce the speed of flowing water

TYPES OF SOIL EROSION

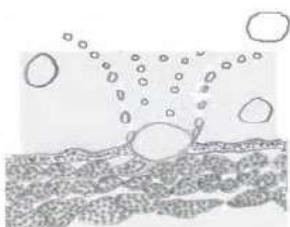
- Splash erosion (rain drop erosion)
 - Sheet erosion
 - Rill erosion
 - Gully erosion
 - River bank erosion

SPLASH EROSION

This occurs when rain drops form small holes in the soil

Rain drops scatter soil particles

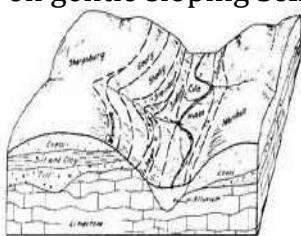
It is common on soil where iron sheets pour water



SHEET EROSION

This is when top soil is uniformly eroded by wind or flowing water

It is common on gentle sloping **school compounds**



RILL EROSION

This is when small channels are formed on the ground by flowing water

These small channels are called **rills**

It is common on gentle sloping areas

Rill erosion results from sheet erosion



GULLY EROSION

- This is when big channels formed on soil by flowing water
- It is common on **hilly areas**

EFFECTS (DANGERS) OF SOIL EROSION

- It leads to soil infertility (soil exhaustion)
- It leads to land degradation (makes soil unproductive)
- It leads to silting
- It destroys crops
- It makes soil hard to dig
- It destroys homes of soil organisms

SILTING

- This is the deposition of eroded materials into a water body

AGENTS OF SILTING

- Flowing water
- Strong wind
- Moving animals

SILT

- These are eroded materials deposited into a water source

EXAMPLES OF SILT

- Soil/mud
- Cow dung
- Grass
- Rubbish

CAUSES OF SILTING

- Soil erosion
- Cultivating along riverbanks and lake shores
- Allowing animals to drink in water sources
- Clearing vegetation on riverbanks and lake shores

EFFECTS (DANGERS) OF SILTING

- It leads to water pollution
- It makes water bodies shallow (it reduces the depth of a water body)
- It leads to flooding of water bodies
- It leads to death of some marine animals
- It destroys the habitats for marine animals

How does silting lead to floods (flooding of water bodies)?

- By reducing the capacity or depth of water bodies

How does silting lead to death of aquatic (marine) animals?

- Silt suffocates marine animals

CONTROL OF SILTING

- Planting short grass around water sources
- Putting silt traps around water bodies
- Avoid cultivating along river banks and lake shores
- Using a dredging machine to remove silt from water bodies

SOIL CONSERVATION:

- This is the way of maintaining (improving) soil fertility

Soil fertility

- This is the ability of soil to support proper plant growth.

WAYS OF CONSERVING SOIL (WAYS OF MAINTAINING ON SOIL FERTILITY)

- | | |
|---------------------|------------------|
| ▪ Mulching | ▪ Bush fallowing |
| ▪ Contour ploughing | ▪ Agroforestry |
| ▪ Manuring | ▪ Terracing |
| ▪ Planting legumes | ▪ Afforestation |
| ▪ Crop rotation | ▪ Inter cropping |
| ▪ Strip cropping | |

INTERCROPPING

- This is the growing of different crops on the same piece of land at the same time.

MULCHING.

- This is the covering of top soil with dry plant materials.

Mulches

- These are dry plant materials used to cover top soil.

EXAMPLES OF MULCHES

- | | |
|------------------------|---------------------|
| ▪ Dry grass | ▪ Dry maize stalks |
| ▪ Dry coffee husks | ▪ Dry bean husks |
| ▪ Dry banana leaves | ▪ Dry banana fibres |
| ▪ Chopped banana stems | |

Main reason for mulching

- To conserve moisture in the soil (to keep water in the soil)

ADVANTAGES OF MULCHING (REASONS FOR MULCHING)

- It keeps water (moisture) in the soil
- ✓ Mulches reduce the rate of evaporation of moisture from the soil
- It controls the growth of weeds
- ✓ Mulches prevent weeds from getting sunlight
- It improves soil fertility
- ✓ Mulches rot to form humus
- It controls soil erosion (sheet erosion)

- ✓ Mulches reduce the speed of flowing water
- ✓ Mulches prevent rain drops from hitting the soil directly
- ✓ Mulches prevent top soil from being blown away by strong wind
- It regulates soil temperature
- ✓ Mulches act as heat insulators

DISADVANTAGES OF MULCHING

- Mulches can be fire hazards (mulches can easily catch fire)
- Mulches hide crop pests.
- Wet mulches can grow into weeds.
- Mulching is tiring

CROP ROTATION

- This is the growing of different types of crops on the same piece of land seasonally

FACTORS TO CONSIDER WHEN CARRYING OUT CROP ROTATION

- Legumes should be included in crop rotation
- ✓ They add nitrogen in the soil
- Bush fallowing should be included in crop rotation
- ✓ It helps the soil to regain its fertility (it restores soil fertility)
- Deep-rooted crops should follow shallow-rooted crops
- ✓ It improves proper use of soil nutrients
- Crops of the same family should not follow each other
- ✓ To starve pests
- ✓ To control parasitic weeds

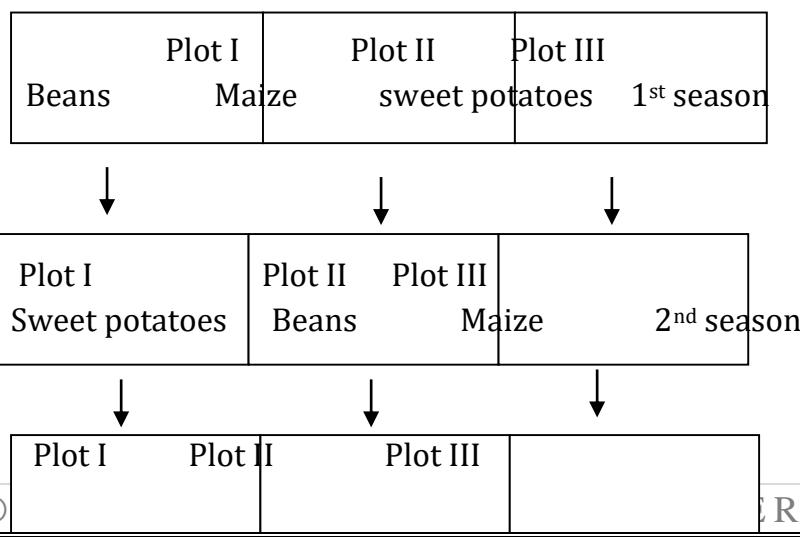
BUSH FALLOWING

- This is the practice in which the land is left uncultivated for a period of time to regain its fertility.

Importance of bush fallowing

- It helps the soil to regain its fertility

An illustration of crop rotation on a three year cycle



Advantages of crop rotation

- ❖ It controls crop pests
It starves crop pests to death
- ❖ It controls parasitic weeds
It starves parasitic weeds to death
- ❖ It improves soil fertility
It involves legumes which add nitrogen to the soil
- It involves bush fallowing which help the soil to rest and regain its fertility
 - ❖ It improves crop yields
 - ❖ It controls soil erosion
- It involves growing of cover crops

FERTILIZERS

- These are substances that are added to the soil to improve its fertility

Methods of applying fertilizers

- ❖ Top dressing (foliar spraying)
- ❖ Broadcasting method
- ❖ Placement method (side dressing or band or ring method)
- ❖ Injection method

TYPES OF FERTILIZERS

1. Natural fertilizers (manure/organic fertilizers)
2. Artificial fertilizers (inorganic fertilizers)

Natural fertilizers (manure or organic fertilizers)

- These are fertilizers got from plant and animal remains
- They are called organic fertilizers **because** they are made from plants and animals remains

EXAMPLES (TYPES) OF MANURE:

- Farm yard manure (FYM)
- Compost manure
- Green manure

Farm yard manure: (FYM)

- This is the manure got from animal waste

Materials from which Farmyard manure is made

- Animal dung
- Animal droppings
- Urine

GREEN MANURE

This is manure got from decomposed crops and dry grass (e.g maize, beans and cow peas)

Crops are cut before flowering and ploughed back into the garden

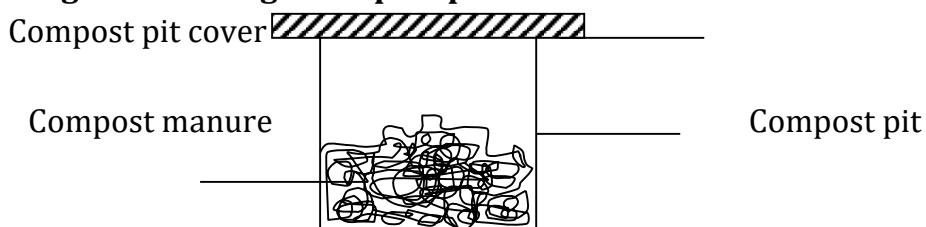
COMPOST MANURE

This is manure got from plant remains and animal wastes after decomposition e.g kitchen refuse, weeds, plant remains and left over food.

Methods of making compost manure

- ❖ Pit method
- ❖ Heap method

A diagram showing a compost pit



A compost pit is a pit where household refuse and left over food are put to rot and form compost manure

Compost cover prevents bad smell from going out of the pit

Why are faeces not always used as manure?

- ❖ Faeces can lead to easy spread of faecal (diarrhoeal) diseases.

Advantages of natural fertilizers

- ❖ They are cheap
- ❖ They last longer in the soil
- ❖ They improve soil texture
- ❖ They do not need skilled labour to apply
- ❖ They improve water holding capacity of the soil
- ❖ They do not pollute the soil
- ❖ They do not leach easily

Disadvantages of natural fertilizers

- ❖ They are dirty to handle
- ❖ They are bulky
- ❖ They take long to decompose (nutrients take long to enter the soil)

Artificial fertilizers (inorganic fertilizers)

- These are fertilizers made in factories (industries)

Types (groups) of artificial fertilizers

- Straight fertilizers
- Compound fertilizers

Straight Artificial Fertilizers

- These are fertilizers made up of one element

Examples of straight fertilizers

- SSP (Single super phosphate)
- DSP (Double super phosphate)
- TSP (Triple super phosphate)

Compound Fertilizers

- These are fertilizers made up of two or more elements.

Examples of compound fertilizers

- NPK – Nitrogen, phosphorous and Potassium
- CAN – Calcium Ammonium Nitrates
- DAP - Di Ammonium Phosphate
- Sodium nitrate
- Ammonium sulphate

Advantages of using artificial fertilizers

- They are very effective
- They are easy to apply
- They are not bulky
- Their side effects are known
- They contain known amount of chemical elements

Disadvantages of Artificial Fertilizers

- They are expensive
- They stay in the soil for a short time
- They need skill and care
- They leach easily
- They destroy soil texture if used for a long time
- They cause poisoning to children and poultry

Agroforestry

This is the growing of crops and trees together in the same garden

Importance of agroforestry

Trees provide shades to the crops

Tree leaves form manure when they rot

Trees help in water cycle

Trees help to control soil erosion

Some trees act as fences

Trees reduce global warming

Trees purify air

Trees provide wood fuel
Trees provide wood for timber
Fruit trees provide fruits to the farmer.
Trees are sources of herbal medicine.
Shady trees prevent growth of some weeds
Trees provide extra support to weak stems
Tree leaves form manure when they rot

SOIL POLLUTION

- This is the releasing of harmful substances into the soil

SOIL POLLUTANTS

- These are substances that are harmful to the soil

EXAMPLES OF SOIL POLLUTANTS

- | | |
|---|------------------|
| ▪ Plastics | ▪ Old engine oil |
| ▪ Polythene papers | ▪ Broken glasses |
| ▪ Scrap metals | ▪ Garbage |
| ▪ Agrochemicals (e.g herbicides and pesticides) | |

Ways of polluting the soil (causes of soil pollution)

- Dumping polythene papers on the soil
- Dumping plastics on the soil
- Dumping broken glasses on the soil
- Dumping scrap metals on the soil
- Dumping garbage on the soil
- Dumping untreated industrial waste into the soil
- Using herbicides to kill weeds
- Excessive use of artificial fertilizers
- Pouring old engine oil to the soil

DANGERS OF SOIL POLLUTANTS (How do soil pollutants affects the soil?)

- **Polythene papers, plastics, broken glasses and scrap metals**
 - ✓ They lead to soil exhaustion (soil infertility)
 - ✓ They prevent water and air from entering the soil
- **Waste (old) engine oil**
 - ✓ It kills the soil organisms
 - ✓ It prevents air from entering the soil
- **Artificial fertilizers**
 - ✓ They destroy soil texture
 - ✓ They make the soil acidic
- **Herbicides and pesticides**
 - ✓ They kill soil organisms

EFFECTS OF SOIL POLLUTION

- It leads to soil exhaustion/soil infertility
- It leads to death of soil organisms
- It leads to poor crop yields

CONTROL OF SOIL POLLUTION

- Use organic manure instead of artificial fertilizers
- Ensure proper disposal of non-biodegradable waste e.g polythene papers and plastics.
- Use the 5Rs of waste management
- Avoid dumping polythene papers on the soil
- Avoid dumping plastics on the soil
- Avoid dumping broken glasses on the soil
- Avoid dumping untreated waste from factories on the soil

NON-BIODEGRADABLE WASTES

- These are wastes that cannot rot/decay

Examples of non-biodegradable wastes

- | | |
|--------------------|------------------|
| ▪ Old plastics | ▪ Broken glasses |
| ▪ Polythene papers | ▪ Scrap metals |

How do non-biodegradable wastes affect the soil?

- They prevent water and air from entering the soil
- They lead to soil exhaustion
- They lead to soil pollution
- They lead to death of soil organisms

WRITE DOWN THE 5RS OF WASTE MANAGEMENT

- | | |
|-----------|-----------------|
| ▪ Recycle | ▪ Reduce |
| ▪ Reuse | ▪ Reject/Refuse |
| ▪ Return | |

RECYCLE

- This is the converting of a waste material into a new material.

RECYCLABLE WASTES

- These are waste materials that can be converted into new materials.
- These are waste materials that can be processed and used again.

EXAMPLES OF RECYCLABLE WASTE

- | | |
|----------------|------------------|
| ▪ Old plastics | ▪ Broken glasses |
| ▪ Scrap metals | ▪ Old papers |

MATTER AND ENERGY

TERMS USED IN MATTER AND ENERGY

COHESION

- This is the force of attraction between molecules of the same kind

ADHESION

- This is the force of attraction between molecules of different kinds e.g water and glass

VISCOSITY

- This is the friction found in liquids and gases

MATTER

- This is anything that occupies space and has weight

AN ATOM

- This is the smallest unit of matter that has properties of a chemical element

MOLECULE

- This is a group of two or more atoms joined together

PROPERTIES OF MATTER

- ❖ Matter occupies space (matter has volume)
- ❖ Matter has weight
- ❖ Matter exerts pressure
- ❖ Matter is made up of molecules
- ❖ Matter can neither be created nor destroyed

EXAMPLES OF MATTER

- | | |
|--------------|---------|
| ▪ Stones | ▪ Chalk |
| ▪ Water | ▪ Milk |
| ▪ Air | ▪ Smoke |
| ▪ Human body | ▪ Ash |
| ▪ Soil | |

THINGS THAT ARE NOT REGARDED AS MATTER

- | | |
|---------------|----------|
| ▪ Radio waves | ▪ Dreams |
| ▪ Memories | ▪ Warmth |
| ▪ Ideas | |

Why is warmth not regarded as matter?

- It does not occupy space
- It has no weight

MAIN STATES OF MATTER

- Gaseous state (gas)
- Liquid state (liquid)
- Solid state (solid)

NOTE

- **Water** can exist in all the three main states of matter.

Why does water exist in all the three main states of matter?

- The orientation of hydrogen bonds in water allows it to change to all the three main states of matter.

Besides the three main states of matter, name other state of matter

- Plasma (e.g stars and the sun belong to plasma state of matter)

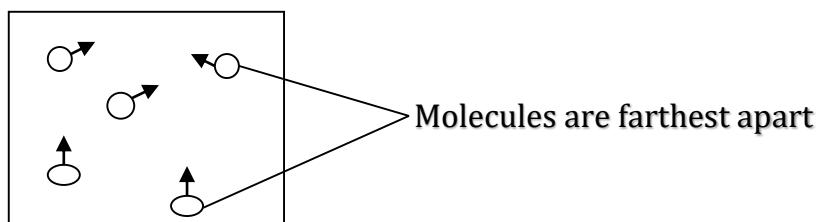
GASEOUS STATE

- Molecules in gases are farthest apart.
- Heat travels **fastest** in gaseous state.
- ✓ It has mobile (freely moving) molecules.
- Sound travels **slowest** in gaseous state.
- ✓ Its molecules are farthest apart.
- Gases turn into liquid by **condensation**.
- Gases turn into solids by **deposition**.

EXAMPLES OF SUBSTANCES IN GASEOUS STATE OF MATTER

- | | |
|------------------------|-----------------|
| ▪ Smoke | ▪ Air |
| ▪ Water vapour (steam) | ▪ Exhaust fumes |

A DIAGRAM SHOWING MOLECULES IN GASEOUS STATE



PROPERTIES OF GASES

- They have no shape.
- Molecules in gases are farthest apart.
- Heat travels in gases by **convection**.
- Gaseous state has the smallest density.
- Gases have no cohesion forces.

AIR

- This is the mixture of gases

COMPONENTS OF AIR

- | | |
|-------------------|-------|
| ▪ Nitrogen: | 78% |
| ▪ Oxygen: | 21% |
| ▪ Rare gases: | 0.97% |
| ▪ Carbon dioxide: | 0.03% |

PROPERTIES OF AIR

- | | |
|----------------------|-------------------------|
| ▪ Air has weight | ▪ Air can be compressed |
| ▪ Air occupies space | ▪ Air exerts pressure |

DIAGRAMS SHOWING THE PROPERTIES OF AIR

1. AIR HAS WEIGHT

What shows that air has weight in the diagram above?

- An inflated balloon has lifted a deflated balloon.

Why does an inflated balloon lift a deflated balloon?

- An inflated balloon is heavier than a deflated balloon.

Why should an inflated balloon be tied with a thread on its neck??

- To prevent air from inside it from escaping

APPLICATION OF AIR HAS WEIGHT

2. AIR EXERTS PRESSURE

State the importance of cardboard in the experiment above.

- To prevent water from coming out

Why does the cardboard stick on glass for some time without falling?

- Air pressure outside is equal to pressure inside the glass

APPLICATION OF AIR EXERTS PRESSURE

- It helps in drinking soda using straws
- It helps in sucking ink into fountain pens
- It helps in sucking liquid medicine using a syringe
- It helps in flying kites and balloons

3. AIR CAN BE COMPRESSED

APPLICATION OF AIR CAN BE COMPRESSED

- It helps in spraying agrochemicals (e.g using knapsack sprayer)
- It helps in pumping air in tubes of tyres (e.g using pumps)
- It helps in spraying insecticides and perfumes (e.g using aerosol sprays)
- It helps in using fire extinguishers to put out fire
- It helps tyres to support the weight of vehicles

4. AIR OCCUPIES SPACE

APPLICATION OF AIR OCCUPIES SPACE

- It helps us to fill up balloons with balloons

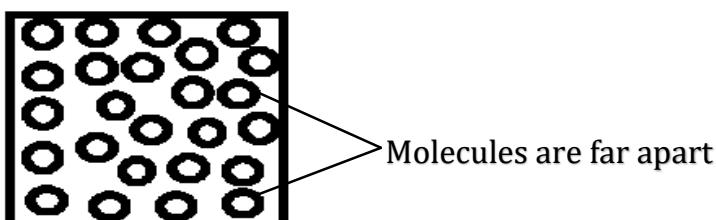
LIQUID STATE

- Molecules in liquids are farther apart.
- Liquids turn into gases by **evaporation**.
- Liquids turn into solids by **freezing**.

EXAMPLES OF SUBSTANCES IN LIQUID STATE

- | | | |
|-----------|----------|------------|
| ▪ Water | ▪ Soda | ▪ Kerosene |
| ▪ Alcohol | ▪ Milk | ▪ Porridge |
| ▪ Syrup | ▪ Petrol | ▪ Honey |

A DIAGRAM SHOWING MOLECULES IN LIQUID STATE



PROPERTIES OF LIQUIDS

- They have indefinite shape

- They take up the shape of the container in which they are put.
- Liquids flow
- ✓ They have weak cohesion forces
- Heat travels in liquid state by **convection**.
- Molecules in liquids are farther apart
- Liquids find their own level
- Pressure in liquids increases with increase in depth
- Pressure in liquids act equally in all directions at the same level

DIAGRAMS SHOWING PROPERTIES OF LIQUIDS

VISCOSITY

- This is the friction in liquids and gases

VISCOUS LIQUIDS

- These are liquids that cannot flow easily
- They have great viscosity

EXAMPLES OF VISCOUS LIQUIDS

- Porridge
- Syrup
- Honey

SOLID STATE

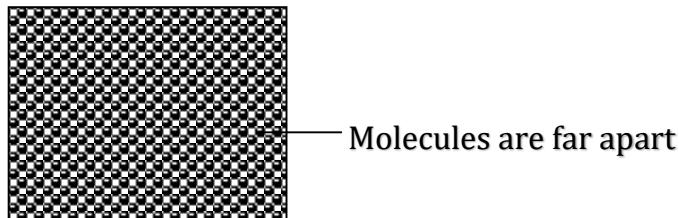
- Molecules in solids are compact (closely packed together)
- Solids turn into liquids by **melting**
- Solids turn into gases by **sublimation**
- Sound travels **fastest** in solids
- ✓ It has closely packed molecules

- Heat travels **slowest** in solid state

EXAMPLES OF SUBSTANCES IN SOLID STATE

- Wood
- Soil
- Charcoal
- Maize flour
- Ice
- A bar of soap

A DIAGRAM SHOWING MOLECULES IN SOLID STATE



PROPERTIES OF SOLIDS

- They have shape.
- They have compact (closely packed) molecules.
- ✓ They have strong cohesion (cohesive force).
- Heat travels in solids by **conduction**.
- Solids have the greatest density
- Solids cannot be reduced by compression

PHYSICAL CHANGES

These are changes that do not form new permanent substances.

Changes in the states of matter

All changes in the states of matter are **physical processes**

Why?

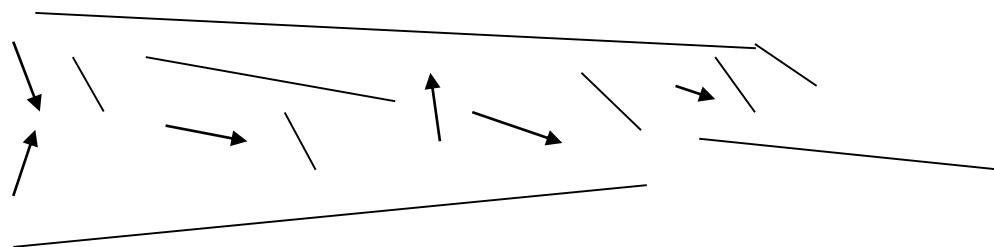
They are reversible

No new permanent substance is formed

EXAMPLES OF PHYSICAL PROCESSES

- Melting
- Condensation
- Evaporation
- Freezing (solidification)
- Sublimation
- Deposition

A summary of changes in the states of matter



Name the process at A - F

- A is melting
- B is condensation
- C is evaporation
- D is freezing (solidification)
- E is sublimation
- F is deposition

PHYSICAL PROCESSES CAUSED BY HEAT LOSS

- Freezing (solidification)
- Deposition
- Condensation

PHYSICAL PROCESSES CAUSED BY HEAT GAIN

- Melting
- Evaporation
- Sublimation

PHYSICAL PROCESSES ARE INVOLVED IN WATER CYCLE

- Evaporation
- Condensation

EVAPORATION

- This is the physical process by which a liquid changes to a gas
- ✓ Evaporation is caused by **heat energy / increase in temperature / heat gain / heating**

EXAMPLES OF EVAPORATION

- Crystallization
- Drying of clothes
- Drying of sweat

IMPORTANCE OF EVAPORATION

- It helps us to recover salt or sugar that has been dissolved in water
- It helps us to obtain common salt from lakes and seas
- It helps in the water cycle
- It helps in drying of clothes
- It helps in distillation
- It helps to cool our bodies during sweating

FACTORS THAT AFFECT THE RATE OF TRANSPERSION.

- Temperature of the liquid
- Surface area of the liquid
- Wind speed
- Humidity

Temperature of the liquid

- ✓ The rate of evaporation increases with increase in temperature e.g a cup of hot tea evaporates quicker than a cup of cold tea

Surface area of the liquid

- ✓ The rate of evaporation increases as with increase in surface area e.g the same amount of water will evaporate quicker in wide container than in a narrow container

Wind speed

- ✓ The rate of evaporation increases with increase in wind speed e.g clothes on a clothesline dry quicker on a windy day than on a still day

Humidity

- ✓ The rate of evaporation decreases with increase in humidity

STEPS TAKEN TO RECOVER SALT FROM A MIXTURE OF SALT AND SAND

- Put the mixture in a clean container
- Add water and stir to dissolve salt
- Filter to remove sand / to obtain salt solution
- Evaporate the salt solution to dryness

CONDENSATION

- This is the physical process by which a gas changes to liquid
- It is caused by **heat loss / decrease in temperature / cooling**

EXAMPLES OF CONDENSATION

- Formation of dew
- Formation of clouds
- Formation of fog

By what process are clouds, fog and dew formed?

- By condensation

Why is dew formed at night?

- Due to very low temperature which lead to condensation

Why does dew disappear during day time?

- Due to high temperature which lead to evaporation

Why is dew formed at night but not during day time?

- The temperature is very low at night and it is high during day time

IMPORTANCE OF CONDENSATION

- It helps in the water cycle
- It helps in distillation
- It helps in water desalination

How is condensation important in the water cycle?

- It helps in the formation of clouds

MELTING

- This is the physical process by which a solid changes to a liquid
- It is caused by **heat energy / increase in temperature / heat gain / heating**

Examples of substances that can melt

- | | |
|-----------------|--------------|
| ▪ Butter / fats | ▪ Blueband |
| ▪ Ice cubes | ▪ Candle wax |

EXAMPLES OF MELTING

- Melting of metals
- Snow melting
- Melting of butter in a hot pan
- Melting of candle wax
- Turning of ice cubes into water

IMPORTANCE OF MELTING

- It helps in iron smelting
- It helps in purity analysis of butter and ghee
- It helps in making of alloys
- It enables a fuse to break the circuit in case of high voltage

FREEZING (SOLIDIFICATION)

- This is the physical change of a liquid to a solid

IMPORTANCE OF FREEZING

- It helps in making of ice cubes
- It helps in making of ice cream
- It helps in preserving some food stuffs e.g ice cream, fish, meat, fruits and vegetables

NOTE:

- Pure water freezes at 0°C (32°F)

Why does water take long to freeze when salt is added to it?

- Salt lowers the freezing point of water

SUBLIMATION

- This is the direct physical change of a solid to a gas

EXAMPLES OF SUBLIMATES (SUBSTANCES THAT CAN SUBLIME)

- | | |
|----------------------------------|---------------------|
| ▪ Iodine | ▪ Sulphur |
| ▪ Dry ice (solid carbon dioxide) | ▪ Arsenic |
| ▪ Mothballs (Naphthalene) | ▪ Ammonium chloride |
| ▪ Camphor | ▪ Snow |

USES OF SUBLIMATES

- Mothballs are used as pesticides
- They are used as air fresheners (deodorants)

- They are used as perfumes

IMPORTANCE OF SUBLIMATION

- It helps in purification of metals
- It helps in using air fresheners
- It helps us to use mothballs to keep away moths from clothes
- It enables dry ice to put out fire

Which component of air is added to the atmosphere when dry ice sublimes?

- Carbon dioxide

DEPOSITION (DESUBLIMATION)

- This is the physical process by which a gas changes directly to a solid

EXAMPLE OF DEPOSITION

- Snow formation
- Frost formation

How is snow formed?

- By deposition

MIXTURE

- This is a combination of two or more substances.

EXAMPLES OF MIXTURES

- Concrete: (cement + sand + stone)
- Porridge: (maize flour + water)
- ORS: (Sugar + salt + water)

TYPES OF MIXTURES

- Solution
- Suspension

1. SOLUTION

- This is the mixture of a solute and solvent
- This is a uniform mixture of two or more substances

TYPES OF SOLUTION

- Saturated solution
- Super saturated solution
- Unsaturated solution

SATURATED SOLUTION

- This is a solution which cannot dissolve any more solute at that temperature

SUPER SATURATED SOLUTION

- This is a solution which cannot dissolve any more solute even after heating.

UNSATURATED SOLUTION

- This is the solution that can dissolve more solutes.

SOLUTE

- This is a substance that dissolves in a liquid (solvent)

EXAMPLES OF SOLUTES

- | | |
|---------|-----------|
| ▪ Salt | ▪ Glucose |
| ▪ Sugar | ▪ Sucrose |

SOLUBLE SUBSTANCES

- These are substances that can dissolve.

EXAMPLES OF SOLUBLE SUBSTANCES

- | | |
|---------|-----------|
| ▪ Sugar | ▪ Glucose |
| ▪ Salt | ▪ Sucrose |

Why does salt dissolve in water?

- Salt is soluble

INSOLUBLE SUBSTANCES

- These are substances that cannot dissolve in a liquid

EXAMPLES OF INSOLUBLE SUBSTANCES

- | | |
|------------------|-----------|
| ▪ Stones | ▪ Glucose |
| ▪ Sand particles | ▪ Sucrose |

Why can't sand dissolve in water?

- Sand is insoluble

SOLVENT

- This is a substance (liquid) that dissolves a solute

Examples of solvents

- | | |
|---------|------------|
| ▪ Water | ▪ Kerosene |
| ▪ Milk | ▪ Alcohol |

Why is water is called a universal solvent?

- It dissolves most solutes

2. SUSPENSION

- This is a mixture of two substance in which a solid is spread but does not dissolve in a liquid.

EXAMPLES OF SUSPENSION

- | | |
|------------------------|-----------------|
| ▪ Maize flour in water | ▪ Sand in water |
| ▪ Muddy water | ▪ Paints |

METHODS OF SEPARATING MIXTURES

- | | |
|---------------------------|---------------------------------|
| ▪ Decantation (decanting) | ▪ Filtration method (filtering) |
|---------------------------|---------------------------------|

- Evaporation to dryness
- Using a magnet
- Hand picking or sorting
- Flotation
- Distillation
- Sieving
- Using a separating funnel
- Winnowing
- Crystallization

METHODS OF SEPARATING MIXTURES OF SOLIDS AND LIQUIDS

1. FILTRATION METHOD

- This is the removal of solid particles from a liquid using a filter
- The solid particles are called **residue**
- The clear liquid is called **filtrate**

MATERIALS THAT CAN BE USED AS FILTER (USED FOR FILTERING)

- | | |
|--|--|
| <ul style="list-style-type: none"> ▪ Clean thick cloth ▪ Sieve | <ul style="list-style-type: none"> ▪ Filter paper ▪ Porcelain filter |
|--|--|

APPLICATION (USES) OF FILTRATION AT HOME

- It helps in separating passion fruit juice from seeds
- It helps in obtaining clean water from dirty water
- It helps in preparing local salt from ash

Water obtained by filtration is not good for drinking

Why?

Filtration does not kill germs.

Diagram showing filtration

2. DECANTATION METHOD

This is the removal of solid particles from a liquid by allowing them to settle at bottom

Importance of decantation

It is used to obtain clean water from muddy water

Steps for decanting

Put dirty (muddy) water in a container

Allow solid particles to settle at the bottom

Carefully pour off the clear liquid

Diagram illustrating decantation

Water obtained by decanting is not good for drinking

Why?

Decanting does not kill germs

Ways of making water collected by decantation and filtration safe for drinking

- By boiling
- Using UV light
- Adding chemicals (like chlorine and fluorine)

Uses of water collected by decantation and filtration

- For washing
- For cooking
- For irrigation (watering crops)
- For mopping
- For cooling machines

3. EVAPORATION TO DRYNESS

- This is the method of separating solid particles from a liquid by boiling to dryness

Importance of evaporation to dryness

- It is used to recover salt that has been dissolved in water
- It is used to obtain salt from lake and sea water

How can you recover salt or sugar that has dissolved in water?

- By evaporation to dryness

STEPS TAKEN TO OBTAIN SALT FROM A MIXTURE OF SALT AND SAND

- Put the mixture in a clean container
- Add water and stir (to dissolve salt)
- Filter to obtain salt solution (filter to remove sand)
- Evaporate the salt solution (filtrate) to dryness

4. DISTILLATION

This is the process of evaporating impure liquid to obtain pure liquid from condensed vapour

The pure liquid obtain is called **distillate**

Distilled water (distillate) is not good for drinking

Why is it not recommendable to drink distilled water (distillate)?

- It lacks minerals salts

USES OF DISTILLED WATER

- It is used to mix medical drugs in hospitals
- It is used to clean the human body before taking an injection
- It is used to clean some medical instruments
- It is used in intravenous rehydration
- It is used in car radiators

APPLICATION OF DISTILLATION

- It is used to obtain pure alcohol from crude alcohol
- It is used to obtain distilled water from impure water
- Fractional distillation helps to obtain petroleum products from crude oil (petroleum)

Dangers of distillation

It can lead to burns and scalds

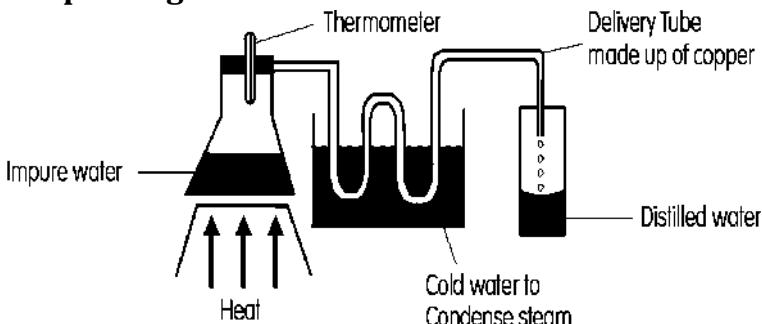
It can lead to fire outbreak

Physical processes in distillation

Evaporation

Condensation

Simple diagram to show distillation



Copper delivery tubes **do not rust**

The delivery tube is coiled as it passes in cold water **to increases surface area for condensation**

METHODS OF SEPARATING MIXTURES OF SOLIDS

1. FLOTATION

- This method of separating solid substances where one sinks and the other float on water

EXAMPLES OF MIXTURES SEPARATED BY FLOTATION

- Saw dust and sand
- Bad beans and good ones

2. USING A MAGNET

- This is the method of separating a magnetic substance from a non-magnetic substance

APPLICATION OF USING A MAGNET IN SEPARATING MIXTURES

- Searching iron pins from grass
- Separating iron wires from copper wires
- Separating iron bits and maize flour

APPLICATION OF HAND PICKING (SORTING)

- Separating stones from rice
- Separating bad beans from good ones

3. SIEVING

- This is a method used to separate large solid particles from small ones using a sieve

4. WINNOWING

- This is the removal of husks from seeds by help of wind

APPLICATION OF WINNOWING

- Separating husks from bean seeds
- Separating hulls from rice grains

SEPARATING MIXTURES OF LIQUIDS

- By fractional distillation
- By using a separating funnel

NOTE

DILUTION

- This is the process of making a concentrated solution weak
- When a substance is in its original form, **it is concentrated**
- When water has been added to a substance, **it is diluted**

Examples of dilution

- Adding water to milk
- Adding water to an acid

DIFFUSION

- This is movement of molecules from an area of high concentration to an area of low concentration

EXAMPLES OF DIFFUSION

- Smoke diffuses into air
- Milk diffuses into water
- Salt diffuses in water

ENERGY

- Energy is the ability to do work.

SOURCES OF ENERGY

- | | |
|----------|------------------|
| ▪ Sun | ▪ Running water |
| ▪ Fuels | ▪ Uranium |
| ▪ Plants | ▪ Electric cells |

FORMS OF ENERGY

- | | |
|---------------------|----------------|
| ▪ Mechanical energy | ▪ Light energy |
| ▪ Heat energy | ▪ Magnetism |
| ▪ Sound energy | ▪ Electricity |

Why is heat regarded as form of energy?

- Heat can do work (it does work)

TYPES OF ENERGY (MECHANICAL ENERGY)

- Potential energy
- Kinetic energy

POTENTIAL ENERGY

- This is a type of energy possessed by an object at rest (stationary object)

Examples of objects with potential energy

- | | |
|--------------------------------------|-------------------------------|
| ▪ A stone resting on a raised ground | ▪ A car parking in a garage |
| ▪ A book placed on table | ▪ A baby on the mother's back |

KINETIC ENERGY

- This is a type of energy possessed by an object in motion (moving object)

EXAMPLES OF OBJECTS WITH KINETIC ENERGY

- A child running along the road
- A stone thrown up in air
- A car moving on the road
- A leaf falling from a tree

EXPERIMENTS ABOUT KINETIC AND POTENTIAL ENERGY

HEAT ENERGY

- Heat is the form of energy that increases the temperature of matter
- Heat is measured by an instrument called **calorimeter**
- Heat energy is measured in units called **Joules (J)**

SOURCES OF HEAT ENERGY

- These are objects which produce heat.

TYPES OF SOURCES OF HEAT

- Natural sources of heat
- Artificial sources of heat

TYPES OF SOURCES OF HEAT	EXAMPLES
1. Natural sources of heat These are sources of heat created by God	<ul style="list-style-type: none">▪ Sun (This is the main natural source of heat)▪ Erupting volcanoes▪ Lightning▪ Natural gas▪ Food during respiration
2. Artificial sources of heat These are sources of heat made by man	<ul style="list-style-type: none">✓ Electricity✓ Fire✓ Burning charcoal✓ Burning candle✓ Biogas✓ Friction✓ Hot electric bulbs

USES OF HEAT IN OUR ENVIRONMENT

- It warms our bodies
- It kills germs (heat is a disinfectant)

Disinfectants are substances that kill germs

- It helps us to cook food
- It helps in food preservation (e.g sundrying and smoking)
- It helps us to iron clothes
- It helps us to weld metals
- It helps us to melt metals in factories
- It is used in science experiments
- Sun's heat helps to dry harvested crops
- Sun's heat helps to dry wet clothes
- Sun's heat helps in water cycle
- Heated objects produce light (e.g electric bulbs and candles)

DANGERS OF HEAT

- It causes fire accidents
- It causes burns (e.g sunburn)

EFFECTS OF HEAT ON MATTER

- It increases the temperature of matter
- It changes the state of matter
- It causes expansion of matter

Effects of heating/heat gain on a metal (What happens to a metal when heated?)

- | | |
|-----------------------------|------------------------|
| ▪ It expands | ▪ Its volume increases |
| ▪ Its temperature increases | ▪ Its density reduces |
| ▪ Its weight reduces | |

Effects of cooling/heat loss on a metal (What happens to a metal when cooled?)

- | | |
|---------------------------|-------------------------|
| ▪ It contracts | ▪ Its volume decreases |
| ▪ Its temperature reduces | ▪ Its density increases |

NOTE

- When an object is either heated or cooled, **its mass remains constant (does not change)**

WHAT HAPPENS TO THE FOLLOWING WHEN WATER IS FROZEN?

- **Mass:** It remains constant (does not change)
- **Volume:** It increases
- **Density:** It reduces

EXPANSION

- This is the increase in size or length of matter when heated
- Expansion occurs in all the states of matter
- Gases have greatest expansion **because** their molecules move freely
- Solids have least expansion **because** their molecules are compact (closely packed together)

APPLICATION (IMPORTANCE) OF EXPANSION

- It helps in baking
- It helps in lighting fireworks
- It helps mercury to measure high temperature

EFFECTS (DANGERS) OF EXPANSION

- It breaks bridges on hot days
- It bends timber dried under sunshine
- It causes cracks on buildings and furniture
- It bends railway lines on hot days
- It causes overflow of boiling milk
- It causes explosion of bombs
- It bursts inflated balloons
- It loosens fixed parts
- It makes electric and telephone wires sag on hot days
- It causes breaking of cold glass when exposed to very hot liquid

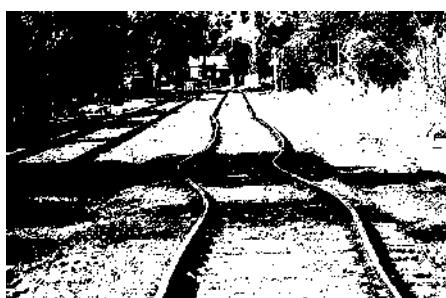
NOTE:

- Sagging electric live wires can cause electric shock

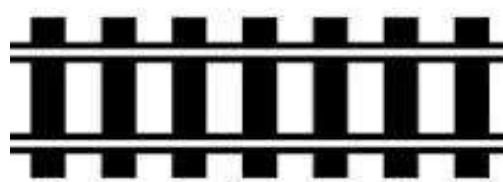
How to prevent dangers (effects) of expansion

- Leaving gaps between railway lines
- ✓ To provide room for expansion on hot days

After expansion



Gaps to allow expansion on hot days



- Making holes of rails oval shaped
- ✓ To allow the railway line slip easily during expansion
- Leaving gaps between metal bars of bridges
- ✓ To provide room for expansion on hot days
- Avoid leaving furniture in sunshine
- Avoid keeping glass soda bottles in a refrigerator for a long time
- Avoid pouring very hot liquid in glass containers
- Timber should be dried under shade to prevent bending (warping)

What happens to the gaps between railway lines during hot days?

- The gaps become narrow

During what type of weather do gaps of the railway line become narrow?

- Sunny weather

Why do gaps between railway lines become narrow on hot days?

- Due to expansion

What would happen to a bridge or railway line on hot days if gaps were not left during construction?

- The bridge or railway line would bend or break due to expansion

Why is a small space left on top when filling the soda bottles?

- To provide room for increase in volume of soda inside the bottle when frozen

An illustration of soda bottle

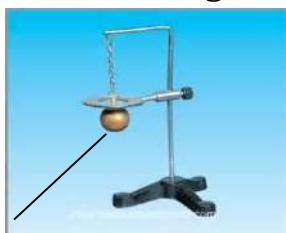
On cooling, the glass bottle contracts while the liquid inside expands

Experiment to show expansion in solids

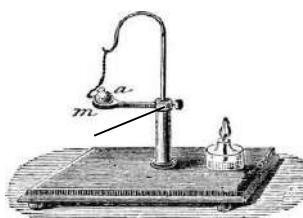
Experiment I (metallic ball and ring experiment)

- When the metallic ball is cold, it passes through the ring
- When the metallic ball is heated, it cannot pass through the ring

Before heating



After heating



What does the experiment shown above show?

- Expansion in metals (solids expand when heated)

Why did the metallic ball fail to pass through the ring after heating?

- The metallic ball had expanded (solids expand when heated)

Why does the metallic ball pass through the ring after being left to cool?

- The metallic ball contracts (due to contraction)

EXPERIMENT II (USING A BIMETALLIC STRIP)

Bimetallic strip

- This is a strip made up of two metals that expand at different rates (e.g copper and iron)
- It works on the principle of **thermal expansion (metals expand at different rates)**

A diagram showing a bimetallic strip (made up of copper and iron)

Heating

cooling

Why does copper curves over iron when the bimetallic strip is heated (Why does the bimetallic strip curve with copper on the outside on heating)?

- Copper expands faster than iron (copper expands more than iron)

Why does iron curves over copper when the bimetallic strip is cooled (Why does the bimetallic strip curve with iron on the outside on cooling)?

- Iron contracts faster than copper

Application (uses) of bimetallic strips

- They are used in fire alarms
- They are used in thermostats
- They are used in bimetallic thermometers

Thermostat

- This is an automatic device that turns on or off electric appliances due to temperature changes

Electric appliances that use thermostats (bimetallic strips)

- | | |
|--|--|
| <ul style="list-style-type: none">▪ Flat irons▪ Refrigerators▪ Electric cookers▪ Electric kettles (percolators) | <ul style="list-style-type: none">▪ Air conditioner▪ Electric ovens▪ Electric incubators |
|--|--|

EXPERIMENT TO SHOW EXPANSION IN GASES

EXPERIMENT I

Requirements

- Empty bottle
- Empty balloon
- Hot water

Diagrams

What does the experiment shown above show?

- Expansion in gases (gases expand when heated)

What will happen to the balloon when the bottle is placed in hot water?

- The balloon will swell (expand)

Why did the balloon swell when the bottle was placed in hot water?

- Due to expansion of air inside the bottle

What substance is contained in an empty bottle?

- Air

Why was the balloon tied with a thread on the bottle?

- To prevent air from escaping

What will happen to the balloon when the bottle is later removed from hot water?

- The balloon will become empty

Why does the balloon become empty when the bottle is removed from hot water?

- Due to contraction of air inside the bottle

EXPERIMENT II

- Put an inflated balloon under sunshine for some time

Diagram

What does the experiment shown above show?

- Expansion in gases (gases expand when heated)

What will happen to the balloon after some time?

- The balloon will burst

Why does an inflated balloon burst when placed under sunshine for some time?

- Due to expansion of air inside the bottle

Which property of air is shown by an inflated balloon?

- Air occupies space

Experiment to show expansion in liquids

Fill a flask with coloured water and fix a narrow tube in the stopper

Mark the level of water as it tries to rise up the tube

Place the flask in a beaker of hot water

Diagram

Observation

The water level in the tube falls and then rises after a few seconds.

Conclusion

Liquids expand when heated

CONTRACTION

- This is the decrease in size or length of matter when cooled
- Contraction occurs in all the states of matter

Application (importance) of contraction

- It helps in measuring lowest temperatures

EFFECTS (DANGERS) OF CONTRACTION

- It reduces air in tubes of tyres
- It breaks electric wires on cold days
- It breaks hot glasses when cold water is put in them
- It breaks electric bulbs when exposed to cold water

WAYS OF PREVENTING THE DANGERS OF CONTRACTION

- Making electric and telephone wires longer than the distance between poles (Fixing electric wires loose between poles)
- ✓ To provide room for contraction on cold days

AN ILLUSTRATION SHOWING THE APPEARANCE OF ELECTRIC WIRES ON COLD DAYS

Why are electric wires fixed loosely between the poles?

- To provide room for contraction on cold days

How do electric wires appear on cold days?

- They appear tight

Why do electric wires appear tight on cold days?

- Due to contraction

What type of weather makes electric wires to appear tight?

- Rainy weather

AN ILLUSTRATION SHOWING THE APPEARANCE OF ELECTRIC WIRES ON HOT DAYS

How do electric wires appear on hot days?

- They appear loose (sagging)

Why do electric wires appear sagging (loose) on cold days?

- Due to expansion

What type of weather makes electric wires to appear loose (sagging)?

- Sunny weather

HEAT INSULATORS AND CONDUCTORS

Heat insulators (bad conductors of heat)

These are materials that do not allow heat to pass through them easily

Examples of heat insulators

- | | |
|--|--|
| <ul style="list-style-type: none">▪ Dry wood▪ Plastic▪ Rubber▪ Paper▪ Blankets▪ Cotton▪ Wool | <ul style="list-style-type: none">▪ Dry leaves▪ Thick clothes▪ Asbestos▪ Feather▪ Clay▪ Air |
|--|--|

Why is air regarded as an insulator / bad conductor of heat?

- Its molecules are too far to disperse heat from one another

Application (uses) of insulators in our daily life

- They are used to make handles of cooking utensils
- Thick clothes keep our body warm
- Feathers keep the bird's body warm
- They are used to cover electric wires
- They are used to lift hot objects
- Asbestos is used to make fire suits
- Asbestos is used to make roofing sheets
- Clay is used to make charcoal stoves

NOTE

Why do clay charcoal stoves use less charcoal?

- Clay keeps heat for a long time (clay reduces heat loss)

How do clay charcoal stoves conserve trees?

- They use less charcoal

Why are handles of kettles, frying pans and iron boxes made of insulators like wood?

- To prevent the hands of the user from getting burnt

Why are electric wires covered with insulators?

- To prevent electric shocks and burns
- To prevent short circuits

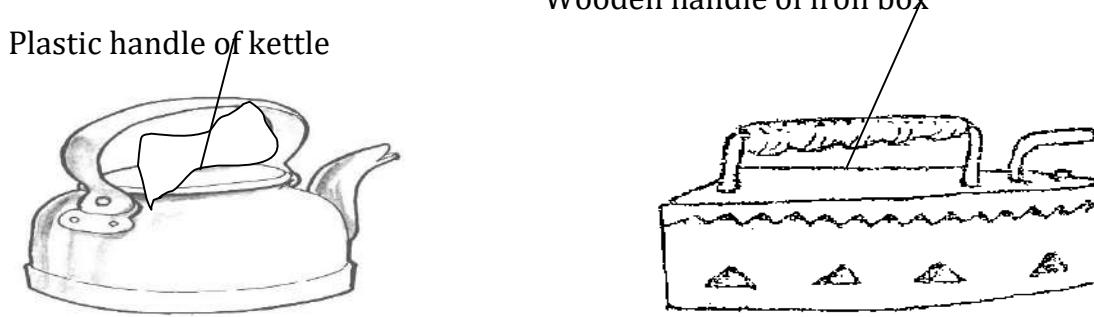
Why is wool regarded as a better insulator than cotton?

- Wool has more tiny spaces than cotton

How do sweaters keep our body warm?

- By preventing heat loss

Simple diagram to illustrate handles of iron box and kettle



Heat conductors (good conductors of heat)

These are materials that allow heat to pass through them easily

Examples of heat conductors (good conductors of heat)

- Silver 100%
- Copper 90%
- Aluminium 48%
- Brass 27%
- Zinc 26%
- Tin 12%
- Iron 12%
- Lead 9%
- Mercury

All metals are conductors of heat

Silver is the best heat conductor

Silver is not used to make cooking utensils because **it is very expensive**

Copper is the second best heat conductor

Copper is not commonly used because **it is very heavy**

Asbestos roofed houses is colder than iron sheets roofed houses on a hot day

Why?

Asbestos is a bad conductor of heat

Reasons why most utensils are made of aluminium

It is a good conductor of heat

It does not rust

It is cheap

It is light

Mercury is a liquid metal that conducts both heat and electricity

Water is the worst conductor of heat (0.01%)

Vacuum cannot conduct heat **because** it has no molecules

Application (uses) of good conductors of heat

- They are used to make cooking utensils (e.g aluminum)
- They are used to make electric wires (e.g copper and aluminum)
- They are used to make flat irons (e.g iron and aluminum)
- Mercury is used in thermometers

HEAT REFLECTORS AND ABSORBERS

1. HEAT REFLECTORS

- These are objects that send back (bounce) heat
- Heat reflectors are shiny

Examples of heat reflectors

- Silvered objects
- Brightly coloured objects (white objects)
- Aluminum painted objects
- Polished objects

APPLICATION OF HEAT REFLECTORS

- Refrigerators are painted white to reflect heat
- Petrol tanks are sprayed with silver paint to reflect sun's heat
- Most buildings are painted with bright colours to reflect sun's heat
- Cars are painted with bright colours to reflect sun's heat
- A Stevenson screen is painted white to reflect sun's heat
- People wear white clothes to reflect sun's heat on hot days
- Shoes are polished to reflect heat

2. HEAT ABSORBERS

- These are objects that retain (keep) heat
- All heat absorbers are **dull coloured**

Examples of heat absorbers

- Dull coloured objects (black objects)
- Unpolished objects

APPLICATION OF HEAT ABSORBERS

- People wear black clothes keep their bodies warm during cold days
- The bottom of cooking utensils is kept with black and rough to absorb more heat

NOTE

1. A person putting on a black shirt feels warmer quicker than a person in white shirt

Why?

- Black absorbs heat while white reflects heat

2. A blue shirt dries faster than a white shirt of the same material on hot days

Why?

- Blue absorbs heat while white reflects heat

Which property of air enables clothes to dry?

- Air exerts pressure

Apart from sun's heat, what else enables wet clothes to dry?

- Wind

How does wind help in drying of clothes?

- It increases the rate of evaporation

HEAT TRANSFER

- This is the movement of heat from one point to another
- ✓ Heat travels from a point of higher temperature to a point of lower temperature

METHODS OF HEAT TRANSFER

- Conduction
- Convection
- Radiation

Substance	Method of heat transfer
Solids	Conduction
Liquids	Convection
Gases	Convection
Vacuum	Radiation
Space	Radiation

Methods of heat transfer in the states of matter

Conduction

Convection

Vacuum

This is the space without matter

Heat travels through vacuum by **radiation**

Vacuum does not allow heat transfer by conduction and convection

Why?

It has no matter

WAYS OF MANAGING HEAT IN OUR DAILY LIFE

- Wearing white clothes on hot days
- Using umbrellas on sunny weather
- Painting houses with white colours
- Putting ceilings in houses
- Painting some objects with bright colours

CONVECTION

- This is the process by which heat travels through fluids (liquids and gases)
- This is the method of heat transfer in liquids and gases

EXPERIMENT TO SHOW CONVECTION IN LIQUIDS

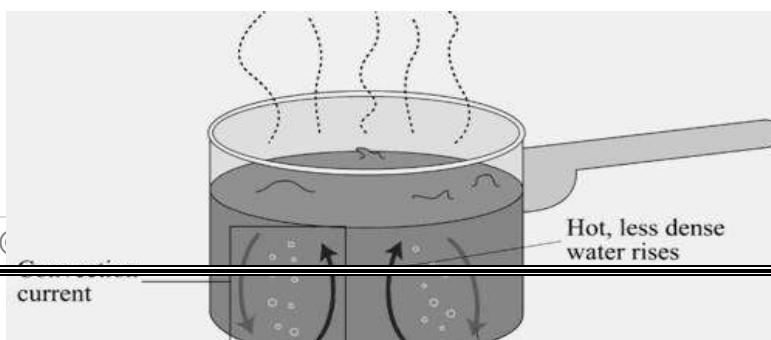
Materials needed

Water

Beaker (saucepan)

Source of heat (stove)

Convection currents in boiling water



Observation

Heated molecules become lighter and move downwards

Unheated molecules become denser and move upwards

This forms a circular movement known as **convection currents**

What causes convection currents?

Different densities of molecules

Conclusion

Heat travels through liquids by the process of convection

Note

Heat travels from stove to water (through the saucepan) by **conduction**

Heat travels in water by **convection**

IMPORTANCE OF CONVECTION OF HEAT IN THE ENVIRONMENT

- It enables air circulation in a house
- It helps in boiling of water
- It enables charcoal stoves to continue burning
- It enables hot water supply in a house
- It enables air circulation in a lantern lamp
- It enables air circulation in a kiln
- It drives out smoke through the chimney of a kitchen
- It helps in the formation of convectional rainfall
- Convection currents take away smoke from cigarettes
- Convection currents drive out bad smell in a VIP latrine through the vent pipe
- It enables charcoal iron box to continue burning

A diagram showing air circulation in a house

CONVECTIONAL CURRENT

- This is the continuous flow of molecules that transfers heat in fluids (liquids and gases)

What causes convection currents?

- Difference in densities of molecules

COMPONENTS OF VENTILATION ON A HOUSE

- Doors
- Windows
- Ventilators
- Louvres

Why should houses be properly ventilated?

- To allow free air circulation
- To allow fresh air into the house

Importance of louvres on a house

- They allow free air circulation

Importance of doors and windows on a house

- They allow in fresh air
- They allow in light

Why are doors and windows put below the ventilators on a house?

- To allow in fresh air easily

Importance of ventilators on a house

- To let out stale air

Why are ventilators put above doors and windows (near the ceiling)?

- To let out stale air easily

Why does stale air go up?

- It is less dense than fresh air

Differences between fresh air and stale air

- Fresh air is denser than stale air
- Fresh air is cool while stale air is warm

SIMPLE DIAGRAM OF VIP LATRINE

Screen

It traps and kills houseflies

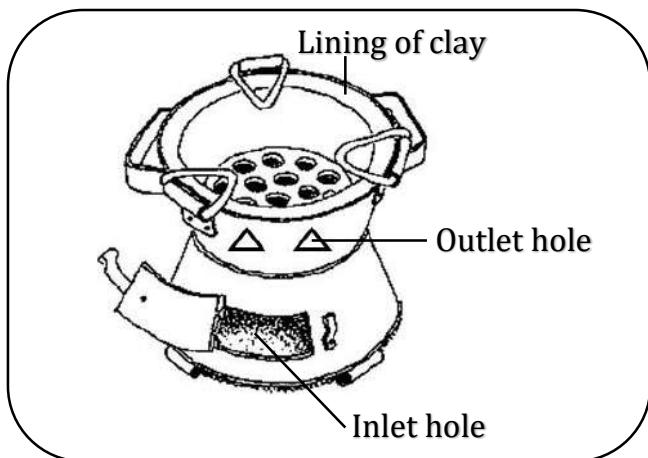
Vent pipe

It drives out stale air

Entrance

It allow in fresh air

Convection currents in charcoal stove and charcoal iron box



The handle of iron box is made of dry wood or plastic

Why?

To prevent the user's hands from getting burnt

The ironing part of iron box is made of iron or aluminium

Why?

Aluminum /iron is a good conductor if heat

Charcoal stoves and iron boxes have lining of clay

Why?

To prevent heat loss

Which fuel is used in charcoal stoves and iron boxes?

- Charcoal

How is charcoal made?

- When wood is burnt in limited supply of oxygen

What happens if wood is burnt in plenty of oxygen?

- Wood turns into ash (complete combustion occurs)

Advantages of using clay charcoal stoves over metallic charcoal stoves

- Clay charcoal stoves use less charcoal
- Clay charcoal stoves keep heat for a long time

Disadvantages of using charcoal stoves and iron boxes

- They pollute air
- They encourage deforestation for charcoal
- They can lead to burns
- They can lead to fire outbreak

How has the government helped to reduce deforestation for wood fuel?

- Through rural electrification

What enables charcoal stoves and iron boxes to continue burning?

- They have holes which allow free air circulation
- They have holes to allow in fresh air

BREEZE

- This is the movement of cool air from sea to land or land to sea.

TYPES OF BREEZE

- Land breeze
- Sea breeze

1. LAND BREEZE

- This is the movement of cool air from land to sea
- Land breeze occurs at night

Why?

- The land is cooler than the sea

DIAGRAM SHOWING LAND BREEZE

- Land cools faster than the sea
- The air on the sea becomes warmer than the air on land
- Warm air on the sea becomes less dense and rises
- Cool air on land moves towards the sea to occupy the space left by warm air

2. SEA BREEZE

- This is the movement of cool air from sea to land
- Sea breeze helps to bring fresh air to the land
- Sea breeze occurs during **day time**

Why?

- The sea is cooler than land

DIAGRAM SHOWING SEA BREEZE

- Land warms faster than the sea
- The air on land becomes warmer than the air on the sea
- Warm air on the land becomes less dense and rises
- Cool air on sea moves towards the land to occupy the space left by warm air

REASONS WHY THE SEA IS COOLER THAN LAND DURING DAY TIME

- Water reflects heat while land absorbs heat
- Sun rays go deep into water since it is transparent unlike land
- Water waves mix the warm water at the surface with cool water below it

REASONS WHY THE LAND HEATS UP QUICKLY DURING DAY TIME

- Land absorbs heat
- Heat doesn't go deep inside the land

CONDUCTION

This is the method of heat transfer in solids

This is the process by which heat travels through solids

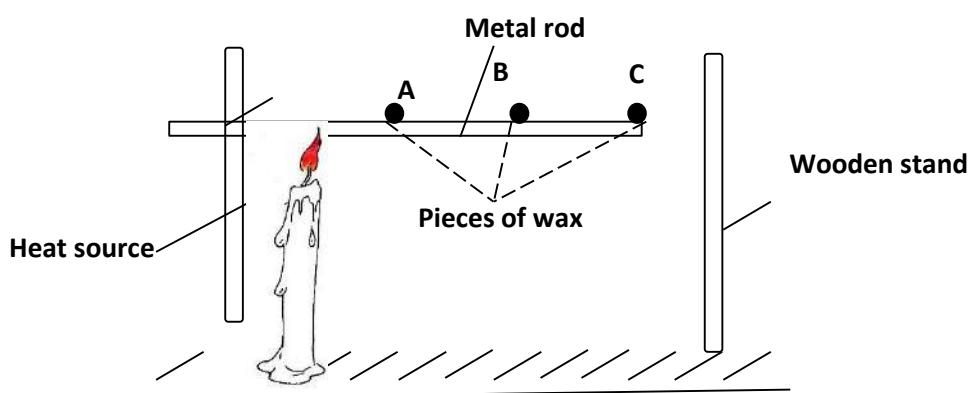
- Molecules in solids vibrate (shake) but do not move

Experiment to show heat transfer by conduction

Tie a metal rod on a wooden stand

Place the candle wax A, B and C on metal rod at intervals

Put one end of the metal rod on source of heat



Observation

- Wax A melts first because it is nearest the source of heat
- Wax C melts last because it is farthest from the source of heat

Conclusion

- Melting of wax shows that heat travels through solids

What shows that heat has traveled through the metal rod?

- Melting of the wax

State the role of candle wax in the experiment above.

- They melt after receiving heat

Experiment to show heat transfer in insulators and conductors of heat

Materials needed

Iron nail

Piece of wood

Plastic

Candle wax

Source of heat

An illustration

Observation

- Wax on iron nail melts first
- Wax on plastic melts second
- Wax on wood melts last

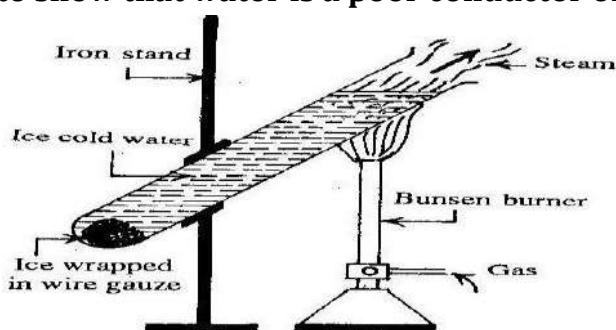
Conclusion

Iron is a good conductor of heat

Plastic is the poor conductor of heat

Wood is a poor conductor of heat

Experiment to show that water is a poor conductor of heat



Observation

- Ice cubes don't melt yet water at the top is boiling

Conclusion

- Water is a poor conductor of heat

Questions

Why does hot water remain on top of cold water as shown in the experiment?

- Heated molecules are less dense than cold molecules

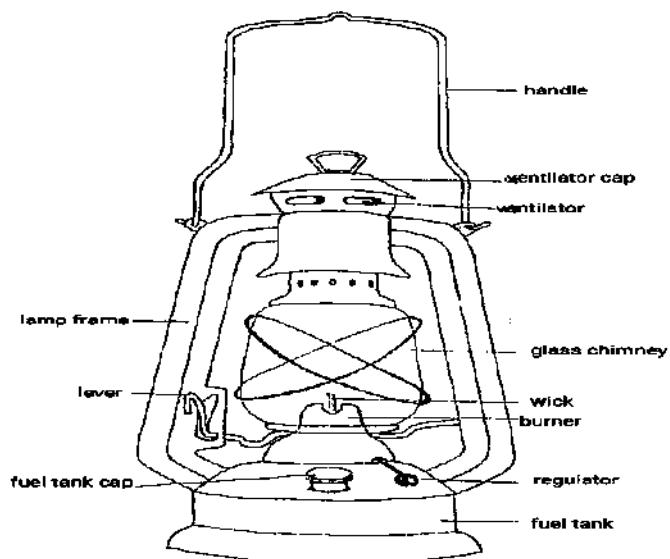
What shows that water is a poor conductor of heat?

- Ice cubes don't melt yet water at the top is boiling

Application (importance) of conduction of heat in our daily life

- It helps in ironing of clothes
- It enables us to cook food in saucepans
- It helps in iron smelting
- It helps in melting of ghee and butter
- It enables us to roast meat on metal rods

Air circulation in a lantern lamp



Fuel tank

- It keeps paraffin (kerosene)

Glass chimney

- It protects the flame from being blown off.
- It directs soot and smoke to the ventilator.
- It allows out light.

Why is the glass chimney made transparent?

- To allow out light

Ventilator (ventilation hole)

- It lets out stale air (soot and smoke)

Inlet holes

- To allow in fresh air

Wick

- It burns to produce light

Regulator

- It regulates the size of the wick at user's will

Fuel tank cap

- It is opened to refill fuel in the tank

Lever

- It is turned to light the wick

CAPILLARY ACTION (CAPILLARITY)

- This is the upward flow of liquids through porous materials (narrow tubes).

EXAMPLES OF CAPILLARY ACTION

- Movement of water/soda up the straw
- Movement of water from roots to leaves of a plant
- Movement of kerosene through the wick
- Movement of tears through tear ducts

How does kerosene move up the wick?

- By capillarity (capillary action)

Which fuel is commonly used in lantern lamps?

- Kerosene (paraffin)

Why is petrol not used in lantern lamps?

- Petrol is highly flammable
- Petrol is very volatile

Why is kerosene used in lantern lamps but not petrol yet they are both flammable liquids?

- Kerosene is less volatile than petrol.

RADIATION

This is the method of heat transfer in vacuum and space

Radiation does not need any medium.

Radiant heat is the heat transferred by radiation

SIMILARITY BETWEEN RADIANT HEAT AND LIGHT

- Both travel in straight line
- Both travel in all directions from the source
- Both travel at the same speed
- Both can be reflected
- Both can be absorbed

Importance of heat transfer by radiation (uses of radiant heat in the environment)

- It helps in drying wet clothes
- It helps in drying harvested crops
- It helps in sunbathing or basking
- It enables us to feel warm when seated near fire
- It helps in water cycle
- It helps in food preservation

How does heat from the sun reach the earth to dry wet clothes?

- By radiation

THE THERMOS FLASK (VACUUM FLASK)

This is a device used to keep hot things hot and cold things cold

This is a device that maintains the temperature of what is put inside it

A diagram showing vacuum flask

FUNCTIONS OF EACH PART OF A VACUUM FLASK

CORK (STOPPER)

- It prevents the heat loss or gain by conduction

How is a cork able to prevent heat loss or gain by conduction?

- It is an insulator of heat

Materials used to make cork

- Plastic
- Wood
- Rubber

VACUUM

- It prevents heat loss or gain by conduction and convection

How is the vacuum able to prevent heat loss or gain by conduction and convection?

- It has no molecules

SILVERED WALLS

- They prevent heat loss or gain by radiation

How do the double silvered walls prevent heat loss or gain by radiation?

- They reflect radiant heat

How are the double silvered walls able to reflect heat (to prevent heat loss or gain by radiation)?

- They are shiny

VACUUM SEAL

- It prevents matter from entering the vacuum

How is the vacuum seal able to prevent matter from entering the vacuum?

- It is sealed

CORK BASE (PAD OR ASBESTOS PAD)

- It absorbs shock

PLASTIC CASE

- It protects the inner parts of the flask from damage

CUP

- It is used to take what is inside the flask

HANDLE

- It is used to hold (lift) the flask

Reasons why thermos flasks are not common in most homes

- They are expensive to buy
- They are delicate to handle

TEMPERATURE

- This is the degree of hotness or coldness of an object or place
- Temperature is measured by an instrument called **thermometer**
- The standard unit (SI base unit) for temperature is **kelvin**

UNITS FOR MEASURING TEMPERATURE

- Kelvin
- Degree Celsius
- Degree Fahrenheit

TYPES OF TEMPERATURE SCALES

- Celsius scale
- Fahrenheit scale
- Kelvin scale

CELSIUS SCALE

- On this scale, the freezing point is 0°C and the boiling point is 100°C
- The space between the two fixed points is divided into 100 equal parts

FAHRENHEIT SCALE

- On this scale, the freezing point is 32°C and the boiling point is 212°C
- The space between the two fixed points is divided into 180 equal parts

KELVIN SCALE

- On this scale, the freezing point is 273.15 K and the boiling point is 373.15 K
- The space between the two fixed points is divided into 100 equal parts

FIXED POINT

- This is a standard degree of hotness or coldness

Name the two fixed points on temperature scales

- Freezing point/melting point (lower fixed point)

- Boiling point (upper fixed scale)

Freezing point is the temperature at which pure water changes to ice

Melting point is the temperature at which ice changes to water

Boiling point is the temperature at which pure water boils

Scale	Freezing point (melting point)	Boiling point
Celsius scale	0°C	100°C
Fahrenheit scale	32°F	212°F
Kelvin scale	273.15 K	373.15 K

THERMOMETER

- This is an instrument used to measure temperature
- Thermometers can either be analog or digital

TYPES OF THERMOMETERS

- Clinical thermometer (doctor's thermometer)
- Wall thermometer
- Laboratory thermometer
- Six's thermometer (maximum and minimum thermometer)
- Infrared thermometer (temperature gun)

1. CLINICAL THERMOMETER (DOCTOR'S / MEDICAL THERMOMETER)

- It is used to measure temperature of the human body or animal's body
- The normal human body temperature is 37°C or 98.4°F.
- It either uses **Celsius scale** or **Fahrenheit scale**

GROUPS OF PEOPLE (HEALTH WORKERS) WHO USE CLINICAL THERMOMETERS

- Doctors
- Nurses
- Veterinary officers

PLACES WHERE A CLINICAL THERMOMETER IS FOUND

- Clinics
- Sick bay
- Hospitals
- Dispensaries
- Pharmacies

Which human body condition is always detected with a clinical thermometer?

- Fever

Human body parts where a clinical thermometer can be placed

- Under the armpits
- In the mouth under the tongue
- In the vagina
- In the rectum via the anus

Why is the clinical thermometer put closed body parts?

- The temperature of the closed body parts is almost the same as internal body temperature

Why is the clinical thermometer put under the tongue but not just in the mouth of a child?

- To prevent the sick child from biting the clinical thermometer

Conditions that can make a woman put a clinical thermometer in the vagina.

- During pregnancy
- During basal body temperature birth control method / when detecting ovulation

Why does the temperature scale of a clinical thermometer run from 35°C to 42°C?

- It is the temperature range within which a person is still alive
- The human body temperature normally does not go below 35°C or above 42°C

Why does the temperature scale of a clinical thermometer start from 35°C?

- The human body temperature normally does not go below 35°C

Why does the temperature scale of a clinical thermometer stop at 42°C?

- The human body temperature normally does not go above 42°C

Name the liquid used to disinfect (sterilize) clinical thermometers.

- Alcohol

Why is a clinical thermometer disinfected (sterilized) using alcohol but not boiling water?

- Alcohol cannot break (burst) the thermometer while boiling water can break it.

Why should a clinical thermometer be disinfected (sterilized) before use?

- To prevent the spread of germs / To kill germs on the thermometer

Why do health workers shake the clinical thermometer (give it jerks) before use?

- To make mercury go back to the bulb
- To reset the thermometer

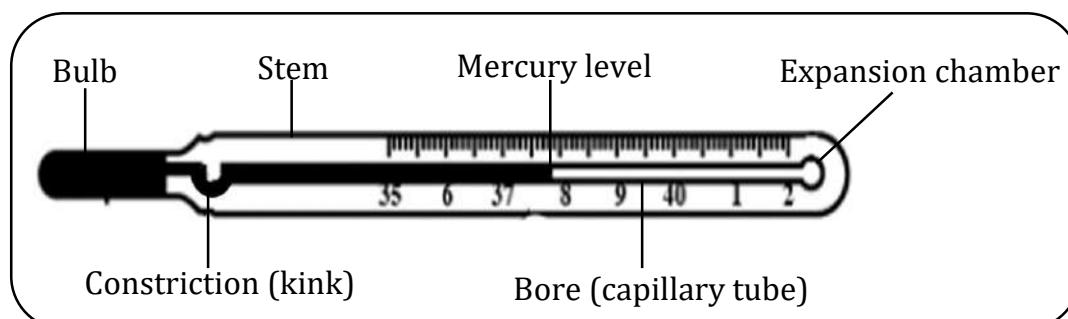
How is the clinical thermometer reset?

- By shaking it

Give any two things that should be done on a clinical thermometer before use.

- A clinical thermometer is reset
- A clinical thermometer is sterilized (cleaned)

A DIAGRAM SHOWING CLINICAL THERMOMETER



FUNCTIONS OF EACH PART OF A CLINICAL THERMOMETER

BULB

- It stores mercury

Why is the bulb made with thin glass (silver lining)?

- To enable it conduct heat easily

KINK (CONSTRICITION)

- It prevents back flow of mercury before readings are taken

How is a kink able to prevent the back flow of mercury?

- It has a bend (it is curved)

How is the function of a kink in clinical thermometer similar to that of valves in the heart and veins?

- Both prevent the back flow of liquids

STEM

- It protects the inside parts of a thermometer
- It contains a temperature scale for correct measurements

What makes it able to read temperature scale on the stem?

- The stem magnifies the mercury thread

Why is the stem made of transparent glass?

- To enable the doctor see the mercury level

Why does a clinical thermometer has a curved stem?

- To magnify the temperature scale

BORE (CAPILLARY TUBE)

- It allows expansion and contraction of mercury
- It allows the flow of mercury when measuring temperature

Why is the bore made narrow?

- For easy expansion of mercury (to make the thermometer more sensitive)

EXPANSION CHAMBER

- It is where air inside the bore collects as mercury expands

MERCURY

- It is the liquid metal used to show temperature in the thermometer

ADAPTATIONS OF THE CLINICAL THERMOMETER

- It has a kink to prevent the back flow of mercury
- It has a narrow bore for easy expansion of mercury
- It has a curved glass to magnify the scale
- Its scale runs from 35°C to 42°C

2. LABORATORY THERMOMETER

- It is used to measure temperature during science experiments
- It uses mercury
- Its temperature scale runs from -10°C to 110°C

Examples of science experiments in which a laboratory thermometer is used

- Artificial incubation
- Measuring freezing points and boiling points of substances

A DIAGRAM SHOWING A LABORATORY THERMOMETER

Disadvantage of using a laboratory thermometer

- It lacks a kink to prevent the back flow of mercury

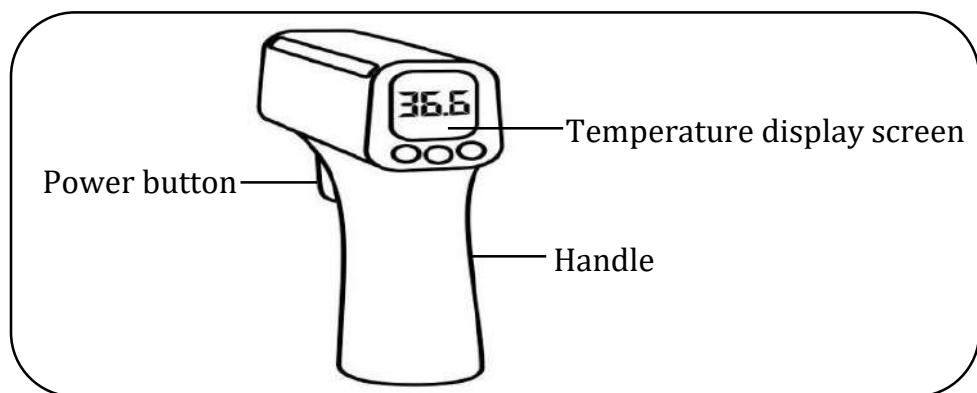
DIFFERENCES BETWEEN A CLINICAL THERMOMETER AND A LABORATORY THERMOMETER

- A clinical thermometer measures temperature of the human body while a laboratory thermometer measures temperature higher than that of the human body
- A clinical thermometer has a kink while a laboratory thermometer lacks a kink
- A clinical thermometer gives more accurate temperature readings than a laboratory thermometer
- A clinical thermometer has a narrow temperature range while a laboratory thermometer has a wide temperature range

3. INFRARED THERMOMETER (TEMPERATURE GUN)

- It measures human body temperature without direct contact with the skin
- It uses dry cells as a source of electricity

A DIAGRAM SHOWING AN INFRARED THERMOMETER



How does an infrared thermometer (temperature gun) help in the control of COVID-19?

- It measures human body temperature without direct contact with the skin

ADVANTAGE AN INFRARED THERMOMETER OVER A CLINICAL THERMOMETER

- It prevents spread of coronavirus unlike a clinical thermometer.

DISADVANTAGE OF AN INFRARED THERMOMETER TO A CLINICAL THERMOMETER

- It is more expensive than a clinical thermometers

4. WALL THERMOMETER

- It is used to measure temperature in a room
- It uses mercury

5. SIX'S THERMOMETER (MAXIMUM AND MINIMUM THERMOMETER)

- It measures the highest and lowest temperature of the day
- It uses both mercury and alcohol
- It uses alcohol to read lowest temperature and mercury to read highest temperature.

A DIAGRAM SHOWING THE SIX'S THERMOMETER

How is the six's thermometer reset?

- By using a magnet to move the metal indices

Why is alcohol used in minimum thermometers (to measure lowest temperatures)?

- It has a very low freezing point (-114.1°C) / It doesn't solidify easily

Advantage of using alcohol over mercury in thermometers

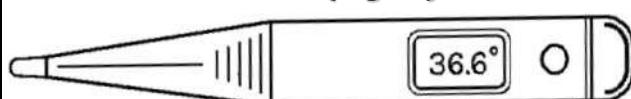
- Alcohol has lower freezing point (-114.1°C) than mercury (-38.83°C)

Why is mercury used in maximum thermometers (to measure highest temperatures)?

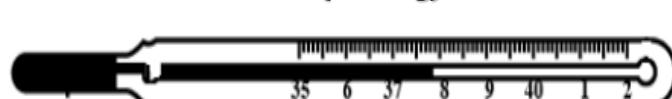
- It has a very high boiling point (356.7°C)

The diagrams below show two clinical thermometers A and B. Study them carefully and answer questions that follow.

A (digital)



B (Analog)



State the advantages of using clinical thermometer A (digital thermometer) over clinical thermometer B (analog).

- Clinical thermometer A is easier to read than clinical thermometer B
- Clinical thermometer A is more accurate than clinical thermometer B
- Clinical thermometer A provides faster results than clinical thermometer B

State one disadvantage of using clinical thermometer A over clinical thermometer B.

- Clinical thermometer A is more expensive than clinical thermometer B

THERMOMETRIC LIQUIDS

- These are liquids used in thermometers

Examples of thermometric liquids

- Mercury
- Alcohol

THERMOMETERS THAT USE MERCURY

- Clinical thermometers
- Maximum thermometers
- Wall thermometers
- Laboratory thermometers

THERMOMETER THAT USES BOTH MERCURY AND ALCOHOL

- Six's thermometers

ADVANTAGES OF USING MERCURY IN THERMOMETERS

(Reasons why mercury is commonly used in thermometers)

- It is visible or easily seen (it is opaque)
- It expands uniformly
- It is a good conductor of heat
- It does not wet (stick on) the glass tube
- It has a high boiling point (about 356.7°C)

DISADVANTAGES OF USING MERCURY IN THERMOMETERS

- It is very expensive
- It is poisonous
- It cannot measure very low temperatures

Reasons why alcohol is not commonly used in clinical thermometers

- It is not easily seen (it has a bright colour)
- It is a bad conductor of heat
- It wets the glass tube
- It does not expand uniformly (it expands more than mercury)

Disadvantages of using water in thermometers

- It wets the glass tube
- It needs a lot of heat to expand
- It is not easily seen (since it is colourless)
- It does not expand uniformly

CALCULATIONS

CHANGING FROM CENTIGRADE SCALE TO FAHRENHEIT SCALE

Formula: ${}^{\circ}\text{F} = (\text{C} \times \frac{9}{5}) + 32$

Standard formula: $9\text{C} + 160 = 5\text{F}$

Examples

1. Change 0°C to Fahrenheit scale

$${}^{\circ}\text{F} = \frac{9}{5} \text{C} + 32$$

$${}^{\circ}\text{F} = \frac{9}{5} \times 0 + 32$$

$${}^{\circ}\text{F} = \frac{0}{5} + 32$$

$${}^{\circ}\text{F} = 0 + 32$$

$$0^{\circ}\text{C} = 32 {}^{\circ}\text{F}$$

2. Change 100°C to Fahrenheit scale

$$= (\text{C} \times \frac{9}{5}) + 32$$

$$= (100 \times \frac{9}{5}) + 32$$

$$= (20 \times 9) + 32$$

$$= 180 + 32$$

$$100^{\circ}\text{C} = 212^{\circ}\text{F}$$

General formula $(9\text{C} + 160) = 5\text{F}$

General formula $9\text{C} = (5\text{F} - 160)$ or ${}^{\circ}\text{F} = \frac{9}{5}\text{C} + 32$

3. Change the following Celsius to Fahrenheit scale

(a) 60°C

(c) 15°C

(b) 40°C

(d) 45°C

CHANGING FROM FAHRENHEIT SCALE TO CENTIGRADE SCALE

To change from Fahrenheit to centigrade scale: Subtract 32 and then multiply by $5/9$

Formula ${}^{\circ}\text{C} = \frac{5}{9} ({}^{\circ}\text{F} - 32)$

Examples

❖ Change 32°F to centigrade scale

$$\text{C}^{\circ} = \frac{5}{9} ({}^{\circ}\text{F} - 32)$$

$$= \frac{5}{9} (32 - 32)$$

$$= \frac{5}{9} (0)$$

$$= (0/9)$$

$$= 32\text{F}^{\circ} = 0^{\circ}\text{C}$$

Change 212°F to centigrade scale

❖ $\text{F}^{\circ} - \text{C}^{\circ} = \frac{5}{9} (\text{F} - 32)$

$$= \frac{5}{9} (212 - 32)$$

$$= \frac{5}{9} (180)$$

$$= 5 \times 20$$

$$212^{\circ}\text{F} = 100^{\circ}\text{C}$$

6. Change the following Fahrenheit to centigrade scale

(b) 95°F

(c) 59°F

(d) 86°F

(e) 113°F

(f) 104°F

BURNING (COMBUSTION)

- This is a chemical reaction which uses oxygen to produce heat and light
- Burning is a **chemical change**

CONDITIONS NECESSARY FOR BURNING (COMBUSTION)

- Ignition temperature

This is the minimum temperature at which a fuel must be heated before it catches fire

- Oxygen
- Presence of a fuel (combustible substance)

Forms of energy produced during burning

- Heat energy
- Light energy

FUELS (COMBUSTIBLE SUBSTANCES)

- These are substances that are burnt to produce energy
- Fuels mainly produce heat energy

Characteristics of a good fuels (combustible substance)

- It should be cheap
- It should burn easily in air
- It should produce large amount of heat
- It should be readily available

GROUPS OF FUELS (CLASSIFICATION OF FUELS)

- Solid fuels
- Liquid fuels
- Gaseous fuels

Solid fuels

- These are solids that are burnt to produce energy

Examples of solid fuels

- Firewood
- Charcoal
- Sawdust
- Wood shaving
- Briquettes
- Coal
- Coke

Liquid fuels

- These are liquids that are burnt to produce energy

Examples of liquid fuels

- Kerosene (paraffin)
- Diesel
- Petrol
- Aviation fuel (Jet fuel)

Gaseous fuels

- These are gases that are burnt to produce energy

Examples of gaseous fuels

- Coal gas
- Natural gas
- Biogas

In which way is the function of food in the human body similar to that of petrol in a car?

- Both food and petrol are burnt to produce energy

FLAMMABLE (INFLAMMABLE) GASES

- These are gases that can catch fire easily

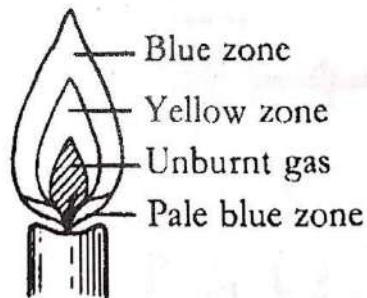
Examples of flammable gases

- Methane (biogas)
- Natural gas
- Butane
- Propane
- Coal gas

FLAME

- This is the visible and gaseous part of fire
- This is the glowing gas produced during burning

Regions (zones or parts) of a flame



BLUE ZONE (OUTER ZONE)

- It is the outermost region
- It is near the base (bottom) of a flame
- It is the hottest region

Why blue zone the hottest region of the flame?

- It is where complete burning (combustion) occurs

Why does complete combustion occur in the blue zone??

- It receives enough oxygen

YELLOW ZONE (MIDDLE ZONE)

- It is the brightest region
- It is moderately hot
- It gives out light

CENTRAL ZONE (UNBURNT GAS/DARK ZONE)

- This region is found deep inside the flame
- It surrounds the wick

- It is the coolest region of a flame
- It does not give out light

Give a reason why the dark zone does not give out any light. (why is dark region the coolest part of a flame?)

- There is no burning in this zone

Why is there no burning in the dark zone?

- It does not receive any oxygen

Examples of gases that do not burn

- | | | |
|------------------|---------|-----------|
| ▪ Carbon dioxide | ▪ Xenon | ▪ Krypton |
| ▪ Nitrogen | ▪ Argon | ▪ Helium |

EXPERIMENT TO SHOW THAT OXYGEN SUPPORTS BURNING

Why does the candle go off when covered for some time?

- Oxygen is used up
- Due to lack of oxygen supply

Which component of air supports burning of the candle shown above?

- Oxygen

Name the gas contained in the test tube when the candle goes off (stops burning)

- Carbon dioxide

EXPERIMENT TO SHOW THAT OXYGEN SUPPORTS BURNING

- Put some water in the beaker
- Fix a burning candle in the beaker
- Cover the candle with a test tube

Why does the candle continue burning for some time?

- It still has oxygen

Why does the candle finally go off (stop burning)?

- Oxygen is used up

Why does the water level rise as shown in diagram B?

- To occupy space for the used oxygen

WAYS OF PUTTING OUT FIRE

- Using fire extinguishers
- Using water for non-petrol fires
- Using sand
- Using thick blankets
- Rolling yourself on ground

Ways of putting out petrol fire

- Using fire extinguishers
- Using sand

Gases used in fire extinguishers

- Carbon dioxide
- Nitrogen

Why is carbon dioxide used in fire extinguishers?

- It does not support burning

Why is oxygen not used in fire extinguishers?

- Oxygen supports burning

Why are fire extinguishers painted with bright colours?

- For easy identification
- To easily be seen in case of fire accidents

STEPS TAKEN WHEN USING A FIRE EXTINGUISHER

- **P:** Pull the pin
- **A:** Aim the nozzle at base of fire
- **S:** Squeeze the handle
- **S:** Sweep nozzle side to side

Why is water not used to put out petrol fire?

- Petrol floats on water and burning continues

How does sand put out fire?

- It cuts off oxygen supply

How does water put out fire?

- Water reduces the temperature of fuel below its ignition temperature

RUSTING

- This is the chemical change in some metals that needs moisture and oxygen to take place
- Metals turn **reddish brown** on rusting
- Rusting is a **chemical change**

Why is rusting regarded as a chemical change?

- It is a new permanent substance
- It is irreversible

Examples of metals that can rust

- Iron
- Steel

Examples of metals that do not rust

- Copper
- Aluminum
- Silver

- Stainless steel
- Brass
- Bronze

CONDITIONS NECESSARY FOR RUSTING

- Oxygen
- Moisture

What is the role of moisture (water) in iron rusting?

- It speeds up oxidation of iron

Importance of rusting

- It adds iron in the soil

Disadvantages of rusting

- It makes metals weak
- It spoils the colour of metals
- It makes sharp metals blunt
- It makes keys fail to fit in padlocks
- It makes bolts and nuts hard to drive (unscrew)
- It makes water in rusty containers is poisonous

Ways of preventing and rusting and corrosion

- By keeping iron metals in clean dry places
- By painting some metals
- By galvanizing (coating iron with zinc)
- By enameling (coating iron with enamel)
- By greasing or oiling some metals
- By making alloys

How does painting prevent rusting?

- Paint cuts off oxygen and moisture supply
- Paint prevents direct contact of moisture and oxygen with the metal

EXPERIMENT TO SHOW RUSTING

- Put iron nails in a test tube and wet them with tap water
- Invert the test tube and place it in a beaker of water
- Leave them for at least a week

Observations

- The iron nails will rust (will turn reddish brown)
- The water level in the beaker will rise

Conclusion

- The water level rises to occupy space for the used oxygen

EXPERIMENT TO SHOW RUSTING

- Put an iron nail in each test tube: A, B and C
- Put tap water in test tube A and cork it

Tap water has oxygen

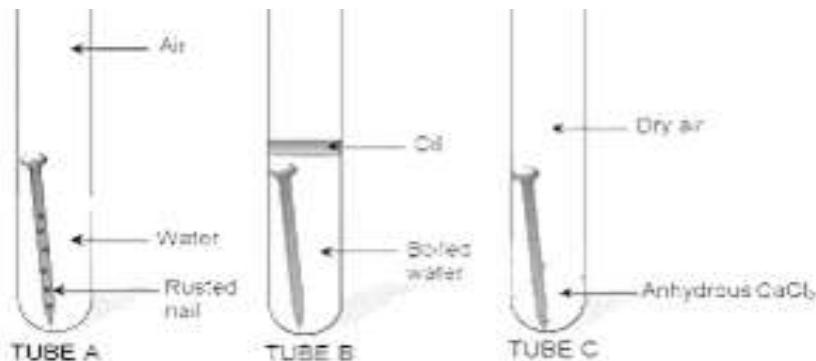
- Put boiled water and oil in test tube B

Boiling removes oxygen from water

Oil cuts off oxygen supply

- Put Calcium chloride in test tube C and cork it

Calcium chloride helps to dry air (remove water from air)



Observation

The iron nail in test tube A rusted

- Due to presence of moisture and oxygen
- It has all necessary conditions for rusting

The iron nail in test tube B did not rust

- Oil cuts off oxygen supply

The iron nail in test tube C did not rust

- It lacks moisture (water)

TOPIC: GROWING TUBER CROPS

Tuber crops

These are crops with swollen underground stems or roots that store food

Groups (types) of tuber crops

- Root tubers

- Stem tubers

Root tubers

- These are swollen underground roots that store food

Examples of root tubers

- | | |
|---|--|
| <ul style="list-style-type: none"> ▪ Cassava ▪ Sweet potatoes ▪ Carrots ▪ Turnips | <ul style="list-style-type: none"> ▪ Parsnips ▪ Swede ▪ Dahlia ▪ Beetroot (beet) |
|---|--|

Propagation (growing) of some root tubers

- Carrots by means of **seeds**
- Cassava by means of **stem cuttings**
- Sweet potatoes by means of **vines or stem cuttings**

Carrots are first planted in a nursery bed (seed bed) and later transplanted

Carrots are rich in Vitamins (Vitamin A) which helps in good night vision

Stem tubers

These are swollen underground stems with stored food

Examples of common stem tubers

- | | |
|--|--|
| <ul style="list-style-type: none"> ▪ Irish potato | <ul style="list-style-type: none"> ▪ White yams |
|--|--|

Propagation (growing) of stem tubers

Irish potatoes and white yams are propagated by means of **stem tubers**

Methods of planting tuber crops

- **Broadcasting method**

This is when crops are scattered randomly in the garden

- **Row planting (row cropping)**

This is when crops are grown in lines with proper spacing

Qualities of good crops to be grown

- They should be resistant to diseases
- They should be resistant to bad weather
- They should have great market value
- They should be good yielding

Ways of caring for tuber crops

- | | |
|--|---|
| <ul style="list-style-type: none"> ▪ Weeding ▪ Spraying with pesticides ▪ Pruning | <ul style="list-style-type: none"> ▪ Watering ▪ Thinning ▪ Earthing up |
|--|---|

PESTS FOR TUBER CROPS

- | | | |
|---|---|--|
| <ul style="list-style-type: none"> ▪ Weevils ▪ Squirrels ▪ Caterpillars ▪ Rats ▪ Grass hoppers (variegated grasshoppers) | <ul style="list-style-type: none"> ▪ Millipedes ▪ Wild pigs ▪ Moles ▪ White fly | <ul style="list-style-type: none"> ▪ Green cassava mites ▪ Aphids ▪ Army worm |
|---|---|--|

Signs of tuber crops attacked by pests

- Wilting of the crop
- Damaged roots and stems
- Black patches on the leaves
- Holes on leaves

Effect of pests and disease on tuber crops

- They destroy leaves
- They eat and destroy tubers
- They make tubers rot
- They eat and destroy the stems

DISEASES OF TUBER CROPS

- Cassava Mosaic
- Brown streak
- Bacterial blight
- Bacterial wilt

Signs of diseased crops

- Stunted growth
- Poor quality of yields
- Yellowing of leaves
- Black patches on the leaves

Controlling pests and diseases of tuber crops

- Spraying using pesticides
- Planting disease resistant varieties
- Regular weeding
- Pruning
- Use of scare crows
- Crop rotation
- Remove and burn infected plants
- Fencing the garden
- Poisoning them
- Use of traps

CHARACTERISTICS OF PESTS FOR TUBER CROPS

- They have sharp claws to dig out tubers from the soil
- They have sharp incisors to bite tubers
- Some have fingers for uprooting the tubers

METHODS OF HARVESTING TUBER CROPS

- Digging out (e.g. sweet potatoes and Irish potatoes)
- Uprooting (e.g. cassava)

SCIENCE ORIENTED CLUBS

- These are clubs that are formed on science basis

Objectives of science oriented clubs

- To enable children acquire science skills
- To make children pick interest in science subjects
- To enable children discover science facts

Examples of science oriented clubs

- Young farmers' club
- Environmental protection clubs
- Wildlife club
- Science and technology clubs

Young farmers' club

- This is a group of young people in a community who have interest in farming

Roles of young farmers' club at school

- They grow food crops in the school garden
- They organize study tours to farm schools
- They teach better farming methods to their fellow school
- They teach school children how to grow and care for crops

CO-OPERATIVE SOCIETIES

- These are groups of people who join together to do a business that they cannot do successfully as individuals.

Functions of co-operative societies

- They provide loans to farmers
- They provide farm machinery for hire
- They find market for the farmers' produce
- They have better storage facilities for farmers' produce
- They teach better farming methods to the farmers

BACTERIA AND FUNGI

BACTERIA

- These are tiny organisms with one cell (single celled microbes)
- They are under **kingdom monera**
- A group of bacteria is called a **colony**

Characteristics of bacteria

- They are single celled/unicellular organisms
- They have a cell wall
- They lack a nucleus
- They are microscopic organisms (microorganisms/microbes)
- They have improper shape
- They have flagella

Why are bacteria called unicellular organisms?

- They have one cell

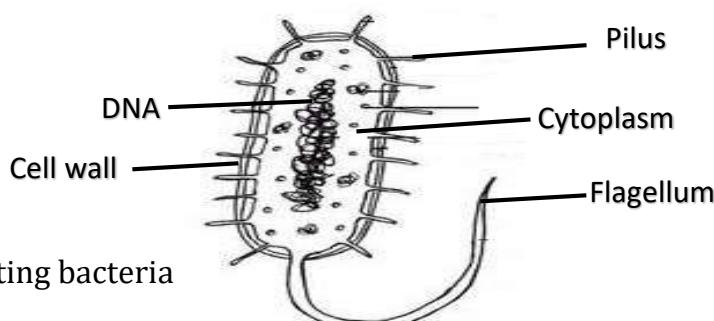
Why are bacteria called microbes/microorganisms/microscopic organisms?

- They are too small to be seen with the naked eyes
- They can only be seen with a microscope

How does a microscope help a doctor to see bacteria?

- It magnifies bacteria (it makes bacteria to appear bigger)

Structure of a bacterium



Cell wall

- For protecting bacteria

Flagella

- These are tail-like structures on some bacteria
- A bacterium can be with a single flagellum or numerous flagella
- They help bacteria to move (for movement)

How do bacteria move (locomote)?

- By using their flagella

Pilus

- For attachment to the source of food

How are bacteria able to survive harsh environmental and chemical conditions?

- By forming endospores

Feeding in bacteria (how bacteria feed)

- Some bacteria feed on dead organic matter (they are saprophytes)
- Some bacteria make their own food (they are autotrophs)

Places (habitats) where bacteria breed from and live

- | | |
|---|--|
| <ul style="list-style-type: none"> ▪ Soil ▪ Latrines ▪ Septic tanks ▪ Rubbish pits ▪ Dirty water ▪ Dirty food | <ul style="list-style-type: none"> ▪ Rotting matter ▪ On plants ▪ On bodies of animals ▪ Infected blood ▪ Nasal mucus ▪ Root nodules |
|---|--|

Conditions needed by bacteria to reproduce (breed)

- | | |
|--|--|
| <ul style="list-style-type: none"> ▪ Food ▪ Moisture (water) | <ul style="list-style-type: none"> ▪ Warmth ▪ Oxygen |
|--|--|

Reproduction/breeding in bacteria (how do bacteria reproduce?)

- By binary fission

BINARY FISSION

- This is the form of asexual reproduction where a parent cell divides into two identical daughter cells

Single celled organisms that reproduce by cell division (binary fission)

- | | |
|---|---|
| <ul style="list-style-type: none"> ▪ Bacteria ▪ Amoeba ▪ Virus | <ul style="list-style-type: none"> ▪ Paramecium ▪ Euglena |
|---|---|

Diagram to show binary fission

Why is the mode of reproduction shown above called asexual reproduction?

- It does not involve the union of gametes

How are bacteria are named?

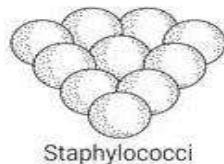
- According to their shapes

TYPES/GROUPS OF BACTERIA (ACCORDING TO THE SHAPES)

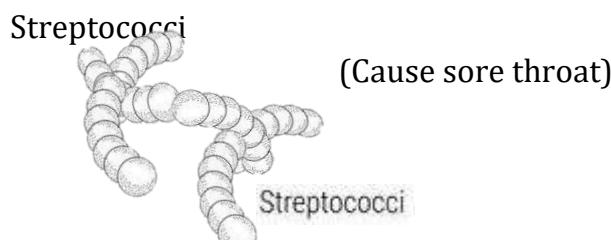
- Spherical bacteria (cocci)
- Spiral shaped bacteria (spirilla)
- Rod shaped (cylindrical) bacteria (bacilli)
- Comma shaped bacteria (vibrios)
- Corkscrew shaped bacteria (Spirochaetes)

Spherical bacteria

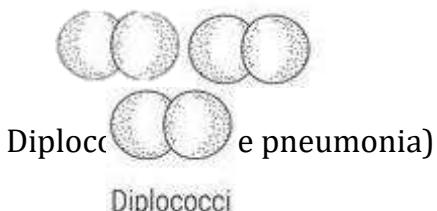
- These are called **cocci**
- They can be monococcus (single), diplococcus (in pairs), tetracoccus (in fours) and staphylococcus (in clusters)
- These cause boils, sore throat and pneumonia



Staphylococci (causes boils)



(Cause sore throat)



Rod shaped bacteria (cylindrical bacteria)

They are called **Bacilli**

Bacillus anthracis causes **anthrax**

Salmonella typhi causes **typhoid**

Spiral shaped bacteria

- These are called **spirilla**

Treponema causes **syphilis**

Comma shaped bacteria

- These are called **vibrios**
- They have flagella at one end
- Vibrio cholerae causes **cholera**

Respiration of bacteria

- Some bacteria need oxygen for respiration
- These are called **aerobic bacteria**
- Other bacteria don't need oxygen
- These are called **anaerobic bacteria**

How do bacteria enter in our bodies?

- Through inhaling contaminated air
- Through drinking contaminated water
- Through eating contaminated food
- Through dirty wounds
- Through playing unprotected sex with an infected person

Nature of bacteria

- Useful bacteria (harmless bacteria)
- Harmful bacteria (useless bacteria)

Useful bacteria

- These are bacteria that are important in the environment

Examples of useful bacteria

- **Putrefying bacteria:** help in decomposition of organic matter to form humus
- **Anaerobic bacteria:** ferment waste in biogas digester to produce biogas
- **Nitrogen fixing bacteria (rhizobia):** fix nitrogen into the soil
- Nitrifying bacteria

Importance of bacteria (ways in which bacteria are useful)

- Some bacteria help to fix nitrogen in the soil e.g nitrogen fixing bacteria /rhizobia
- Some bacteria help in decomposition of organic matter e.g putrefying bacteria
- Some bacteria help to reduce the volume of faeces in latrines and sewage tanks
- Bacteria help to break down complex sugars in the digestive system (some bacteria help in food digestion)
- Some bacteria help in production of vinegar

Vinegar is used to preserve meat

- Some bacteria help in biogas production e.g anaerobic bacteria
- Some bacteria help in making of some vaccines
- Some bacteria help in making cheese, butter and yoghurt
- Bacteria help in genetic engineering

Why is it bad to pour kerosene and oil in latrines?

- Oil kills bacteria and maggots that would reduce volume of faeces

How does oil kill bacteria and maggots in latrines?

- Oil cuts off oxygen supply to bacteria and maggots

Examples of processes which need bacteria to take place

- Decomposition
- Fermentation of milk (production of cheese, butter and yogurt)
- Production of drugs (vaccines and antibiotics)
- Production of vinegar
- Anaerobic fermentation (biogas production)
- Fixation of nitrogen in the soil

HARMFUL BACTERIA

- These are bacteria that are dangerous in the environment

Examples of harmful bacteria

- **Clostridium tetani:** causes tetanus

- **Vibrio cholerae**: causes cholera
- **Salmonella typhi**: causes typhoid
- **Treponema pallidum**: causes syphilis
- **Mycobacterium**: causes leprosy and tuberculosis

Dangers of bacteria (how bacteria are harmful/nuisance)

- Some bacteria cause bacterial diseases (they are pathogens)
- Some bacteria spoil milk (make food go bad)
- Some bacteria make wounds septic
- Some bacteria cause ripening of premature fruits

Which hormone in plants is responsible for ripening of mature fruits?

- Ethylene hormone

Pathogens are tiny organisms that cause diseases

How do bacteria protect themselves against the host's immune system?

- By forming a protective capsule (layer of slime) on its cell wall

A table showing bacterial diseases in people, livestock and plants

In people	In livestock	In poultry	In plants
<ul style="list-style-type: none"> ▪ Cholera ▪ Tetanus ▪ Typhoid ▪ Syphilis ▪ Bacillary dysentery ▪ Pneumonia ▪ Gonorrhoea ▪ Diphtheria ▪ Tuberculosis ▪ Leprosy ▪ Lyme disease 	<ul style="list-style-type: none"> ▪ Anaplasmosis ▪ Mastitis ▪ Black quarter ▪ Pneumonia ▪ Tuberculosis ▪ Anthrax ▪ Brucellosis ▪ Foot rot 	<ul style="list-style-type: none"> ▪ Fowl cholera ▪ Fowl typhoid ▪ Pneumonia 	Bacterial Wilt Fire blight Bacterial spot

PREVENTION OF DANGERS CAUSED BY HARMFUL BACTERIA

- Immunize against bacterial diseases
- Reheat leftover food before eaten
- Always cover leftover food
- By preserving food
- Wash hands after visiting latrine
- Always drink safe water
- Use of antibiotic drugs to treat bacterial infections
- Use of antiseptic drugs to kill bacteria
- Sterilize medical equipment before use
- Abstain from sex
- Keep cuts and wounds clean
- Use clean hands to handle food
- Proper use of latrines and toilets

- Use of disinfectants to clean latrines

ANTISEPTICS

- These are substances used to kill germs on the human body
- They prevent wounds from becoming septic

Examples of antiseptics (antiseptic drugs)

- Dettol
- **Iodine:** It is used to kill germs on cuts
- Carbolic acid
- Hydrogen peroxide
- **Alcohol:** It is used in hand sanitizers

ANTIBIOTICS

- These are drugs that treat bacterial infections

Examples of antibiotics (antibiotic drugs)

- Penicillin
- Septrin

DISINFECTANTS

- These are chemicals that kill germs on non-living surfaces

Examples of disinfectants

- Jik
- Jeyz
- Chlorine (bleach)

FUNGI

- These are organisms that lack chlorophyll and cannot make their own food
- Fungi belong to **Kingdom fungi**
- They can either be unicellular or multicellular organisms
- Fungi are found in **moist places**
- Fungi lack proper roots but they have threadlike structures called **hyphae**
- A group of hyphae is called **mycelium**
- Fungi cannot make their own food
- Most fungi are saprophytes

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 organic 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

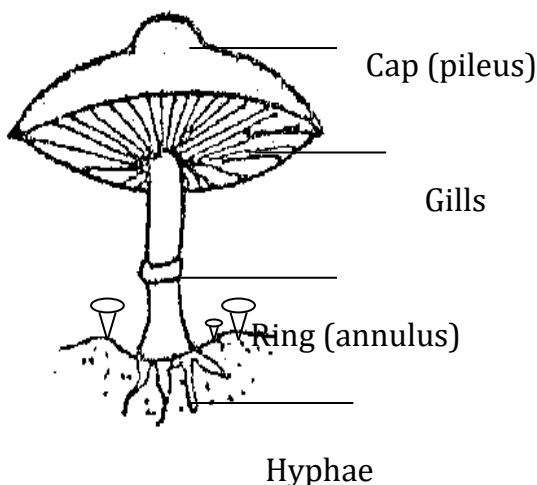
- Yeast
- Moulds (penicillium moulds, rhizopus and mucor)
- Mushrooms
- Toad stools
- Puff balls
- Bracket fungi

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



How are mushrooms grown (propagated/reproduce)?

- By means of spores

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

Cap (pileus)

- It protects the gills

Gills

- They produce and store spores

Stalk/stem/stipe

- It holds the cap and gills

Ring

- It protect the mushroom when it is still young

Hypphae

- 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 while a plant makes its own food

YEAST

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



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 plants and animals

In people

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

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

Similarities between fungi and bacteria

- Both can cause diseases
- Both feed on dead matter
- Both have a cell wall
- Both help in decomposition
- Both fungal and bacterial diseases can be treated

Differences between bacteria and fungi

- Bacteria reproduce by binary fission (cell division) while fungi reproduce by means of spores or budding
- Some bacteria make their own food while fungi don't make their own food
- Most bacteria have one cell while most fungi have many cells
- Bacterial diseases are immunisable while fungal disease are not immunisable

THE GREAT SCIENTISTS

Sir Isaac Newton

- He discovered Newton's laws of motion

Edward Jenner (1749 – 1895)

- He made vaccine for smallpox.

Louis Pasteur (1822 – 1895)

- He discovered pasteurization of milk
- He discovered bacteria make milk go bad

Sir Ronald Ross (1857 – 1982)

- He discovered the cause of malaria

Sir Alexander Fleming (1886 - 1985)

- He discovered penicillin

Joseph Lister (1827 – 1912)

- He discovered the antiseptic to prevent wounds from becoming septic

Robert Koch (1843 – 1910)

- He discovered the bacteria that cause tuberculosis, anthrax and cholera

Sir William Harvey (1578 – 1657)

- He discovered blood circulation in the human body.

TERM THREE

TOPIC: CHANGES IN THE ENVIRONMENT

ENVIRONMENT

- These are things that surround an organism

Types of changes in our environment

- | | | |
|----------------------|--------------------|--------------------|
| ▪ Biological changes | ▪ Chemical changes | ▪ Physical changes |
|----------------------|--------------------|--------------------|

BIOLOGICAL CHANGES

- These are changes that occur in the life of living things

Characteristics of biological changes

- They are irreversible (cannot be reversed)
- They take place in the life of living things

Examples of biological changes

- | | | |
|----------------|-----------------|-------------|
| ▪ Moulting | ▪ Germination | ▪ Flowering |
| ▪ Growth | ▪ Fertilization | ▪ Fruiting |
| ▪ Reproduction | ▪ Ovulation | |

Advantages of biological changes

- Moulting helps some organisms to increase in size
- Reproduction prevents extinction of living things
- Reproduction increases population of living things

CHEMICAL CHANGES

- These are changes that form a new permanent substance

Characteristics of chemical changes

- They are irreversible (cannot be reversed)
- They form a new permanent substance
- They either absorb or give off heat
- The weight an object changes

Examples of chemical changes

- | | | |
|-----------------|----------------------|------------------|
| ▪ Burning | ▪ Fermentation | ▪ Photosynthesis |
| ▪ Rusting | ▪ Respiration | |
| ▪ Decomposition | ▪ Chemical digestion | |

Advantages of chemical changes

- Burning produces heat for cooking
- Rusting adds mineral salts (e.g iron) to the soil
- Decomposition helps in soil formation
- Fermentation helps in making of alcohol and yogurt
- Respiration helps the body to get energy
- Chemical digestion eases absorption of food
- Photosynthesis helps plants to get food
- Photosynthesis provides oxygen to animals
- Photosynthesis helps to purify air

Disadvantages of chemical changes

- | | |
|---------------------------------------|------------------------------------|
| ▪ Rusting weakens metals | ▪ Burning pollutes the environment |
| ▪ Rusting spoils the colour of metals | ▪ Burning causes fire accidents |

PHYSICAL CHANGES

- These are changes that do not form a new permanent substance

Characteristics of physical changes

- They do not form a new permanent substance
- They are reversible
- They neither absorb nor give off heat

Examples of physical changes

- | | | |
|----------------|---------------|----------------------|
| ▪ Evaporation | ▪ Sublimation | ▪ Crystallization |
| ▪ Condensation | ▪ Deposition | ▪ Breaking of an egg |
| ▪ Freezing | ▪ Expansion | |
| ▪ Melting | ▪ Contraction | |

Advantages of physical changes

- Evaporation helps us to obtain salt from salt solution
- Evaporation helps to concentrate liquid foods e.g noodles
- Evaporation and condensation help in water cycle

- Evaporation of sweat cools our bodies
- Freezing helps in making of ice cubes
- Freezing helps in food preservation e.g ice cream, juice and tomatoes
- Melting helps us to butter in cooking
- Melting helps in making of alloys
- Sublimation helps us to wear perfumes

Disadvantages of physical changes

- Freezing makes water transport difficult
- Expansion causes cracks on buildings and furniture
- Expansion breaks bridges on hot days
- Expansion bends wet timber dried under sunshine
- Contraction reduces air pressure in the tubes of tyres
- Contraction causes breaking of hot glass when cold water is put in it
- Contraction causes breaking of electric bulbs when exposed to cold water
- Some cause weather changes in the atmosphere

NATURAL AND PEOPLE MADE CHANGES

NATURAL CHANGES

- These are changes that occur in nature

Examples of natural changes

- | | | |
|---------------|-----------------|---------------------|
| ▪ Floods | ▪ Lightning | ▪ Change in seasons |
| ▪ Earth quake | ▪ Wind movement | |

MAN MADE CHANGES

- These are changes that are caused by man

Examples of man made changes

- | | | |
|----------------------|---------------------------|--------------------------|
| ▪ Afforestation | ▪ Industrialization | ▪ Vegetative propagation |
| ▪ Deforestation | ▪ Cross breeding | ▪ Mulching |
| ▪ Bush burning | ▪ Artificial insemination | |
| ▪ House construction | | |
| ▪ Road construction | | |

ADVANTAGES AND DISADVANTAGES OF MANMADE CHANGES

MANMADE CHANGE	ADVANTAGES	DISADVANTAGES
Mulching	It keeps water in the soil It improves soil fertility Controls weeds	Mulches hide pest Wet mulches grow into weeds Mulching is tiring
Road construction	It eases transport It eases communication	It leads to destruction of vegetation Poor roads cause accidents
MANMADE CHANGE		ADVANTAGES
House construction		Houses protect from bad weather Houses protect from thieves

	Houses protect from wild animals
Afforestation	Trees control soil erosion Trees help in rain formation Trees provide wood fuel Trees provide herbal medicine Trees provide timber
MANMADE CHANGE	EFFECTS
Deforestation	It causes soil erosion It causes drought It destroys wild life It leads to global warming
Bush burning	It causes soil erosion It leads to soil infertility

TOPIC: KEEPING GOATS, SHEEP AND PIGS

COMMON TERMS USED IN KEEPING GOATS

- **A nanny goat (doe):** This is an adult female goat
- **A Billy goat (buck):** This is an adult male goat
- **Wether:** This is a castrated billy goat
- **Kid:** This is a young goat
- **Kidding:** This is the act of giving birth to kids (act of giving birth in goats)
- **Browsing:** This is the act of feeding on leaves and soft shoots of plants
- **Weaning:** This is the gradual introduction of other foods to a baby to supplement breast milk
- **Gestation period:** This is the time taken from conception to birth
- **Lactation:** This is production of milk by the mother's mammary glands after birth

REASONS FOR GOAT KEEPING (WHY FARMERS KEEP GOATS AND SHEEP?)

- For milk production
- For meat production
- For income after sale
- For mohair production

IMPORTANCE (USES) OF GOATS TO PEOPLE

- They provide milk
- They provide meat
- They are sold for money
- Their droppings and urine are used as farm yard manure
- Their skins are used to make leather products and dance costumes
- Angora goats provide mohair
- They are used as dowry
- They are used as sacrifices

Examples of leather (products made from animal skins)

- Leather shoes
- Leather bags
- Leather belts
- Leather jackets

EXTERNAL PARTS OF A GOAT

TYPES OF GOATS

- A type of goats is a group of goats kept for a specific purpose

TYPES OF GOATS

- Dairy breeds (milk goats)
- Meat goats
- Mohair goats

BREEDS OF GOATS

- A breed of goats is a group (family) of goats with the similar characteristics (features)

Types of breeds of goats

- Local breeds (indigenous/native breeds)
- Exotic breeds
- Cross breeds

LOCAL BREEDS

- These are breeds of goats that have been in Uganda for a long time
- Local breeds of goats are mainly kept for **meat**

Characteristics of local breeds of goats

- They are small in size
- They are resistant to diseases
- They are resistant to bad weather
- They mature slowly
- They need less care and attention
- They have good quality products
- They produce less products

EXAMPLES OF LOCAL BREEDS OF GOATS

- Mubende goats
- Small East African goats

- Kigezi goats
- Sebei goats

- Karamoja goats

ADVANTAGES OF LOCAL BREEDS

- They are resistant to diseases
- They are resistant to bad weather
- They need less care and attention

- They produce less milk and meat
- They have good quality products

DISADVANTAGES OF LOCAL BREEDS

- They mature slowly
- They produce less milk and meat

- They have hard meat

EXOTIC BREEDS OF GOATS

- These are breeds of goats that were imported from other countries

CHARACTERISTICS OF EXOTIC BREEDS OF GOATS

- | | |
|---|---|
| <ul style="list-style-type: none"> ▪ They are big in size ▪ They are vulnerable to diseases ▪ They are vulnerable to bad weather | <ul style="list-style-type: none"> ▪ They need much care and attention ▪ They mature quickly ▪ They produce a lot of meat and milk |
|---|---|

EXAMPLES OF EXOTIC BREEDS OF GOAT	REASON FOR KEEPING THEM
<ul style="list-style-type: none"> ▪ Boer goats ▪ Savanna goats ▪ Kalahari Red goats ▪ Somali goats (Galla goats) ▪ Galla goats (Somali goats) ▪ Kiko goats 	For meat production
<ul style="list-style-type: none"> ❖ Saanen goats ❖ Toggenburg goats ❖ Alpine goats ❖ Anglo-Nubian goats ❖ Golden Guernsey goats 	For milk production
<input checked="" type="checkbox"/> Angora goats	For mohair production

Advantages of exotic breeds of goats

- They mature quickly
- They produce a lot of meat and milk
- They have soft meat

- They have soft meat

Disadvantages of exotic breeds of goats

- They are not resistant to diseases
- They are not resistant to bad weather
- They need much care and attention

- They need much care and attention

BREEDING IN GOATS

- A Nanny goat is mated for the first time at the age of 14 – 18 months.

How often do goats breed in a year?

- Goats breed once in a year.

GESTATION PERIOD OF A GOAT

- **Gestation period** is the time taken from conception to birth
- The gestation period of a nanny goat is **5 months (150 days)**

HEAT PERIOD IN GOATS

- This is the time when the nanny goat is ready to mate with a billy goat

Signs of a nanny goat on heat

- | | |
|--|---|
| <ul style="list-style-type: none"> ▪ It becomes restless ▪ It mounts other goats ▪ It stands still when mounted ▪ It urinates frequently | <ul style="list-style-type: none"> ▪ It makes a lot of noise ▪ Loss of appetite ▪ The vulva swells and turns red ▪ Mucus discharge from the vulva |
|--|---|

CARING FOR A PREGNANT GOAT

- Providing concentrates one month before kidding.
- ✓ Concentrate feeds are rich in carbohydrates and proteins.
- Providing them with mineral licks.
- ✓ Mineral licks are rich in mineral salts
- Providing a separate clean dry shelter to pregnant goats

WEANING IN GOATS

- Weaning should be done at least 3 - 4 months after kidding.

SIGNS OF A GOOD MILK BREED OF GOAT

- It has a large udder and teats.
- It has large milk veins which appear below the belly.
- It has strong and well placed hind legs.
- It has strong back muscles.

MANAGEMENT (ROUTINE) PRACTICES IN GOAT KEEPING

(Ways of caring for farm animals)

- | | |
|--|---|
| <ul style="list-style-type: none"> ▪ Numbering ▪ Dehorning/Disbudding ▪ Hoof trimming ▪ Castration ▪ Deworming ▪ Dehorning | <ul style="list-style-type: none"> ▪ Spraying ▪ Dipping ▪ Dusting ▪ Culling ▪ Feeding ▪ Housing |
|--|---|

NUMBERING (IDENTIFICATION OF ANIMALS)

- This is the putting of a mark or label on the body of animals.

Importance of numbering (livestock identification)

- It helps a farmer to easily find his lost animals
- It helps a farmer to keep proper farm records

HOOF TRIMMING

- This is cutting of overgrown hooves from the animal

- It reduces the risk of foot rot disease

DEHORNING/DISBUDDING

- **Dehorning** is the removal of horn buds from the animal
- **Disbudding** is the removal of horn buds from the animal
- It increases space in the barn/byre

CASTRATION

- This is the removal or inactivation of testicles of a male animal

METHODS OF CASTRATION

- | | |
|-------------------------------------|---------------------|
| ▪ Open castration | ▪ Closed castration |
| ▪ Loop castration (band castration) | |

1. OPEN CASTRATION (SURGICAL CASTRATION)

- This is when the scrotum is cut to remove the testicles

Instruments used in open castration

- | | | |
|---------------|--------------|-----------|
| ▪ Sharp knife | ▪ Razorblade | ▪ Scalpel |
|---------------|--------------|-----------|

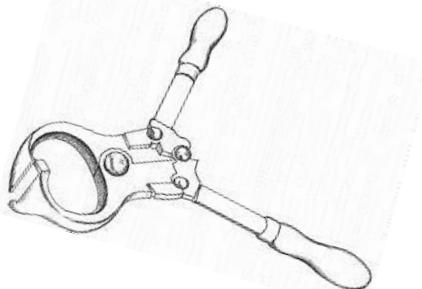
2. CLOSED CASTRATION

- This is the use of burdizzo to crush the sperm ducts and blood vessels

Instrument used in closed castration

- Burdizzo

A diagram showing a burdizzo



How is a burdizzo useful on cattle farm?

- It is used in closed castration

How is a burdizzo adapted to its function?

- It has blunt pincers

3. LOOP CASTRATION (BAND CASTRATION)

- This is the use of a rubber band to squeeze and break the sperm ducts and blood vessel

Instruments used in loop castration

- | | |
|---------------|--------------|
| ▪ Rubber band | ▪ Elastrator |
|---------------|--------------|

An elastrator is used to apply rubber band around the scrotum during band castration

Why is loop castration impossible in pigs (boars)?

- They don't have sagging testicles

ADVANTAGES OF CASTRATION

- | | |
|---------------------------------------|--|
| ▪ It prevents inbreeding | ▪ It makes the animal grow big and fat |
| ▪ It prevents random mating | ▪ It reduces bad smell in male animals |
| ▪ It makes the animal humble (docile) | ▪ It prevents unwanted pregnancies |

DISADVANTAGES OF CASTRATION

- It is painful
- It increases the risk of infections
- It needs a skilled person
- It denies the male animal its right of reproduction

DEWORMING

- This is the giving of medicine through the mouth to kill worms (endoparasites) in animals

Why farmers deworm their animals? (Importance of deworming)

- To kill endoparasites (worms)

METHODS OF DEWORMING

- Drenching
- Dosing

1. DOSING

- This is the giving of solid medicine through the mouth to kill worms in animals

2. DRENCHING

- This is the giving of liquid medicine through the mouth to kill worms in animals.

Farm tools used for drenching

- Drenching gun
- Syringe
- Bottle

DIAGRAM OF A DRENCHING GUN

How is a drenching gun important on a livestock farm?

- It is used for drenching

State the importance of spraying, dipping and dusting livestock with acaricides

- To kill ticks and mites
- To prevent tick-borne diseases

How is a knapsack sprayer important on a goat farm?

- It is used for spraying acaricides

HOUSING GOATS

- This is the act of constructing a house for goats

QUALITIES OF A GOOD HOUSE FOR GOATS

- It should be well ventilated
- It should have a strong roof

- It should have a slanting floor
- It should be clean and dry

IMPORTANCE OF A HOUSE TO GOATS

- To protect goats from bad weather
- To protect goats from predators
- To protect goats from thieves

DANGERS OF SHARING A HOUSE WITH DOMESTIC ANIMALS

- It leads to bad smell in the house
- It leads to parasites in the house
- It leads to competition for oxygen
- It leads to easy spread of diseases to people
- It leads to destruction of household property

SYSTEMS (METHODS) OF GRAZING GOATS

- Free range grazing or Herding
- Tethering
- Paddock grazing
- Zero grazing
- Strip grazing

Mention three methods of rotational grazing

- Tethering
- Paddock grazing
- Strip grazing

HERDING

- This is when a herdsman looks after animals as they graze
- It is also called **free range grazing** because animals move on their own looking for food

Advantages of herding

- Animals get a balanced diet
- Animals make enough body exercise
- Less attention is needed
- It is cheap to manage

Disadvantages of herding

- It leads to easy spread of diseases
- Animals can destroy crops
- Animals can get lost
- It needs a big piece of land
- It can lead to overgrazing

PADDOCK GRAZING

- This is the method of grazing in which a pastureland divided into small fenced plots
- **Paddocks** are small fenced plots on pastureland

An illustration showing paddock grazing

Advantages of paddock grazing

- It allows proper use of pasture
- It gives pasture time to grow
- Manure is evenly distributed on the farm
- It controls over grazing
- It controls tickborne diseases

How does paddock grazing control ectoparasites and diseases in livestock?

- It starves ticks to death (it breaks the feeding cycle of ticks)

DISADVANTAGES OF PADDOCK GRAZING

- It is expensive to manage
- It needs a big piece of land
- Animals do not make enough body exercises

STRIP GRAZING

- This is the grazing of animals on a pastureland divided into strips using electric wires.

Advantages of strip grazing

- There is proper use of pasture.
- It controls diseases and parasites
- It prevents over grazing
- Animals do not destroy crops

Disadvantages of strip grazing

- It is expensive to maintain
- Few animals are kept
- Animals do not make enough body exercises
- It can only be used in areas with electricity

TETHERING

- This is the method of grazing where a farmer ties the animal on a peg or tree using a rope
- The animals tethered is moved to a new place when necessary

An illustration showing tethering

Advantages of tethering

- There is no need for fencing
- It is easy to start
- It is cheap to manage
- It needs a small piece of land
- Animals may not destroy crops
- The farmer gets time to do other work

Disadvantages of tethering

- Animals do not get balanced diet
- Few animals are kept
- Animals can easily be stolen
- Animals can easily be killed by predators
- The rope can easily strangle the animal

- Animals do not make enough body exercises

ZERO GRAZING

- This is the keeping of animals in stalls where water and food are provided.
- It is also called **stall grazing**

An illustration showing zero grazing

Advantages of zero grazing

- Many animals are kept in a small area
- It prevents wastage of feeds
- It needs a small piece of land
- It protects animals from bad weather
- It is easy to collect manure
- It is easy to cull sick animals
- Animals produce a lot of milk

Why? There is no wastage of energy

- It controls the spread of diseases and parasites

Disadvantages of zero grazing

- It is expensive to manage
- Animals lack body exercises
- It needs a lot of labour

SHEEP REARING

TERMS USED IN SHEEP REARING

Ram:

- This is a mature male sheep.

Ewe:

- This is a mature female sheep.

Lamb:

- This is the young of a sheep.

Lambing:

- This is the act of giving birth in sheep.

Mutton:

- This is the meat of sheep.

Shearing:

- This is the removal of wool from a sheep.

Docking:

- This is the cutting of the lamb's tail short

Gestation period:

- This is the period between conception and birth.

REASONS FOR DOCKING

Importance of docking sheep

- It makes mating easy
- It promotes hygiene of a sheep (reduces the risk of fly strike)

REASONS FOR REARING SHEEP (Why do farmers keep sheep?)

- | | |
|--------------------------------|-------------------------|
| ▪ For meat (mutton) production | ▪ For income after sale |
| ▪ For wool production | |

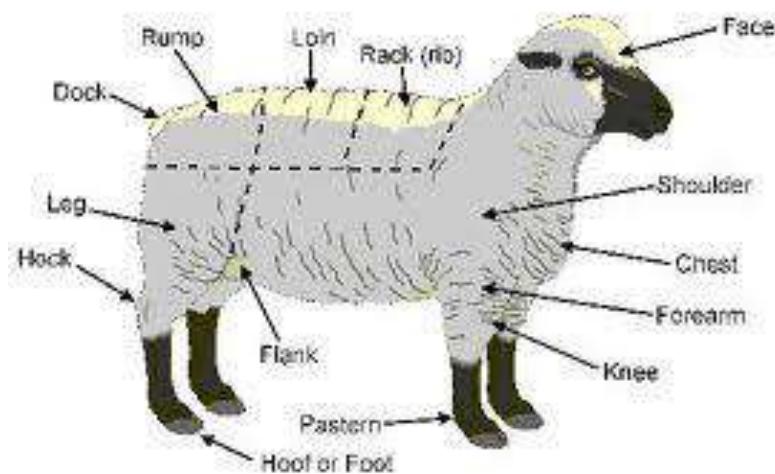
IMPORTANCE OF KEEPING SHEEP

- It is a source of meat (mutton)
- It provides wool (fleece)
- It provides skins to make leather products
- Its droppings are used as farm yard manure
- Its horns and hooves are used to make buttons and glue
- It is used as sacrifice on cultural ceremonies

Products from goats and sheep

- | | |
|-----------------|--------------------|
| ▪ Mutton (meat) | ▪ Sheep droppings |
| ▪ Wool (fleece) | ▪ Horns and hooves |
| ▪ Skins | |

EXTERNAL PARTS OF A SHEEP



GROUPS OF SHEEP KEPT IN UGANDA

LOCAL (INDIGENOUS/NATIVE) BREEDS OF SHEEP

All local breeds of sheep are kept for mutton production

- Black-headed Persian
- Somali sheep
- Red Maasai
- Dorper

EXOTIC BREEDS OF SHEEPS

- Suffolk
- Dorset
- Southdown
- Cheviot
- Texel
- Hampshire
- Merino
- Rambouillet
- Bluefaced Leicester
- Romney marsh

Exotic breeds of sheep kept for meat (mutton) production/mutton breeds of sheep

- Suffolk
- Dorset
- Southdown
- Cheviot
- Texel
- Hampshire

Exotic breeds of sheep kept for wool (fleece) production/wool breeds of sheep

- Merino
- Rambouillet
- Bluefaced Leicester
- Romney sheep

Exotic breeds of sheep kept for both mutton and wool production/dual purpose breeds of sheep

- Corriedale sheep
- Romney sheep (previously called **Romney marsh sheep**)

BREEDING IN SHEEP

- A ewe should be served at the age of 16 -18 months
- The gestation period of sheep is **5 months (150 days)**.

FLUSHING

- This is the providing of extra nutritious feeds to a ewe before mating

IMPORTANCE OF FLUSHING

- It stimulates ovulation (increases the rate of ovulation)
- It increases the chances of multiple births

STEAMING UP

- This is the practice of feeding a pregnant animal on food rich in proteins

IMPORTANCE OF STEAMING UP

- It lengthens the next lactation period
- It increases colostrum
- It prevents low birth weight
- It enables the foetus to grow well
- It enables the pregnant animal to get strength for giving birth

WEANING

- This is the gradual introduction of other foods to a baby to supplement breast milk
- Weaning in sheep is done between 3 – 4 weeks.

SHEARING:

- This is the removal of wool (fleece) from a sheep
- It is done using **electric shears or hand shears**

- Electric shears remove wool faster than hand shears
- Weaning sheep should be sheared at 8 months
- A mature sheep should be sheared once a year

Why is shearing done in summer season?

- There is enough sunshine to keep the sheep warm

Why is shearing not done in winter season?

- To prevent death of sheep due to coldness

FACTORS CONSIDERED WHEN CHOOSING A GOOD SHEEP (EWE/RAM).

- It should be humble/docile/calm
- It should have well developed udder and teats
- It should be healthy (free from diseases)
- Its mother should have a multiple birth

PARASITES (PESTS) IN FARM ANIMALS.

- **A parasite** is an organism that depends on a host for food and shelter
- **A host** is an organism on which a parasite depends for food.

How do parasites benefit from their host for survival?

- They get food
- They get shelter

GROUPS (TYPES OR CLASSES) OF PARASITES

- External Parasites (ectoparasites)
- Internal Parasites (endoparasites)

EXTERNAL PARASITES

- These are parasites that live outside the body of host

Examples of ectoparasites (external Parasites)

- Ticks
- Tsetse flies
- Mites

CONTROL OF ECTOPARASITES

- Spraying with acaricides
- By dusting with acaricides
- Dipping in acaricides
- Clearing bushes around livestock farms (to control tsetse flies)
- Use tsetse fly traps to control tsetse flies
- By paddock grazing
- By deticking

INTERNAL PARASITES

- These are parasites that live inside the body of the host.
- They live in muscles, intestines and liver

Examples of endoparasites (internal Parasites)

- Tape worms
- Hook worms
- Thread worms

- Liver flukes
- Ascaris worm

Control of endoparasites

- By deworming
- Giving animals clean feeds
- Regular cleaning of the houses for animals
- Regular cleaning of the feeding equipment for animals
- Grazing in well drained areas (to control liver flukes)

EFFECTS OF PARASITES (PESTS) OF CATTLE

- Some parasites suck blood which leads to anaemia
- Some parasites spread diseases to animals
- Some parasites damage the skins of animals
- Some parasites cause discomfort to animals

DISEASES OF GOATS AND SHEEP

- Foot rot
- Heart water
- Red water
- Pneumonia
- Coccidiosis
- Anthrax
- Nairobi diseases
- Nangana
- Mastitis
- Lamb dysentery
- East coast fever
- Rift valley disease
- Foot and mouth disease
- Blue tongue disease

PIG KEEPING

- This is the rearing of domestic pigs

TERMS IN RELATION TO PIG KEEPING

- **Piggery:** is the place where domestic pigs are kept.
- **Boar:** is male pig.
- **Sow:** is an adult female pig.
- **Barrow (hog):** castrated male pig
- **Herd:** a group of pigs
- **Gilt:** is a young female pig
- **Farrowing:** is the act of giving birth in pigs.
- **Pork:** is the meat from pigs.
- **Lard:** fats from pigs.
- **Sty:** house for pigs.
- **Litter:** A group of piglets produced by the sow at one time

- **Piglet:** is a young pig.
- **Runt:** is smallest and weakest piglet in a litter

NOTE:

- The gestation period of a pig (sow) is **3 months, 3 weeks and 3 days**

EXTERNAL PARTS OF A PIG

TYPES OF BREEDS OF PIGS

- Local breeds
- Exotic breeds
- Wild pigs (warthog)

Examples of local breeds of pigs.

Black pigs

Old spotted pigs

Exotics breeds of pigs.

- | | |
|---------------------------|----------------------|
| ▪ Landrace | ▪ Poland China |
| ▪ Large white (Yorkshire) | ▪ Wessex saddle back |
| ▪ Hampshire | ▪ Tamworth |
| ▪ Duroc | ▪ Camborough |
| ▪ Middle white | |

Factors considered when selecting a good pig for rearing.

>heredity: it should be from a good ancestral family.

>it should be free from sickness.

>the piglet should have 12 teats.

SYSTEMS OF KEEPING PIGS

- Intensive system
- Extensive system

CHARACTERISTICS OF A GOOD PIGSTY

- It should have a slanting floor

- ✓ For easy cleaning
- ✓ For easy drainage of waste
- It should be well ventilated
- ✓ To allow free air circulation
- It should be cleaned dry
- To prevent the risks of pneumonia
- It should have farrowing pens
- It should not be slippery
- It should be leak proof
- It should have guard rails

To prevent the mother from crushing the piglets.

TYPES OF FEEDS IN PIGS.

- The creep food
- Sow and weaner meal
- The fattener (finisher) meal.

1. The creep food

- For piglets between 1 day to 8 weeks

2. Sow and weaner meal

- For weaning piglets
- It is introduced to piglets at 8 weeks up to 50kgs

3. The fattener (finisher) meal.

- For pig ready for sale
- It helps to fatten the pigs

NOTE:

- ✓ Piglets are given red soil to provide iron.

TEETH-CLIPPING

- This is the cutting of pointed teeth of piglets
- It should be done in the first day after birth.
- It can be done when the piglet is 15 minutes old
- It is done using **tooth clippers or forceps**

REASON FOR TEETH CLIPPING (IMPORTANCE OF TEETH CLIPPING)

- To prevent injuries to the udder and teats of the sow
- To prevent injuries to the other piglets (littermates)

Why should the sow be restrained (tied or put in a separate pen/pig sty) during tooth clipping?

- To prevent injuries as the sow tries to protect its young

DISADVANTAGE OF TEETH CLIPPING

- It can cause damage to the gums
- It can lead to infections

COLOSTRUM

- This is the first milk got from a mother animal after giving birth

IMPORTANCE OF COLOSTRUM

- It opens up the digestive system of a baby
- It boosts immunity of the baby (it contains a lot of antibodies)
- It is easy to digest
- It has a lot of nutrients (it provides a balanced diet to a baby)
- It provides energy to the piglet to activate its own heat production

DISEASES IN PIGS

Viral diseases

- **Swine fever**
 - i) African swine fever
 - ii) Classical swine fever (hog cholera)
- Swine flu (swine influenza)

Bacterial diseases

- Swine dysentery
- Mastitis
- Foot rot
- Pneumonia
- Greasy pig disease
- Anthrax

Protozoan disease

- Coccidiosis
- Nagana (trypanosomiasis)

Malnutritional disease

- Piglet anaemia

EXAMPLES OF ECTOPARASITES (EXTERNAL PARASITES) IN PIGS

- Jiggers
- Lice
- Ticks
- Mange
- Fleas
- Mites

EXAMPLES OF ENDOPARASITES (INTERNAL PARASITES) IN PIGS

- Tape worms
- Thread worms
- Ascaris worm
- Hook worms
- Liver flukes
- Lungworm

WAYS OF CONTROLLING ANIMAL DISEASES

- Regular vaccination
- By culling
- By paddock grazing
- Isolate and treat sick animals
- Applying quarantine
- Proper feeding
- Use a strip cup to detect mastitis in milk
- Regular cleaning of the animal houses
- Spraying with acaricides to control tickborne diseases

- Use artificial insemination to avoid mating infection

RECORD KEEPING

- This is the writing of information about different activities done on a farm

FARM RECORDS

- These are written information about different activities done on a farm.

TYPES (EXAMPLES) OF FARM RECORDS

- Production records
- Health records
- Labour records
- Sales and expenses records
- Inventory records
- Feeding records
- Breeding records

REASONS FOR KEEPING FARM RECORDS (IMPORTANCE OF RECORD KEEPING)

- It enables a farmer to know the profits or losses
- It enables a farmer to be taxed fairly
- It enables a farmer to get loans easily
- It enables a farmer to know the farm history
- It enables a farmer to plan for the farm
- It enables a farmer to make proper decisions

FACTORS TO CONSIDER BEFORE STARTING A LIVESTOCK FARM

- Land
- Capital
- Labour
- Market
- Management

TOPIC: FOOD AND NUTRITION

- **Food** is something good to eat or drink
- **Nutrition** is the study of food and how it is used in the body
- **Feeding** is the act of taking food into the body

IMPORTANCE OF FOOD IN THE BODY

- It keeps the body healthy
- It gives the body energy
- It builds the body (helps in body growth)
- It keeps the body warm
- It repairs the worn out body tissues

BREASTFEEDING

- This is the feeding of a baby on breast milk produced by the mother's mammary glands
- Babies should feed only on breast milk for 6 months without any other food
- At 6 months, babies should be weaned

EXCLUSIVE BREASTFEEDING

- This is act of feeding a baby on breast milk alone for the first six months

ADVANTAGES OF BREASTFEEDING TO THE:

i) BABY

- It boosts the baby's immunity
- Breast milk is always ready
- Breast milk is at the right temperature
- Breast milk is easy to digest
- Breast milk has a balanced diet for a new born baby

ii) MOTHER

- It is cheap
- It saves time
- Prolonged breastfeeding delays the next pregnancy
- It improves the mother's health since she feeds well to produce more breast milk

How does prolonged breast feeding delay the next pregnancy?

- It delays ovulation

iii) FAMILY

- It promotes saving in the family
- It improves the health of family members

DISADVANTAGES OF BREASTFEEDING TO THE:

iv) BABY

- The baby can be underfed in case the mother has little breast milk
- The baby does not feed in case the mother is absent
- It leads to easy spread of AIDS from an infected mother to the baby

v) MOTHER

- It is difficult to practise when the mother is sick
- It can dehydrate the mother

BOTTLE FEEDING

- This is the feeding of babies on animal's milk using bottle

CONDITIONS THAT CAN LEAD TO BOTTLE FEEDING

- When the mother is HIV positive (has AIDS)
- When the mother dies
- When the mother is very sick
- When the mother produces little or no breast milk

- When the mother has breast cancer
- When the mother stays away for a long time

DISADVANTAGES OF BOTTLE FEEDING

- It is expensive to manage
- It encourages early pregnancy
- Animal's milk is not easy to digest
- Milk in dirty bottles can lead to diarrhoeal diseases
- Animal's milk does not contain a balanced diet for human baby
- It wastes time (needs a lot of time to prepare milk)

WEANING

- This is the gradual introduction of other foods to a baby to supplement breast milk
- Babies should be weaned at **6 months**
- Weaning babies need mashed (soft) food because **they have no teeth**
- Hard food during weaning **leads to indigestion**
- Weaning babies are fed frequently because **they have small stomach which allows little food (they eat little food at a time)**

REASONS FOR WEANING AT 6 MONTHS

- To provide iron to the baby
- To prevent marasmus and kwashiorkor
- Breast milk alone is not enough for the baby

FOOD FOR WEANING BABIES

- | | |
|-------------------|-------------|
| ▪ Mashed potato | ▪ Meat soup |
| ▪ Mashed fruits | ▪ Porridge |
| ▪ Mashed egg yolk | |

VULNERABLE GROUPS OF PEOPLE

- These are people whose health can easily be harmed by poor feeding
- These are people whose health can easily be harmed without special care and diet

EXAMPLES OF VULNERABLE GROUPS OF PEOPLE

- Pregnant women (expectant mothers)
- The sick people
- Breastfeeding mothers (lactating mothers)
- Babies (breastfeeding and weaning babies)
- The elderly people

FOOD VALUES FOR VULNERABLE PEOPLE

FOOD FOR PREGNANT WOMEN

- They should eat more food **because** they share food with the embryo/foetus in the womb

FOOD VALUES	FUNCTION
Proteins	<ul style="list-style-type: none"> ▪ To build up body tissues of the foetus (for proper growth of the foetus)

	<ul style="list-style-type: none"> ▪ To repair the worn out body tissues of a mother
Carbohydrates	<ul style="list-style-type: none"> ▪ To provide energy to the mother's body
Vitamins	<ul style="list-style-type: none"> ▪ To keep their body healthy ▪ To boost the mother's immunity
Roughage	<ul style="list-style-type: none"> ▪ To prevent constipation
Fats and oils (lipids)	<ul style="list-style-type: none"> ▪ To provide energy and warmth ▪ To keep their skins smooth and healthy
Mineral salts	
Iron	<ul style="list-style-type: none"> ▪ To make blood ▪ To prevent anaemia
Calcium	<ul style="list-style-type: none"> ▪ To strengthen bones

FOOD FOR BREASTFEEDING MOTHERS

i) **Water (fluids)**

- To produce more breast milk

ii) **Carbohydrates**

- To provide energy to the body

iii) **Calcium**

- To replace calcium lost through breast milk

FOOD FOR BABIES

i) **Proteins**

- To build the body tissues
- To make enzymes

ii) **Vitamins**

- To protect babies from diseases (to boost their immunity)

iii) **Carbohydrates**

- To provide energy to the body

iv) **Fats and oils (lipids)**

- To provide energy and warmth
- To keep their skins smooth and healthy

FOOD FOR BREASTFEEDING BABIES (NEW BORN BABIES)

i) **Breast milk**

- It has a balanced diet for a baby (it has all food values apart from iron)
- It boosts the baby's immunity (it has a lot of antibodies)
- It is always ready
- It is at the right temperature
- It is easy to digest

THE SICK PEOPLE

- Sick people can be invalid or convalescents

An invalid

- This is a person who is totally sick

A convalescent

- This is a person who is recovering from sickness

FOOD FOR THE SICK PEOPLE

i) **Proteins**

- To repair the worn out body tissues

ii) **Vitamins and mineral salts**

- To boost their immunity

iii) **Fluids**

- For rehydration

FOOD FOR THE ELDERLY PEOPLE

- The elderly people need mashed (soft) food because **they have no teeth (due to loss of teeth)**
- Feeding on hard food **leads to indigestion**
- The elderly people eat frequently because **they eat little food at a time**

i) **Carbohydrates**

- To provide energy to the body

ii) **Proteins**

- To repair the worn out body tissues

iii) **Vitamins and mineral salts**

- To boost their immunity

iv) **Fats and oils (lipids)**

- To keep their skin healthy
- To provide energy and warmth

MALNUTRITION AND MALNUTRITIONAL (DEFICIENCY) DISEASES

MALNUTRITION

- This is the condition when the body lacks some food values
- This is the lack of some food values in the body
- Malnutrition is sometimes called **poor feeding or poor nourishment**

CAUSES OF MALNUTRITION

- | | |
|---------------------------------|----------------------------|
| ▪ Poverty | ▪ Food taboos |
| ▪ Shortage of food | ▪ Inadequate breastfeeding |
| ▪ Ignorance about balanced diet | |

SIGNS OF MALNUTRITION IN CHILDREN

- | | |
|--------------------------|------------------------|
| ▪ Swollen belly | ▪ Swollen moon face |
| ▪ Reduced night vision | ▪ Little brown hair |
| ▪ Swollen moon face | ▪ Bleeding gums |
| ▪ Stunted growth | ▪ Poor growth of teeth |
| ▪ Swollen legs | ▪ Too much sleeping |
| ▪ Poor healing of wounds | |

SYMPTOMS OF MALNUTRITION IN ADULTS

- Tiredness/fatigue
- Loss of interest in work
- Low concentration at work

EFFECT OF MALNUTRITION

- It leads to deficiency diseases

PREVENTION OF DEFICIENCY DISEASES

- By feeding on a balanced diet

MALNUTRITIONAL (DEFICIENCY) DISEASES

- These are diseases caused by lack of some food values in the body
- **Deficiency** means lack of

CAUSES OF MALNUTRITIONAL (DEFICIENCY) DISEASES

- | | |
|---------------------------------|----------------------------|
| ▪ Poverty | ▪ Food taboos |
| ▪ Shortage of food | ▪ Inadequate breastfeeding |
| ▪ Ignorance about balanced diet | |

EXAMPLES OF MALNUTRITIONAL (DEFICIENCY) DISEASES

- These are diseases caused by lack of some food values in the diet

EXAMPLES OF DEFICIENCY DISEASES

Deficiency disease	Deficiency (lack of)/food value lacked
Marasmus	Carbohydrates
Kwashiorkor	Proteins
Vitamin deficiency diseases	
Night blindness	Vitamin A
Beriberi	Vitamin B ₁
Pellagra	Vitamin B ₃
Scurvy	Vitamin C
Rickets/osteoporosis	Vitamin D
Infertility/Sterility	Vitamin E
Hemorrhagic disease/Vitamin K deficiency bleeding	Vitamin K
Mineral salt deficiency diseases	
Anemia	Iron
Rickets/Osteoporosis	Calcium
Goitre	Iodine

KWASHIORKOR

- It is caused by lack of proteins in the diet

Signs of kwashiorkor in children

- Little brown hair
- Swollen moon face
- Swollen belly full of air
- Edema (swollen feet)

A drawing showing a baby suffering from kwashiorkor

Prevention of kwashiorkor

- Feeding on food rich in proteins

Examples of food sources of proteins

- | | | |
|--------|--------------|----------------|
| ▪ Eggs | ▪ Beans | ▪ Grasshoppers |
| ▪ Meat | ▪ Groundnuts | ▪ Mushroom |
| ▪ Milk | ▪ Cow peas | ▪ Soya beans |

MARASMUS

- It is caused by lack of marasmus in the diet
- Marasmus is also said to be starvation disease

Signs of marasmus in children

- | | |
|--|------------------|
| ▪ Pot belly | ▪ Underweight |
| ▪ Elderly face (little old man's face) | ▪ Very thin body |

A drawing showing a baby suffering from marasmus

Prevention of marasmus

- Feeding on food rich in carbohydrates

Examples of food sources of carbohydrates

- Maize
- Sweet potato
- Rice
- Cassava
- Irish potato
- Wheat
- Millet
- Bread

BERIBERI

- It is caused by lack of vitamin B₁ (thiamine) in the diet
- It affects muscles, nerves and heart

Signs of beriberi in children

- Vomiting
- Muscle weakness
- Loss of muscle function in the legs
- Paralysis
- Mental confusion

Prevention of beriberi

- Feeding on food rich in vitamin B₁

Examples of food sources of vitamin B₁

- Yeast
- Beef
- Whole grains
- Cauliflower
- Liver
- Pork

PELLAGRA

- It is caused by lack of vitamin B₃ (niacin) in the diet
- It affects the skin

Signs of pellagra in children

- Sores on the skin
- Loss of body weight
- Mental confusion

Prevention of pellagra

- Feeding on food rich in vitamin B₃

Examples of food sources of vitamin B₃

- Yeast
- Meat
- Cereals
- Liver
- Coffee or tea
- Milk

SCURVY

- It is caused by lack of vitamin C in the diet
- It affects the skin

Signs of scurvy in children

- Bleeding of gums
- Poor healing of wounds
- Sores on the mouth
- Retarded growth

Prevention of scurvy

- Feeding on food rich in vitamin C

Examples of food sources of vitamin C

Vitamin C is found in fresh fruits mainly

- Mango
- Orange
- Lemon
- Guava
- Pawpaw
- Jackfruit
- Pineapple
- Fruit juice

Why is vitamin C not found in cooked fruits?

- Vitamin C is destroyed by heat

NIGHT BLINDNESS

- It is caused by lack of vitamin A in the diet
- It affects the eyes

Signs of night blindness in children

- Reduced vision at night
- Sores in the eyes
- Skin becomes dry and scaly
- Reduced resistance to diseases

Prevention of night blindness

- Feeding on food rich in vitamin A

Examples of food sources of vitamin A

- Carrot
- Red pepper
- Spinach
- Liver

RICKETS

- It is caused by lack of vitamin A in the diet
- Lack of calcium and phosphorus in the diet
- It affects the bones

Signs of rickets

- Bowlegs or knock-knee legs
- Oddly shaped skull
- Poor teeth formation
- Delayed tooth formation
- Common fractures

A drawing showing a baby suffering from rickets

Symptom of rickets

- Weak bones of the legs

Prevention of rickets

- Feeding on food rich in vitamin D, calcium and phosphorus
- Sunbathing in early morning

Examples of food sources of vitamin D

- Liver
- Red meat
- Oily fish
- Mushroom

TRADITIONAL FOOD CUSTOMS, BRIEFS AND TABOOS

FOOD CUSTOMS

- These are established practices which are accepted in a community about food

EXAMPLES OF FOOD CUSTOMS

- A neighbor who helps during harvesting should be given a basket of food
- A family which gets an early harvest should send some food to the neighbour
- A woman should kneel while peeling or serving food
- You should give food to a visitor if found eating

ADVANTAGES OF FOOD CUSTOMS

- They promote friendship in the community
- They promote sharing in the community
- They promote cooperation in the community
- They conserve culture
- They promote food security

FOOD BRIEFS

- These are feelings taken to be true about food by a group of people

EXAMPLES OF FOOD BRIEFS

- Women were not allowed to eat chicken because they would lead to infertility
- Men were not allowed to eat oil nuts because they would become impotent
- Children with measles were not allowed to eat meat because it would worsen the disease
- Babies were not allowed to eat eggs because they would defecate on bed

DANGERS OF FOOD BELIEF

- They lead to deficiency diseases
- They lead to malnutrition

FOOD TABOOS

- These are cultural or religious customs that forbid people to eat some kinds of food

EXAMPLES OF FOOD TABOOS

RELIGIOUS FOOD TABOOS

- Muslims and SDA do not eat pork
- Muslims do not eat meat slaughtered by a non-Muslim
- Catholics do not eat meat on Good Friday (Fridays during lent period)

CULTURAL FOOD TABOO

- Clan members are not allowed to eat their totems

ADVANTAGES OF FOOD TABOOS

- Food taboos help to conserve plants and animals
- People who are not affected by taboos get a lot of food
- Food taboos promote respect for food hence good handling of our totems

DANGERS OF FOOD TABOOS

- They lead to deficiency diseases
- They lead to malnutrition

FOOD CONSUMPTION

- This is the type and amount of food eaten by people in a given area

FACTORS THAT DETERMINE FOOD CONSUMPTION.

- Availability of food
- Food beliefs and taboos
- Level of hunger and appetite
- Taste of food
- Peer influence

EXAMPLES OF FOOD CONSUMPTION PATTERNS.

- People near water bodies have a lot of fish but little fruits and vegetables.
- People near forests have a lot of fruits and vegetables but lack fish.
- People in villages have fresh foods unlike those in towns.

STAPLE FOOD

- This is the food stuff commonly eaten by most people in a given area

EXAMPLES OF DIFFERENT COMMUNITIES AND THEIR STAPLE FOODS.

- | | |
|---------------------|--|
| ▪ Baganda: | Matooke (banana) |
| ▪ Banyankore: | Millet |
| ▪ Iteso: | Millet |
| ▪ Banyoro: | Millet |
| ▪ Boarding schools: | Posho |
| ▪ Basoga: | Banana, sweet potatoes, and cassava |

Why are carbohydrates called the main staple foods?

- They are more in the people's diet than other food values.

TOPIC: PRIMARY HEALTH CARE

HEALTH

- This is the state of physical, emotional, social and spiritual wellbeing of an individual

Aspects of health

- | | |
|---|---|
| <ul style="list-style-type: none"> ▪ Physical health ▪ Emotional health | <ul style="list-style-type: none"> ▪ Social health ▪ Spiritual health |
|---|---|

PRIMARY HEALTH CARE (P.H.C)

- This is the essential health care where individuals, families and communities work together to solve their health problems

PRINCIPLES OF P.H.C

These are basic rules followed when carrying out Primary Health Care

- Everyone must benefit (total health for all people)
- Everyone must participate
- P.H.C activities must be affordable
- P.H.C activities must be acceptable by culture or religion
- It must be organized according to priorities

ELEMENTS OF P.H.C

- These are health programmes that protect and maintain good health

Elements of P.H.C

- | | |
|--|---|
| <ul style="list-style-type: none"> ▪ First aid ▪ Immunization ▪ Family planning ▪ Water and sanitation ▪ Personal hygiene ▪ Control of Communicable Diseases (CCD) ▪ Control of Diarrhoeal Diseases (CDD) | <ul style="list-style-type: none"> ▪ Food and nutrition ▪ Oral and dental health ▪ Maternal and child health ▪ Health education |
|--|---|

IMPORTANCE OF THE ELEMENTS OF P.H.C

Health education

- It helps people to address health concerns
- It helps people to know the value of good health
- It reduces poor traditional beliefs about diseases

Ways of providing health education

- Through health songs
- Through health debates and quiz
- Through health programmes on media
- Through forming health clubs

Immunization

- It prevents immunisable diseases among people
- It reduces infant mortality rate

Food and nutrition

It is promoted by feeding on a **balanced diet**

- It protects people from poor feeding and deficiency diseases

Maternal and child health care

It is promoted by getting **antenatal care (prenatal care)**

- It improves the health of pregnant women and their unborn babies

Water and sanitation

- It promotes clean and safe water supply
- It prevents multiplication of insect vectors

Oral and dental health care

It is promoted by brushing teeth and dental flossing

- It prevents teeth diseases and disorders

Family planning

- It controls rapid population growth in a country
- It promotes saving in a family
- It promotes child spacing
- It enables a child to get enough basic needs

First aid

- | | |
|------------------------------|--------------------------------|
| ▪ It saves life | ▪ It stops external bleeding |
| ▪ It reduces pain | ▪ It prevents further injuries |
| ▪ It promotes quick recovery | |

Control of communicable diseases (CCD)

It is promoted by;

- Abstaining from sex
- Avoiding sharing sharp objects with an infected person
- Using condoms when playing sex
- Being faithful to your sexual partner

Communicable diseases

- These are diseases that can spread from one person to another
- They are caused by germs
- They are also called **infectious diseases**

How do communicable diseases spread?

- Through insect bites
- Through animal bites
- Through body contact with an infected person
- Through playing unprotected sex with an infected person
- Through inhaling contaminated air
- Through open cuts and dirty wounds

RESPONSIBILITIES OF AN INDIVIDUAL, FAMILY AND COMMUNITY IN PROMOTION OF PHC

Activities done by an individual to promote P.H.C

- Participating in general cleaning sessions
- Feeding on a balanced diet
- Bathing daily
- Brushing teeth every after a meal
- Washing hands with clean water and soap after visiting latrines

- Cutting fingernails and toenails short
- Washing clothes and beddings regularly
- Grooming hair
- Going for immunization
- Making O.R.S

Activities done by a family to promote P.H.C

- Constructing a latrine at home

For proper disposal of human wastes

- Digging a rubbish pit at home

For proper disposal of rubbish

- Boiling water for drinking

To prevent diarrhoeal diseases

- Setting up a plate rack at home

To prevent washed utensils from getting contaminated with dust

- Taking children for immunization
- Observing good food hygiene at home
- Preparing a balanced diet for members

To prevent deficiency diseases

- Having clean and safe water at home
- Destroying breeding places for insect vectors near the home
- Sharing health information among family members
- Avoiding drug abuse among family members

Activities done by the community to promote P.H.C

- Constructing public latrines
- Constructing public water sources (wells and bore holes)
- Protecting water sources
- Repairing damaged roads
- Organizing community health days
- Distributing public garbage containers
- Organizing general cleaning sessions
- Organizing public fumigation to kill insect vectors
- Establishing rehabilitation centres for the disabled
- Announcing any outbreak of a disease in the community

Examples of community groups that promote PHC

- Self-help groups
- Religious groups
- Village health committees
- Cooperative groups
- Social welfare groups
- Youth groups

HEALTHY LIFESTYLES THAT PROMOTE GOOD HEALTHY

- Feeding on a balanced diet
- Doing regular body exercises
- Getting enough rest and sleep to refresh the brain
- Avoid drug abuse e.g alcoholism and smoking
- Reading books in enough light
- Maintaining good body posture
- Washing clothes to remove germs
- Ironing clothes to kill germs and parasites
- Abstaining from sex to prevent contacting STDs
- Trimming finger nails to remove hiding places for germs

Importance of getting enough rest and sleep

- It refreshes the brain
- It breaks fatigue

Importance of good posture

- It prevents deformation of bones
- It prevents back and chest pain
- It prevents dislocation
- It helps in proper working of body organs

Importance of performing physical exercises

- It reduces body weight
- It makes the joints flexible
- It prevents heart attack
- It makes the heart muscles grow stronger
- It breaks fatigue (body weakness)
- It makes food digestion easy
- It prevents sprains and strains
- It helps the heart to pump more blood to the muscles

UNHEALTHY LIFESTYLES AND BAD SOCIAL HABITS

- Tobacco smoking
- Alcoholism
- Playing unprotected sex with an infected person
- Drug abuse

Good health practices in schools

- Conducting health parades
- Having a school health committee

SCHOOL (HEALTH CLUB) COMMITTEE

- This is a group of people in a school who work together to promote good health

Members of the school health committee

- | | |
|----------------|---------------------|
| ▪ School nurse | ▪ Sanitary prefects |
|----------------|---------------------|

- Science teachers
- Senior man and woman
- School cleaners
- Food mess

Activities/roles/duties of a school health committee

- Organizing health parades
- Organizing class health meetings
- Organizing general cleaning activities
- Organizing health education seminars
- Reporting any disease outbreak
- Discouraging anti-social behaviour
- Designing health rules
- Identifying school children who are not immunised
- Inviting health workers to discuss health issues with school children

HEALTH PARADES

- This is an assembly done at school to check on children's hygiene

People who conduct health parades in schools

- Health prefect
- Sanitary prefects
- Science teachers
- Teachers on duty

Activities carried out at a health parades

- Checking children with unbrushed teeth
- Checking children with long fingernails
- Checking children with dirty uniforms
- Checking children with uncombed hair
- Checking children with jiggers

Why are health parades done? (Importance/reasons for carrying out health parades)

- To promote personal hygiene among school children
- To promote good health among school children
- They promote child to child programme

CHILD TO CHILD PROGRAMME

- This is a health programme where older children help the young ones to promote good health

A symbol showing child to child programme (approach)



Activities done in child to child programme

- Older children teach young ones how to use a latrine
- Older children teach young ones how to brush their teeth
- Older children teach young ones to wash hands before meals
- Older children teach young ones to wash hands after visiting latrines
- Older children take young ones for immunization

Importance of child to child programme

- It prevents the spread of some communicable diseases among children
- It promotes good healthy lifestyles among children
- It improves health among children

PEOPLE WITH SPECIAL NEEDS IN THE COMMUNITY

- These are people whose some body parts do not work well
- They are also called **people with disabilities (PWDs)**
- **PWDs** may either be physically or mentally affected

Types of disabilities

- Physical disability
- Sensory disability

Physical disability

- This is when a person's limbs (arms or legs) are crippled

Sensory disability

- This is when a person's senses do not work well

Groups of people with disabilities (PWDs)

- Crippled/lame people
- Blind
- Deaf
- Dumb
- Mentally disturbed people

CARE FOR DISABLED/PEOPLE WITH DISABILITIES (PWDs)/PEOPLE WITH SPECIAL NEEDS

Crippled/lame people

- Providing them with wheel chairs
- Providing them with crutches
- Providing them with a walking stick
- Providing them with artificial legs and arms
- Providing them with special shoes
- Helping them to wear clothes

Some equipment for helping the disabled/people with disabilities (PWDs) in movement

- Wheel chair
- Crutches
- Artificial leg

- Artificial arm

Why should the crippled people be provided with wheel chairs?

- To help them in movement

Blind people

- Providing them with a white cane/sonar stick

To enable them locate places

To enable them dodge obstacles

- Bathing them
- Washing their clothes and beddings

Deaf people

- Providing special hearing devices
- Use of sign language while communicating with them
- Use of typed conversations while communicating with them

Mentally disturbed people

- Taking them to rehabilitation centres
- Helping them to go to latrines
- Bathing them
- Washing their clothes

SOME ABBREVIATIONS USED IN PRIMARY HEALTH CARE

- **P.H.C:** Primary Health Care
- **M.C.H.C:** Maternal and Child Health Care
- **CHWs:** Community Health Workers
- **SYFA:** Safeguard youth from AIDS
- **TBAs:** Traditional Birth Attendants
- **PWDs:** People with disabilities
- **SNP:** Special Needs People
- **CDD:** Control of Diarrhoeal Diseases
- **CCD:** Control of Communicable Diseases
- **P.M.T.C.T:** Prevention of mother to child transmission of HIV
- **E.M.T.C.T:** Elimination of mother to child transmission of HIV
- **HIV:** human immunodeficiency virus

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 respire |
| ▪ They reproduce | ▪ They grow |
| ▪ They excrete | ▪ They move (locomote) |
| ▪ They respond to their stimuli | ▪ 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 their friends |
| ▪ To look for shelter | ▪ To look for their young ones |
| ▪ To look for mates | |
| ▪ To run away from their enemies (to escape danger) | |

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 to the body

Name the two types of respiration

- Aerobic respiration
- Anaerobic respiration
- ✓ **Aerobic respiration** needs oxygen to occur while **anaerobic respiration** does not need oxygen

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.
- ✓ Sensitivity enables living things to detect danger

EXAMPLES OF EXTERNAL STIMULI

LIVING THINGS	STIMULI
Plants	<ul style="list-style-type: none">▪ Touch▪ Light▪ Gravity▪ Water▪ Chemicals
Animals	<ul style="list-style-type: none">▪ 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

NUTRITION

- This is the study of food and how it is used in the body

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

EXAMPLES OF LIVING THINGS

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

- Butterfly

- Tick

- Mite

KINGDOMS OF LIVING THINGS

- Animal kingdom (Kingdom Animalia)
- Plant kingdom (Kingdom Plantae)

- Kingdom Monera
- Kingdom Protista
- Kingdom Fungi

GROUPS OF LIVING THINGS

- Animals
- Plants

- Monerans / prokaryotes

- Fungi
- Protists

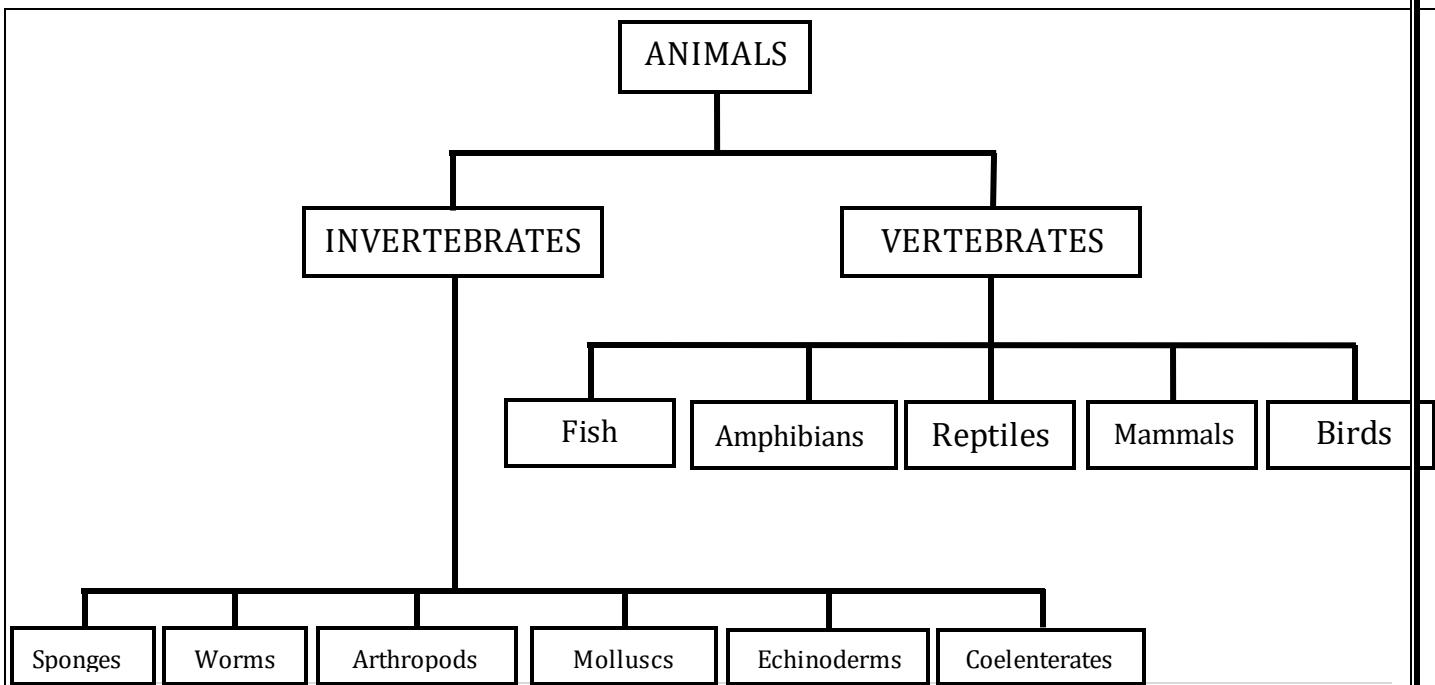
DIFFERENCES BETWEEN PLANTS AND ANIMALS

- 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

A FLOW CHART SHOWING CLASSIFICATION OF ANIMALS



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

GROUPS OF VERTEBRATES

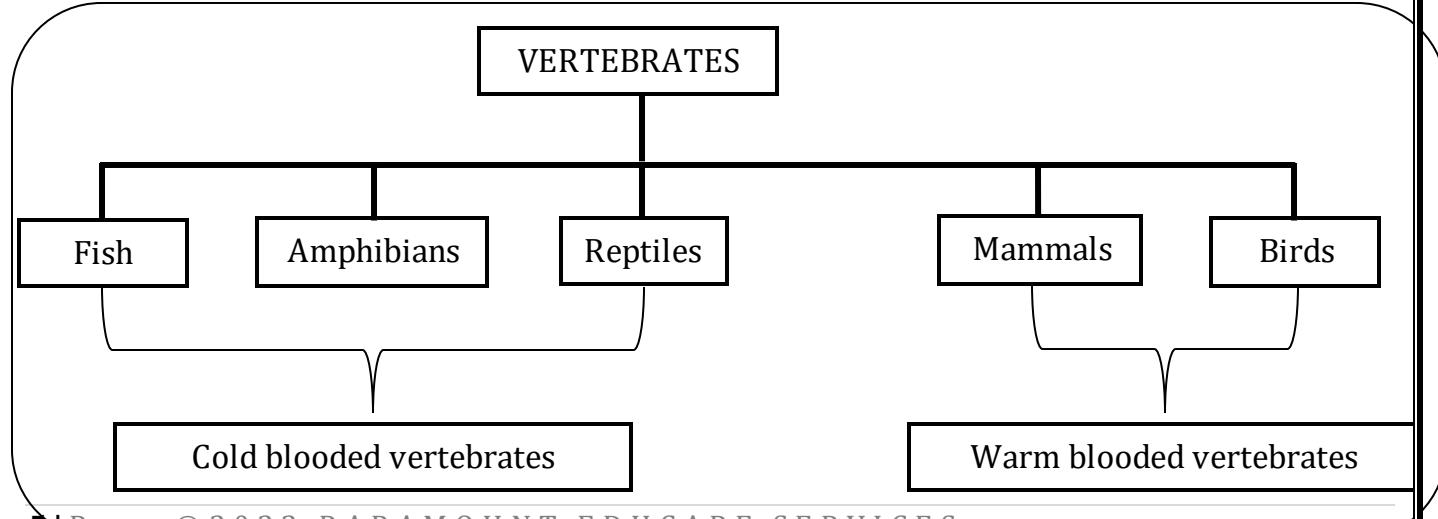
- Fish
- Amphibians
- Reptiles
- Mammals
- Birds



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 | ▪ Turkey | ▪ Dog |
| ▪ Duck | ▪ Pigeon | ▪ Cow |
| ▪ Emu | ▪ Goat | ▪ 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 | ▪ Crocodile |
| ▪ Mudfish | ▪ Turtle |
| ▪ Nile perch | ▪ Green snake |
| ▪ Chameleon | ▪ Frog |
| ▪ Gecko | ▪ Toad |
| ▪ Common lizard | ▪ Newt |

BIRDS

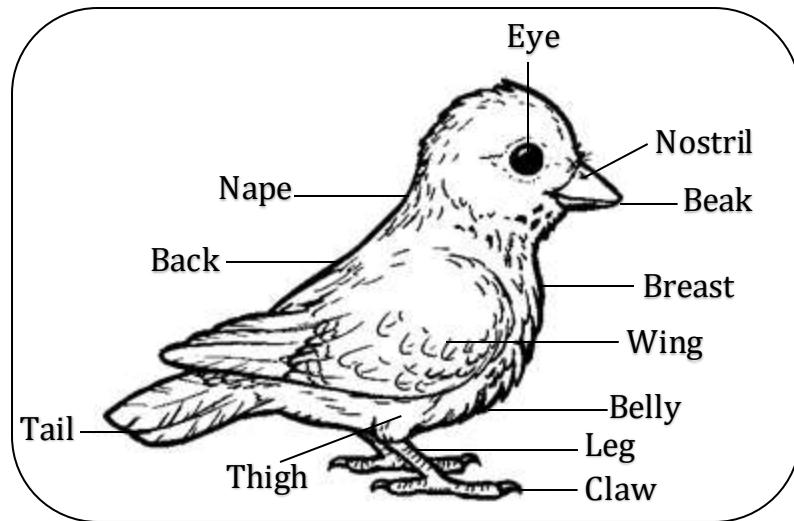
- These are vertebrates with feathers on their bodies

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	<ul style="list-style-type: none"> ▪ For sight
Beak	<ul style="list-style-type: none"> ▪ For feeding ▪ For protection ▪ For egg turning during incubation
Legs	<ul style="list-style-type: none"> ▪ For walking
Wattle and comb	<ul style="list-style-type: none"> ▪ For temperature regulation
Nostril	<ul style="list-style-type: none"> ▪ For smelling
Wings	<ul style="list-style-type: none"> ▪ For flight
Claws	<ul style="list-style-type: none"> ▪ For 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

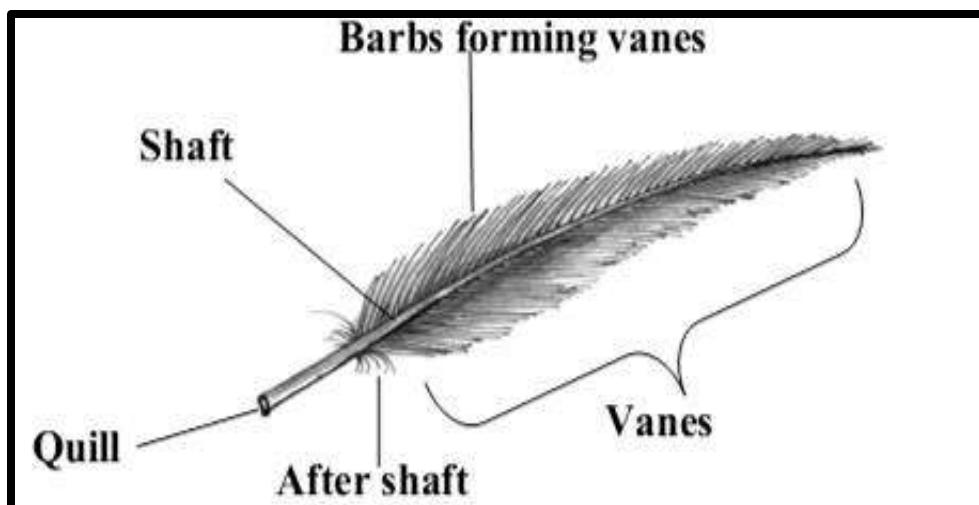
QUILL FEATHERS (FLIGHT FEATHERS)

- 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

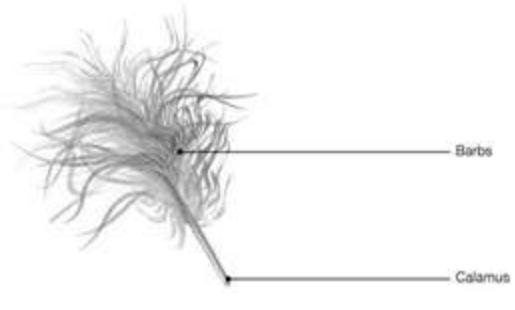
DOWN FEATHERS

- 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

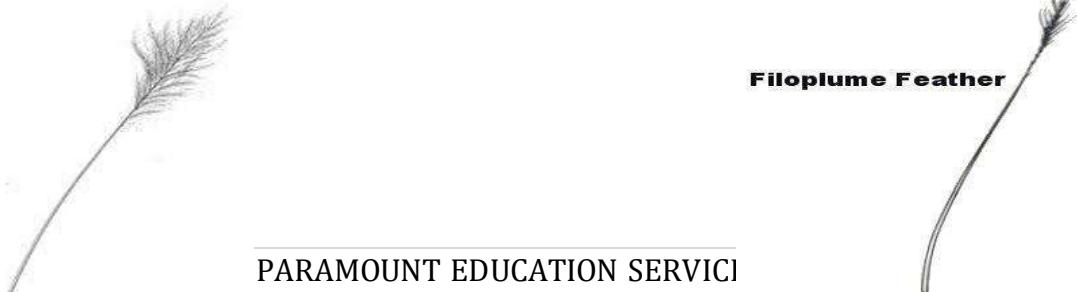
STRUCTURE OF A DOWN FEATHER



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

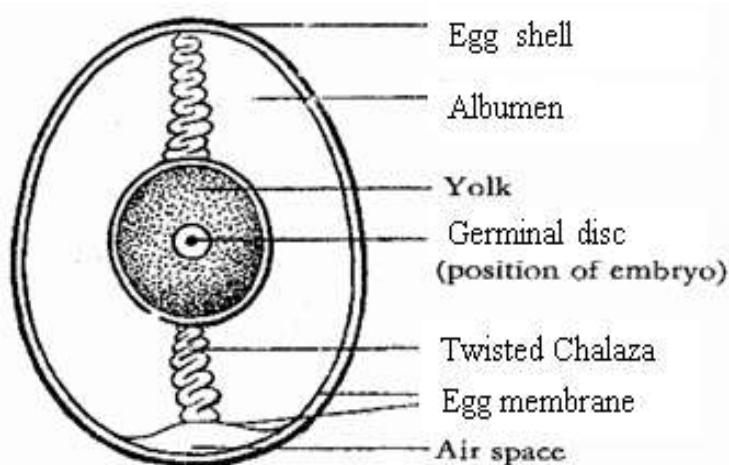
A DRAWING OF A FILOPLUME FEATHER



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

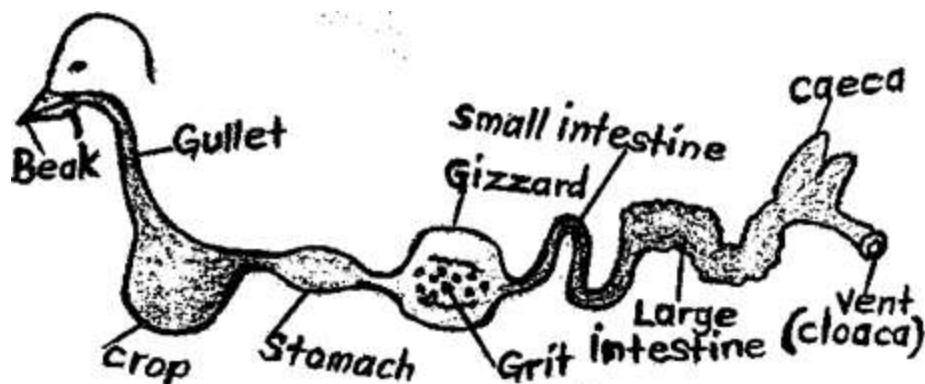
EMBRYO

- ✓ 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 sharp hooked beaks
- ✓ For tearing their prey (flesh)
- They have strong sharp curved claws or talons
- ✓ For gripping and killing their prey
- They have strong eye sight
- ✓ To spot their prey from long distances

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 | ▪ Mice | ▪ Chicks |
| ▪ Fish | ▪ Geckos | ▪ 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)

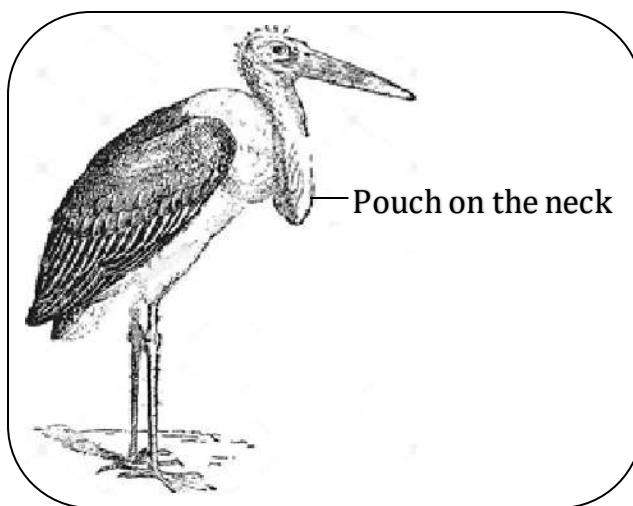
SCAVENGER BIRDS

- 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



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

- It is used during courtship

How are scavenger birds important in the environment?

- They clean the environment by eating carrion (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

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?

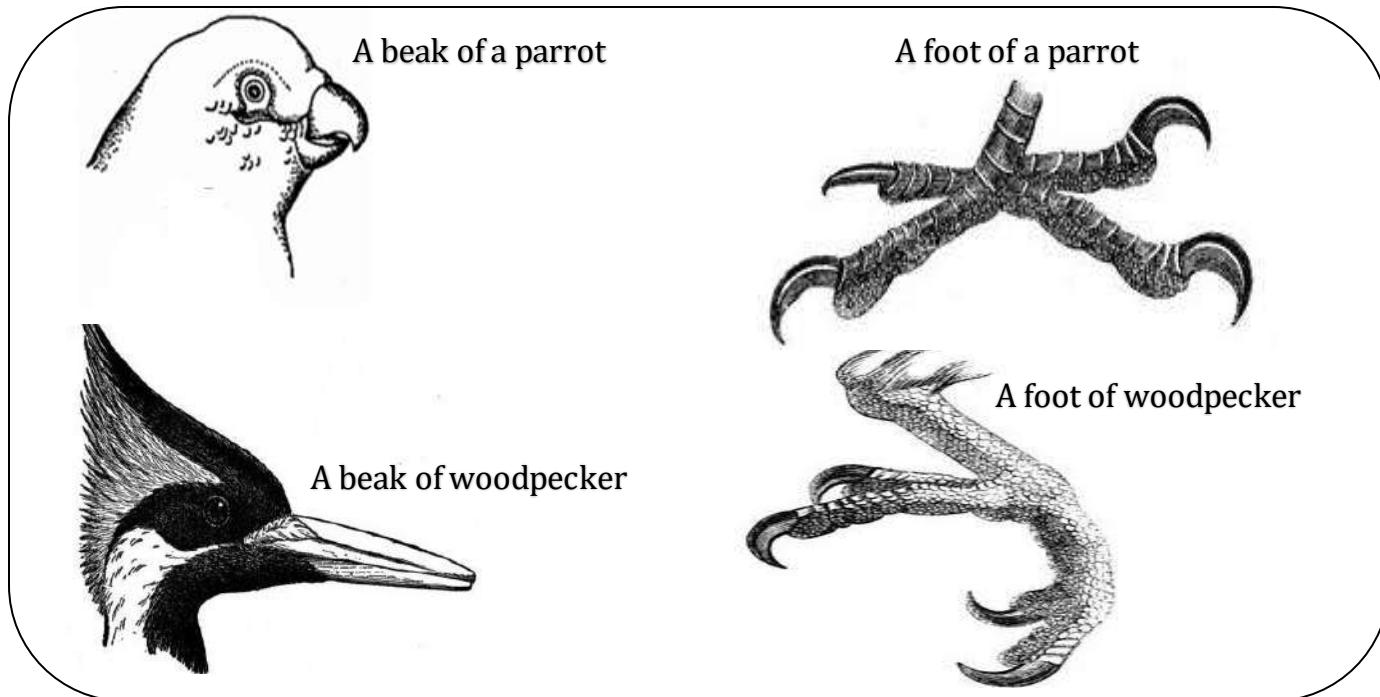
- To attract mates
- To chase away predators
- To communicate to other woodpeckers

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



FOOD FOR CLIMBING BIRDS

- Insects
- Seeds

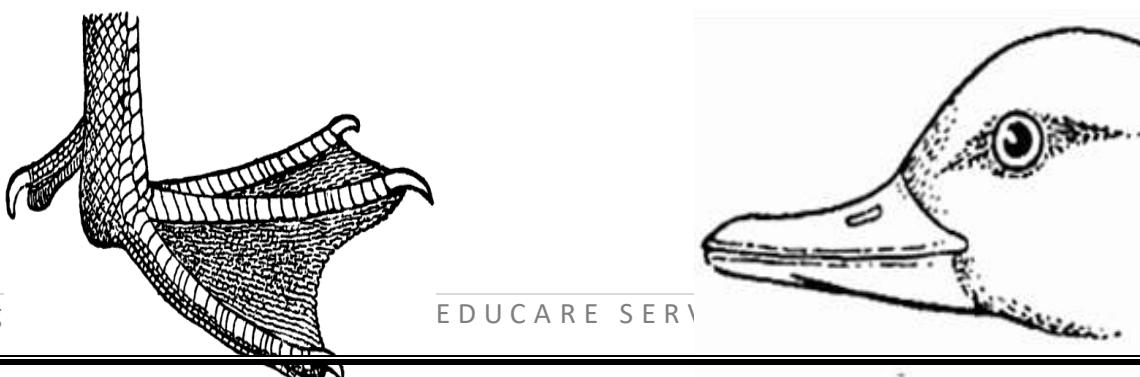
SWIMMING BIRDS

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

EXAMPLES OF SWIMMING BIRDS

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

STRUCTURE OF A FOOT AND BEAK OF A SWIMMING BIRD



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

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

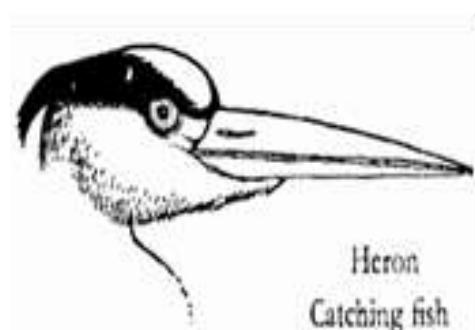
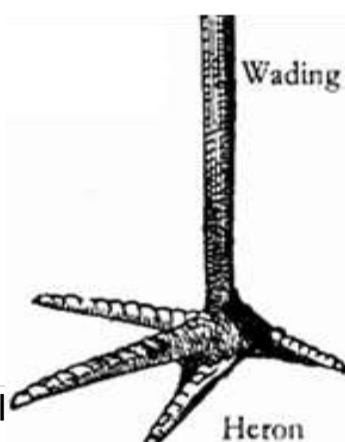
EXAMPLES OF WADING BIRDS

- 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

STRUCTURE OF A BEAK AND FOOT OF HERON



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

FOOD FOR WADING BIRDS

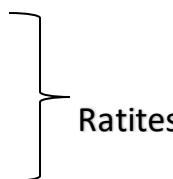
- Fish
- Frogs
- Worms

FLIGHTLESS BIRDS (WALKING BIRDS)

- These are birds that cannot fly

EXAMPLES OF FLIGHTLESS BIRDS

- Kiwi
- Ostrich
- Emu
- Rhea
- Cassowary
- ✓ Penguin



CHARACTERISTICS OF FLIGHTLESS BIRDS

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

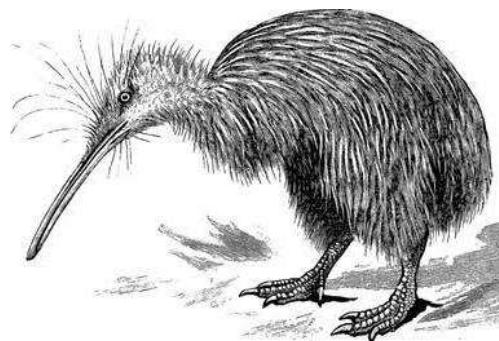
FOOD FOR FLIGHTLESS BIRDS

- Worms
- Insects
- Small animals

KIWI

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

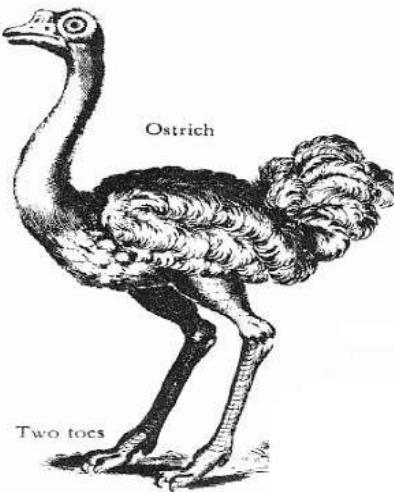
AN ILLUSTRATION SHOWING A KIWI



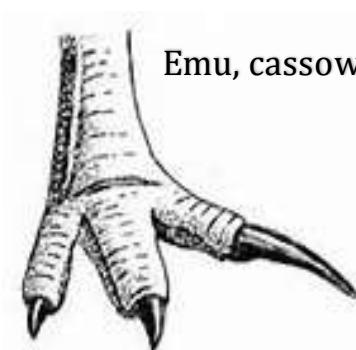
OSTRICH

- 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

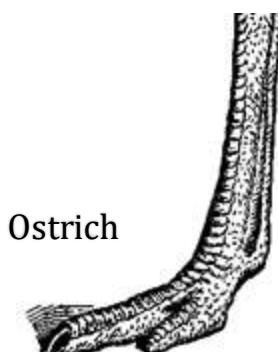
A DIAGRAM SHOWING AN OSTRICH



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

Why is penguin not regarded as a ratite yet it is a flightless bird?

- It lacks a flat breast bone
- It lacks a bony palate
- It has well developed chest muscles and sternum

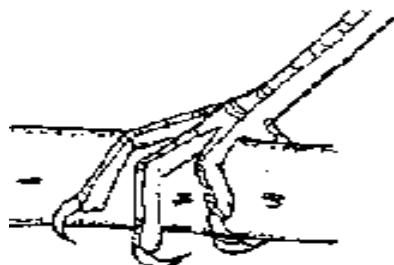
PERCHING BIRDS (SONG BIRDS/PASSERINES)

- 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

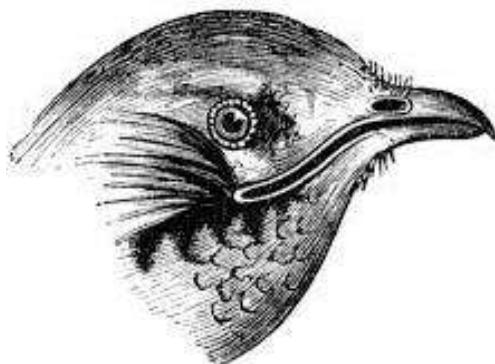
- These are perching birds that feed on insects.
- They have short narrow beaks;
- ✓ For picking up insects from tree barks

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

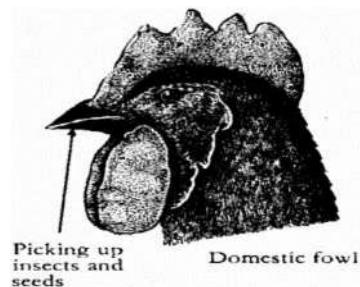
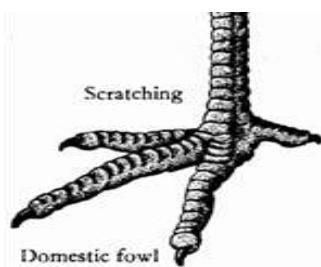
EXAMPLES OF SCRATCHING BIRDS

- 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.

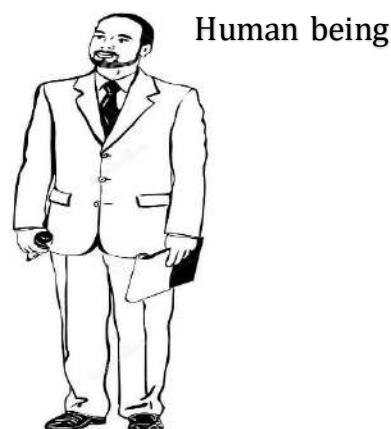
Why are mammals called omnivores?

- They feed on both meat and vegetation

EXAMPLES OF PRIMATES

- Human being
- Chimpanzee (bonobo)
- Gorilla
- Orangutan
- Gibbons
- ✓ Monkey
- ✓ Baboon
- ✓ Bushbaby

Apes

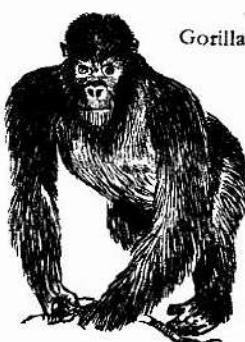


Human being

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

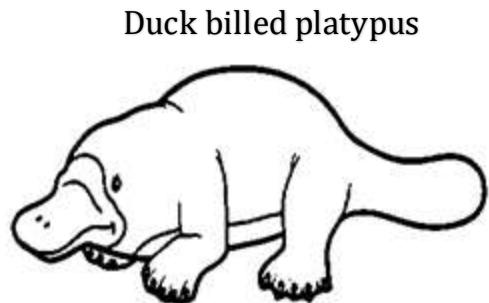
EXAMPLES OF EGG LAYING MAMMALS (MONOTREMES)

- Duck billed platypus
- Spiny anteater (echidna)

DIAGRAMS SHOWING MONOTREMES



Spiny anteater



Duck billed platypus

How do monotremes locate their food?

- By electroreception

UNGULATES (HOOVED 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: has 5 toes on each foot
- ✓ Rhino: has 3 toes on each foot

DRAWINGS SHOWING TOES OF ODD TOED UNGULATES

Horse

Rhino



2. EVEN TOED UNGULATES

- These are ungulates with two toes on each foot

EXAMPLES OF EVEN TOED UNGULATES

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

DRAWINGS SHOWING TOES OF EVEN TOED UNGULATES

Camel



Cow



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 | ▪ Camel |
| ▪ Goat | ▪ Deer |
| ▪ Sheep | ▪ Antelope |
| ▪ Giraffe | ▪ Elk |

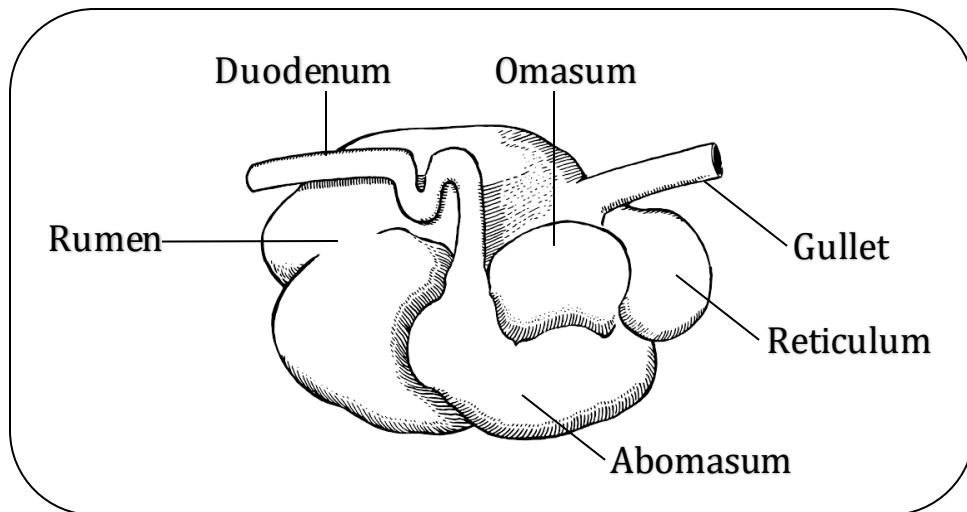
How do most ruminants protect themselves?

- 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

ii) 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

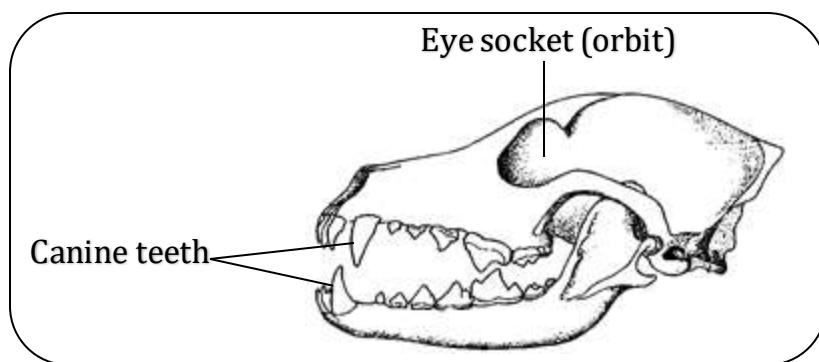
CARNIVOROUS MAMMALS (FLESH EATING MAMMALS)

- 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 THE SKULL OF A DOG



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

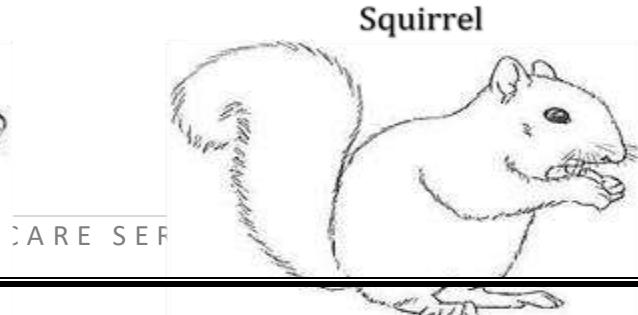
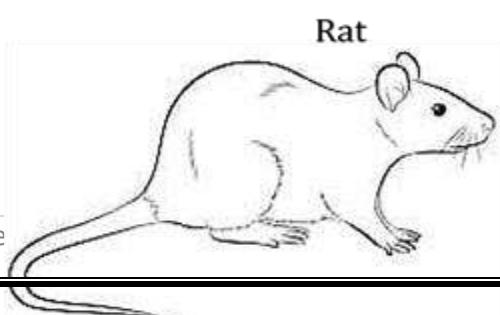
RODENTS

- These are gnawing mammals with one pair of upper incisors

EXAMPLES OF RODENTS

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

DRAWINGS SHOWING RODENTS (RAT AND SQUIRREL)



CHARACTERISTICS OF RODENTS

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

LAGOMORPHS

- These are gnawing mammals with two pairs of upper incisors

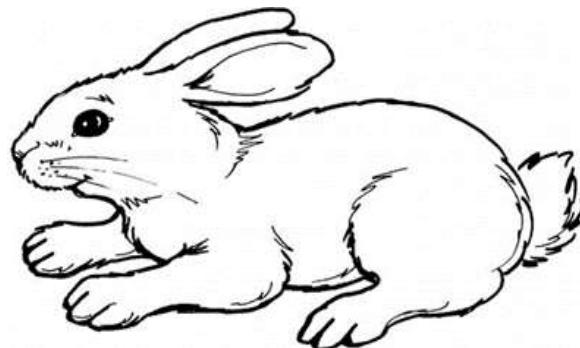
CHARACTERISTICS OF LAGOMORPHS

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

EXAMPLES OF LAGOMORPHS

- Rabbits
- Hares
- Pikas

A drawing showing a lagomorph (rabbit)



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

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 | ▪ Aardwolf |
| ▪ Elephant shrew | ▪ Golden mole |
| ▪ Aardvark | ▪ Solenodon |

A DRAWING OF A HEDGEHOG



How does a hedgehog protect itself?

- It rolls up itself into a spiny ball

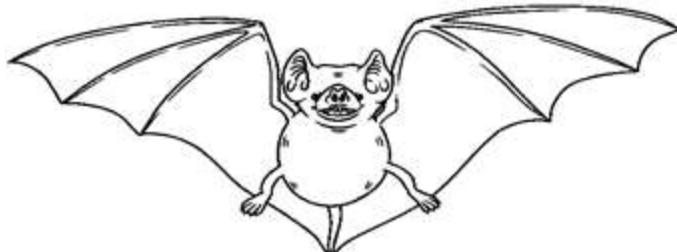
FLYING MAMMALS (CHIROPTERA)

- 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 forelimbs are modified into wings for flight (it has webbed wings for flight)

Why are bats called nocturnal animals?

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

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)

GROUPS (TYPES) OF BATS

- Insectivorous bats (insect eating bats): They feed on insects.
- Frugivorous bats (fruit bats): They feed on fruits.
- Blood-sucking bats (vampire bats): They 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

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

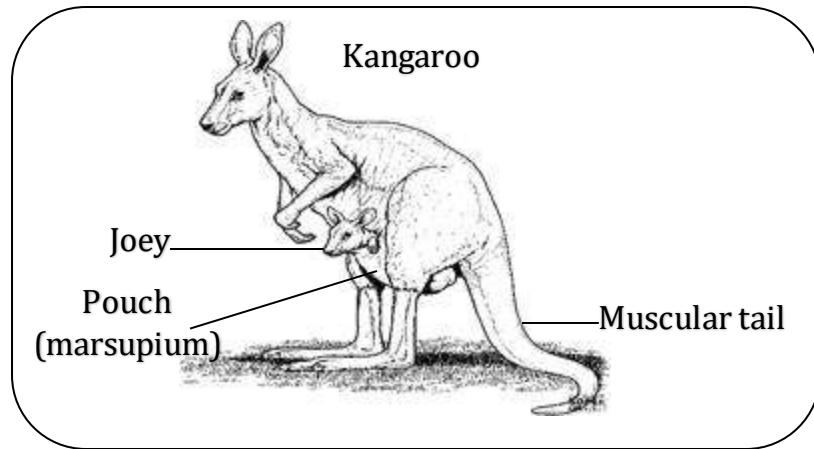
Why does a kangaroo carry its joey in a pouch?

- 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

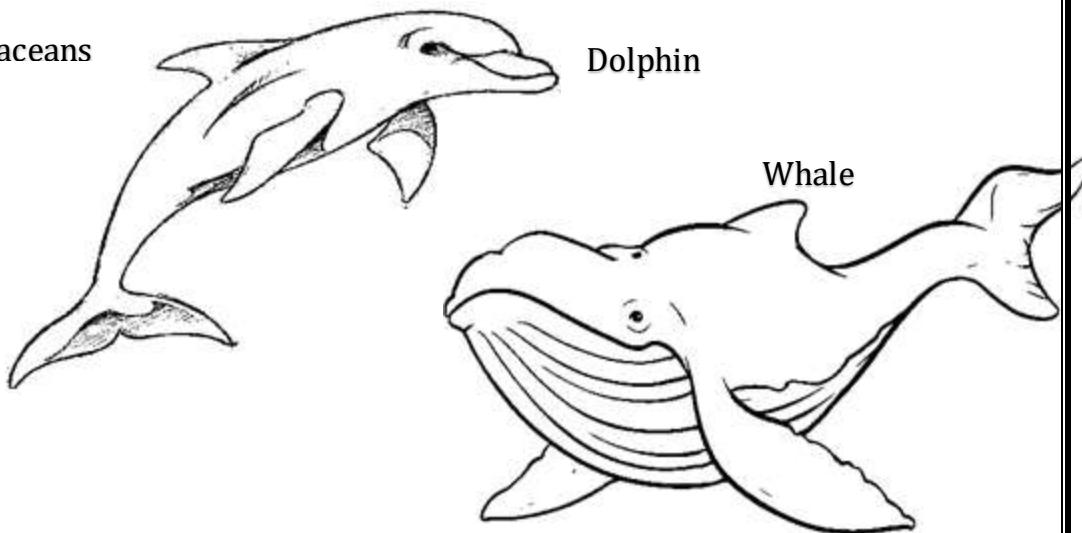
- These are mammals that live in seas
- ✓ They are also called sea mammals or aquatic mammals

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
- ❖ 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 start their lives in water and later live on land.

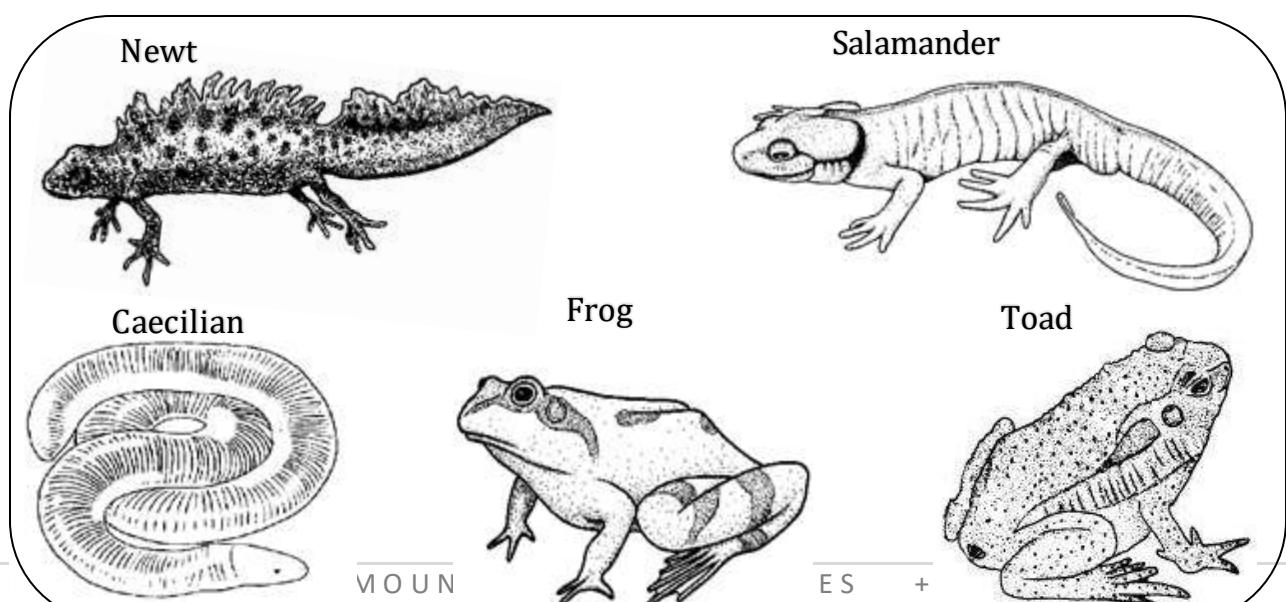
EXAMPLES OF AMPHIBIANS

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

CHARACTERISTICS OF AMPHIBIANS

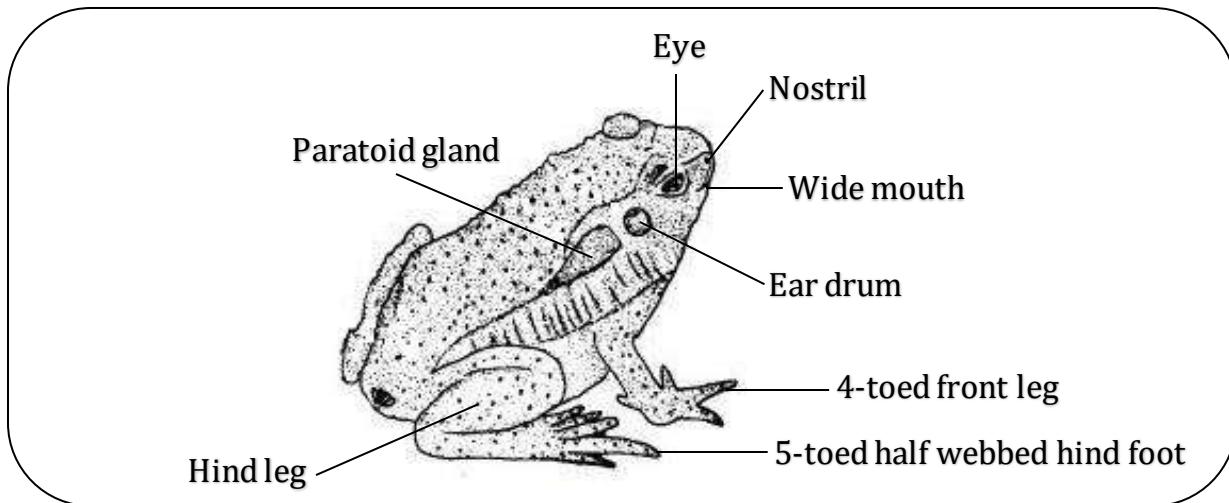
- They can live in water and on land
- They are cold blooded/poikilothermic animals
- They reproduce by laying eggs
- They undergo external fertilization
- They have a backbone
- They have no external ears
- They breathe by means of lungs on land
- They have three chambered hearts
- They have scaleless 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

DRAWINGS SHOWING AMPHIBIANS



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

A DIAGRAM SHOWING THE EXTERNAL FEATURES OF A TOAD



FUNCTION OF EACH BODY PART OF A TOAD

Part	Function
1. Mouth	✓ For feeding
2. Nostrils	✓ For smelling food
3. Eyes	✓ For sight
4. External eardrum	✓ For hearing
5. Paratoid gland	✓ To produce poison which keeps away predators
6. Strong hind legs	✓ For hopping / leaping
7. Webbed hind feet	✓ For swimming in water

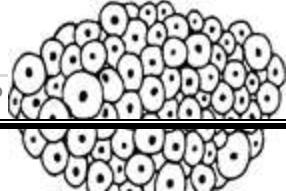
DIFFERENCES BETWEEN A FROG AND A TOAD

- A frog lives in water while a toad lives on land.
- A frog has a moist smooth skin while a toad has a dry 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 hind feet
- A frog has teeth in upper jaw while a toad has no teeth
- A frog has brown tadpoles while a toad has black tadpoles

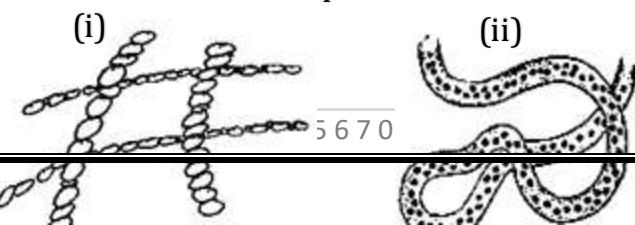
EGGS OF FROGS AND TOADS

- 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 / wrigglers of female anopheles mosquitoes

BREATHING IN TOADS AND FROGS

AMPHIBIAN	BREATHING ORGANS
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Frog	<ul style="list-style-type: none"> ▪ Lungs ▪ Moist skin ✓ In water, a frog breathes <u>through its moist skin</u> ▪ Buccal cavity (lining of the mouth)
Toad	<ul style="list-style-type: none"> ▪ Lungs ▪ Buccal cavity (lining of the mouth)
Salamander	<ul style="list-style-type: none"> ▪ Lungs ▪ Gills ▪ Moist skin
Newts	<ul style="list-style-type: none"> ▪ Lungs ▪ Moist skin
Caecilian	<ul style="list-style-type: none"> ▪ 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 its skin?

- Its skin is smooth and moist

Why can't a toad breathe through its skin?

- Its skin is rough and dry

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

How do amphibians protect themselves?

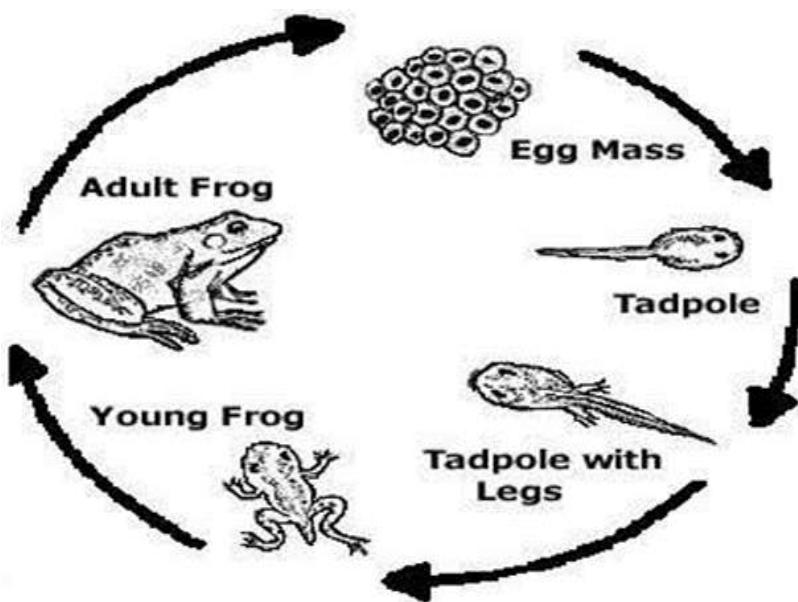
AMPHIBIAN	MODE OF PROTECTION
Toad	<ul style="list-style-type: none"> ▪ By producing poison to kill small enemies ▪ By swelling to scare away enemies
Frog	<ul style="list-style-type: none"> ▪ By using their slippery skin to escape from enemies ▪ By hiding in water

	<ul style="list-style-type: none"> ▪ By swelling to scare away enemies ▪ By camouflaging
Caecilian, salamander and newt	<ul style="list-style-type: none"> ▪ By producing poison in the skin to kill predators

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**
- They 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.

A DIAGRAM SHOWING THE LIFE CYCLE OF A FROG



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

DIFFERENCES BETWEEN A TADPOLE AND A FROG

- A tadpole breathes through gills while a frog breathes through its moist skin and lungs
- A tadpole has a tail while a frog is tailless

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

AESTIVATION IN AMPHIBIANS

- This is the inactive state in amphibians during summer/hot weather/drought

DURING AESTIVATION (INACTIVE/DORMANT PERIODS):

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

REASONS FOR AESTIVATION IN AMPHIBIANS / 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)

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

- | | |
|--|---|
| <ul style="list-style-type: none">▪ Kingsnake▪ Gaboon viper▪ Mamba▪ Chameleon▪ Skink▪ Crocodile | <ul style="list-style-type: none">▪ Tortoise▪ Turtle▪ Alligator▪ Gecko▪ Common lizard |
|--|---|

GROUPS (CLASSES) OF REPTILES

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

TESTUDINES

- These are reptiles with hard bony shells

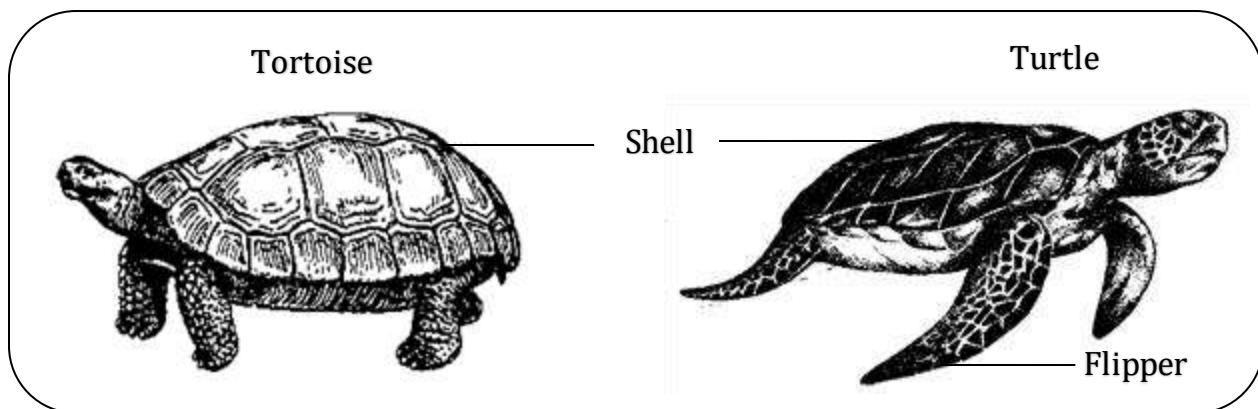
CHARACTERISTICS OF TESTUDINES

- 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 TESTUDINES

- 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 TESTUDINES (TURTLES AND TORTOISES)

- Insects
- Small animals
- Vegetation

SNAKES

- These are limbless reptiles

CHARACTERISTICS OF SNAKES

- They are limbless (lack limbs)
- They undergo moulting
- ✓ To grow/to increase in size
- They move by slithering
- They are carnivores (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 lack external ears but have inner ears

What is moulting?

- This is the shedding of outer skin in reptiles

Why do reptiles moult?

- To grow (to increase in size)

What is the sense organ for hearing in snakes?

- Inner ears

How do snakes hear / detect movement/vibrations?

- They hear vibrations with the help of inner ear inside their jawbones.

Why do snakes move while bringing out their forked tongue?

- For smelling

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

- | | |
|--|--|
| <ul style="list-style-type: none">▪ Cobra▪ Mamba (green mamba/black mamba)▪ Death adder▪ Viper (Gaboon viper/pit viper)▪ Boomslang | <ul style="list-style-type: none">▪ Coral snakes▪ Rattlesnakes▪ Water moccasins▪ Taipan (it is the most venomous snake in the world)▪ Sea snakes |
|--|--|

Reasons why people greatly fear the following venomous snakes.

GABOON VIPER

- Its venom kills within 30 minutes
- ✓ Gaboon viper is a highly venomous snake
- ✓ It is ovoviparous (the eggs hatch inside its body and gives birth to live young)

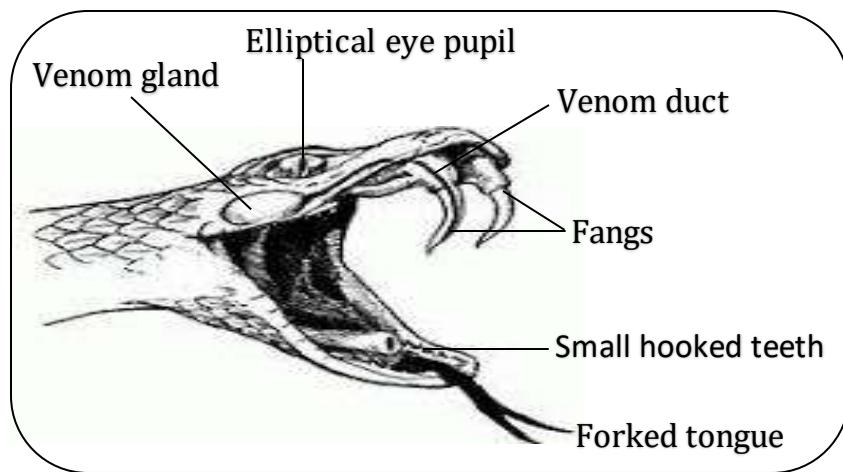
BLACK MAMBA

- 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

BACKWARD HOOKED TEETH

- For preventing the prey from escaping out of the mouth

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

- For killing their prey and enemies

MEDICAL IMPORTANCE OF SNAKE VENOM

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

DANGERS OF SNAKE VENOM TO HUMAN LIFE

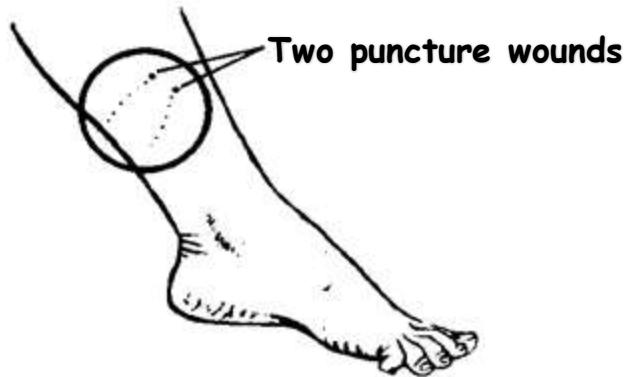
- It poisons blood leading to death
- It clots blood
- It destroys nerve cells

- It leads internal bleeding
- ✓ By destroying the outer membrane of blood capillaries
- ✓ By breaking the cells and tissues
- It paralyzes the heart

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

NOTE

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

A DIAGRAM SHOWING A BITE OF A NON-VENOMOUS SNAKE



CONSTRICATORS

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

CHARACTERISTICS OF CONSTRICATORS

- 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 CONSTRICATORS

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

REASONS WHY SNAKES BITE

- For protection
- To trap their prey

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 | ▪ Garter snake | ▪ Gaboon viper |
| ▪ Green anaconda | ▪ Rattlesnake | |
| ▪ Pit viper | ▪ Sea snake | |

LIZARDS

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

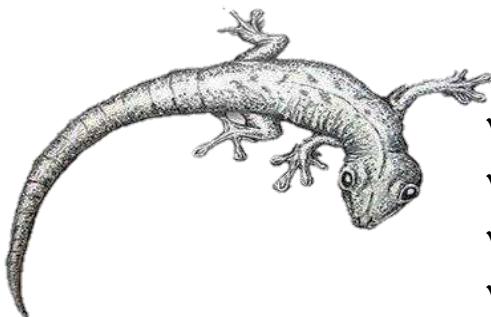
CHARACTERISTICS OF LIZARDS

- 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 animals
- 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 on their toes

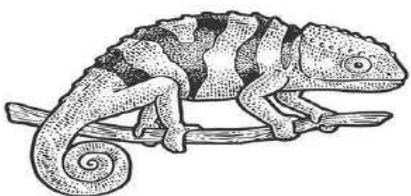
How are geckos useful in our houses?

- 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

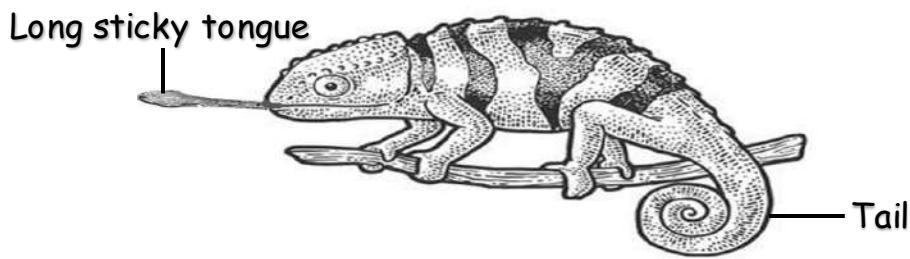
Why does a chameleon camouflage/change its skin colour?

- For protection
- To trap its prey
- To attract mates

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

- These are the largest of reptiles
- They are mainly crocodiles and alligators
- Crocodiles are commonly found in Africa
- Alligators are commonly found in America

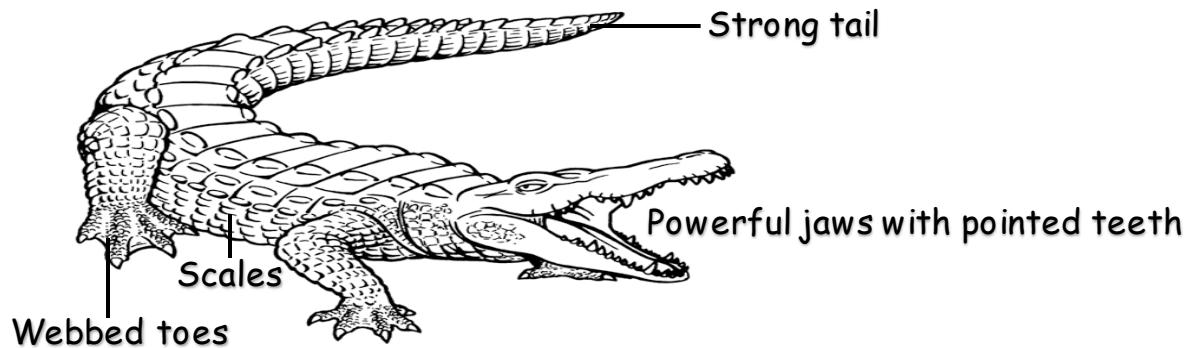
EXAMPLES OF CROCODILIANS

- Crocodile
- Alligator
- Gavial
- Caiman

CHARACTERISTICS OF CROCODILIANS (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

How are crocodiles adapted to their life in water and on land?

- They have a strong tail for swimming in water
- They have a streamlined body to overcome viscosity in water
- Their body allows the eyes and nostrils to be above water

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 start their lives in water and then live 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

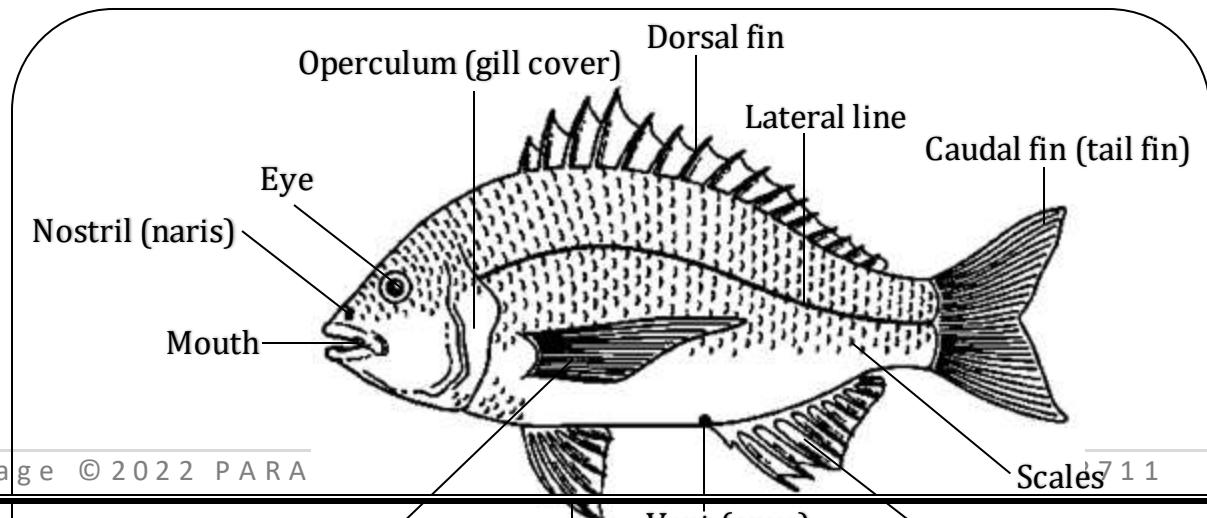
CHARACTERISTICS OF FISH

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

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

How is the lateral line adapted to its functions?

- It has sensory hair cells

ANUS

- To pass out wastes

FINS

- For swimming
- For protection

KINDS OF FINS ON A FISH

- Median fins
- Paired fins

i) **Median fins**

- These are single fins that run down the midline of the fish's body
- They help in balancing

Examples of median fins

- Dorsal fin
- Anal fin
- Tail fin

ii) **Paired fins**

- These are fins which exist in pairs and act as limbs in vertebrates

Examples of paired fins

- Pectoral fins
 - Pelvic fins
- ✓ The pectoral fins act as forelimbs while the pelvic fins act as hind limbs

DORSAL FIN

- For protection
- For balancing

How is the dorsal fin adapted to its main function of protecting the fish?

- ✓ 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

PECTORAL FINS

- For balancing in water
- For slowing down speed/they act as brakes

PELVIC/VENTRAL FINS

- For swimming upwards and downwards

ANAL FIN

- It stabilizes the fish during swimming

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

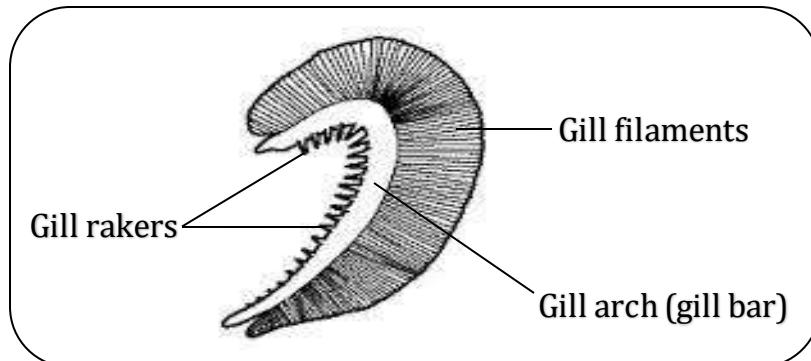
SIMILARITIES BETWEEN A TILAPIA AND A TADPOLE.

- 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 ARCH / GILL BAR

- It supports the gill filaments and gill rakers

GILL RAKERS

- To trap solid materials from damaging the gills
- To filter food from water as it moves from mouth to the gills

GILL FILAMENTS

- For gaseous exchange

ADAPTATIONS OF GILL FILAMENTS TO GASEOUS EXCHANGE

- They are numerous
- They have a dense network of blood capillaries
- They are moist
- They have thin walls

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

How are fish with no swim bladders (cartilaginous fish) able to float on water?

- They use their fins to keep swimming

EXAMPLES OF CARTILAGINOUS FISH

- Shark
- Ray/stingray
- Dogfish
- Skates



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 into lungs for breathing

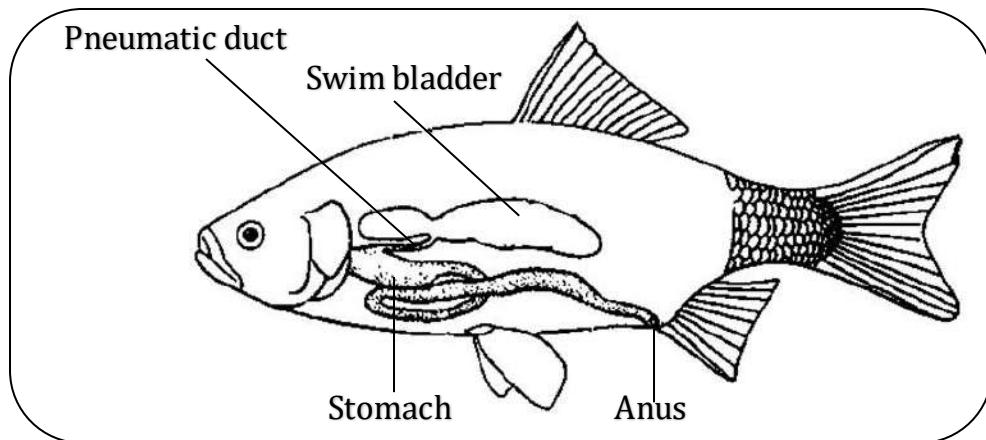
Why does lungfish aestivate/produce mucus that dries into cocoon around its body?

- To survive drought

THE SWIM BLADDER (AIR BLADDER)

- It is a gas filled sac near the backbone of most fish
- The swim bladder is connected to the digestive tract by the **pneumatic duct**
- **The pneumatic duct** allows the fish to adjust the air content in the swim bladder

DIAGRAM SHOWING A SWIM BLADDER



USES OF THE SWIM BLADDER TO A FISH

- It keeps the fish buoyant / it helps the fish to float within water / it controls the depth of fish in water
- It helps in gaseous exchange / breathing e.g lungfish
- It is used by some fish to produce sound e.g toadfish and grunts

How does a swim bladder keep a fish buoyant?

- It reduces the density of a fish's body

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 naturally 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 FISH BASED ON THEIR FEEDING HABITS

- ✓ **Carnivores:** They feed on small animals in water
- ✓ **Herbivores:** They feed on plants in water
- ✓ **Omnivores:** They feed on plants and small animals in water
- ✓ **Detritus feeders:** They feed on dead organic matter at the bottom of the pond

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 } Local methods
- Salting
- ✓ Refrigeration } Modern methods
- ✓ Canning (tinning)

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
- Sponges
- Molluscs
- Echinoderms
- Worms
- Arthropods

COELENTERATES (CNIDARIANS)

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

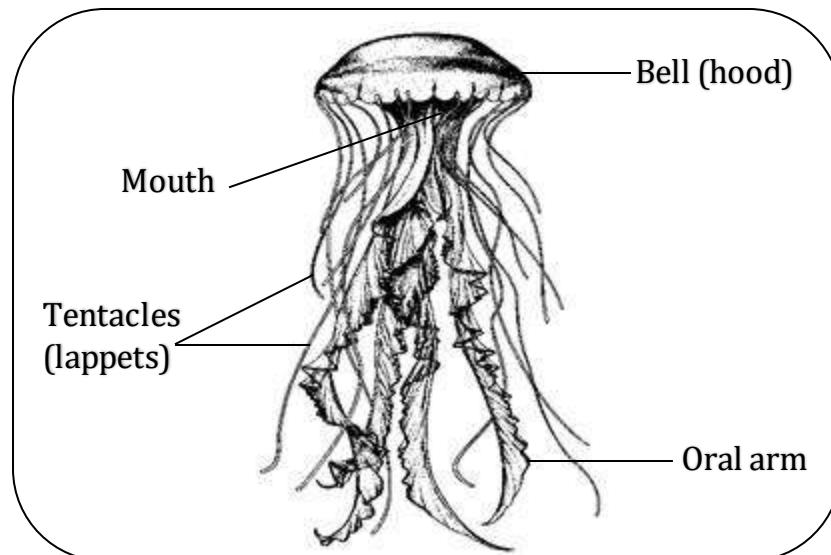
CHARACTERISTICS OF COELENTERATES

- 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

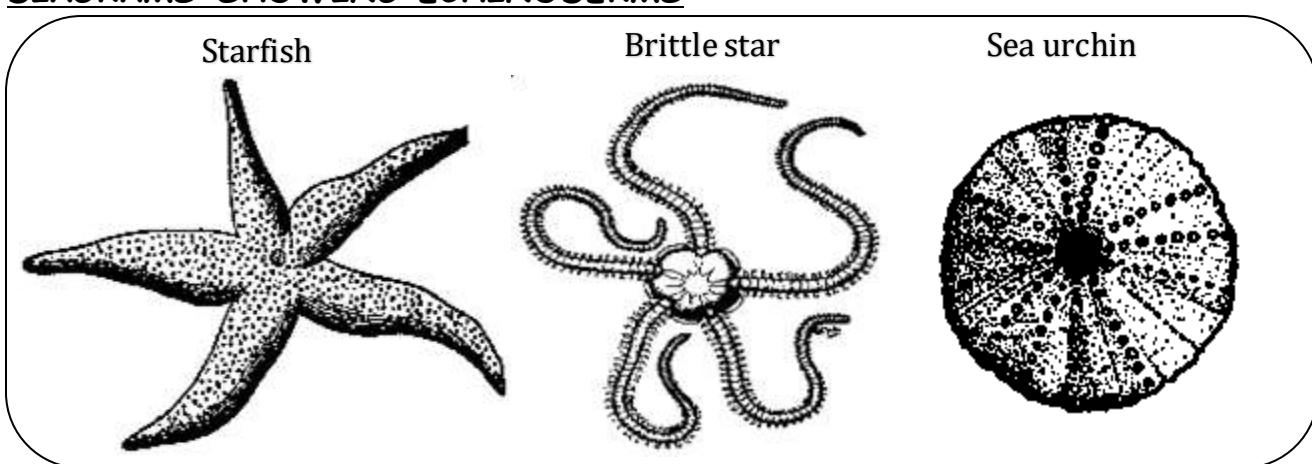
CHARACTERISTICS OF ECHINODERMS

- 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 lily |
| ▪ Sea urchin | ▪ Sea cucumber |
| ▪ Sand dollar | ▪ Brittle star |

DIAGRAMS SHOWING ECHINODERMS



WORMS

- These are long thin soft bodied invertebrates

CHARACTERISTICS OF WORMS

- They breathe through their moist skins
- They reproduce by laying eggs
- They have hydrostatic skeleton
- They have a distinct head and tail end
- They can regenerate their lost/damaged body parts
- They have two identical body sides (they have bilateral symmetry)

NOTE

- ✓ Some worms live in soil or water while others live inside other animals as parasites
- A **parasite** is an organism which depends on another organism for food and shelter
- A **host** is an organism from which a parasite gets food and shelter

REGENERATION IN WORMS

- This is the ability of worms to rebuild/replace their removed body parts

GROUPS (CLASSES) OF WORMS

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

1. SEGMENTED WORMS (ANNELIDS)

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

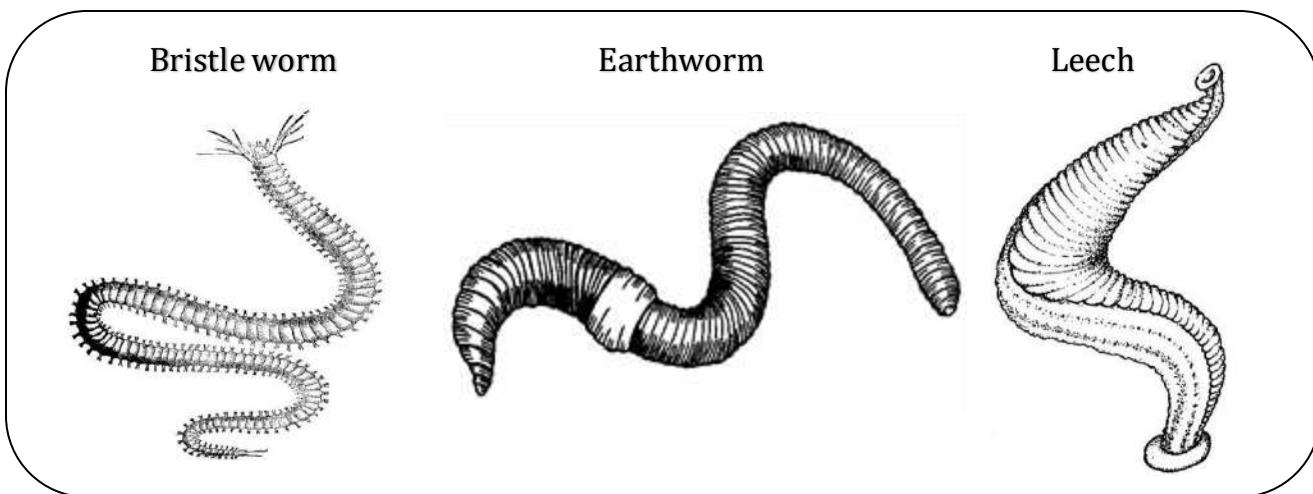
CHARACTERISTICS OF SEGMENTED WORMS (ANNELIDS)

- They have segments
- They are hermaphrodites

EXAMPLES OF SEGMENTED WORMS

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

DIAGRAMS OF SEGMENTED WORMS



EARTHWORM

- It lives in soil
- It reproduces by laying eggs
- The clitellum produces mucus to form cocoon for the eggs
- It undergoes 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

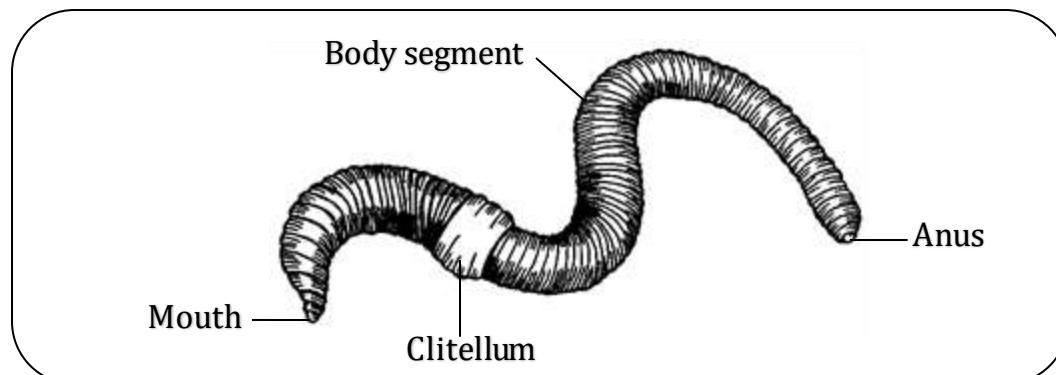
IMPORTANCE OF EARTHWORMS IN THE ENVIRONMENT

- 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 tunnels)

A DIAGRAM SHOWING AN EARTHWORM



Why are earthworms called hermaphrodites?

- They have both male and female sex organs

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

2. FLATWORMS (PLATYHELMINTHES)

- 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

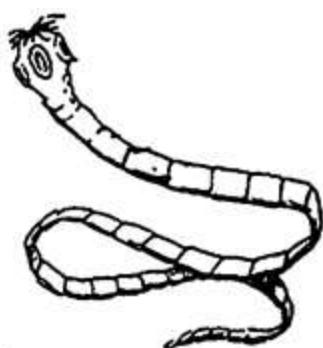
- Tapeworm
- Liver fluke
- Schistosoma (blood fluke): causes bilharziasis or schistosomiasis
- Pond flatworm

DIAGRAMS SHOWING FLAT WORMS

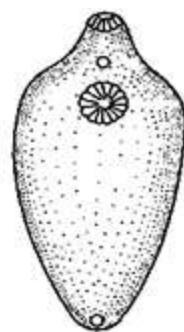
Schistosoma (blood fluke)



Tapeworm



Liver fluke



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

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)

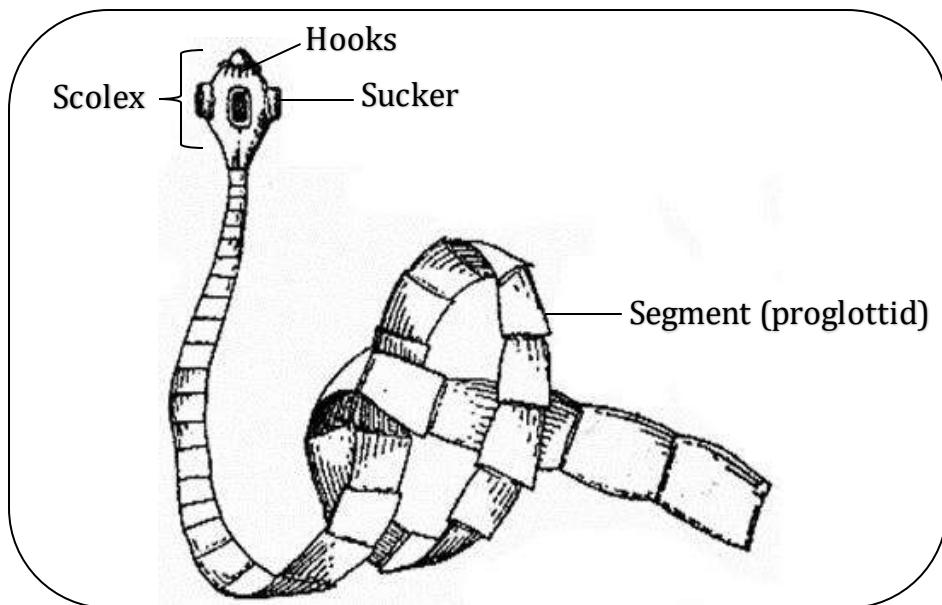
Why can't tapeworms be digested by the host's digestive juices?

- 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.

DIAGRAM SHOWING TAPEWORM



FUNCTION 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

SIGNS OF TAPEWORM INFESTATION

- Diarrhoea
- Indigestion
- Loss of body weight

EFFECTS OF TAPEWORM INFESTATION

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

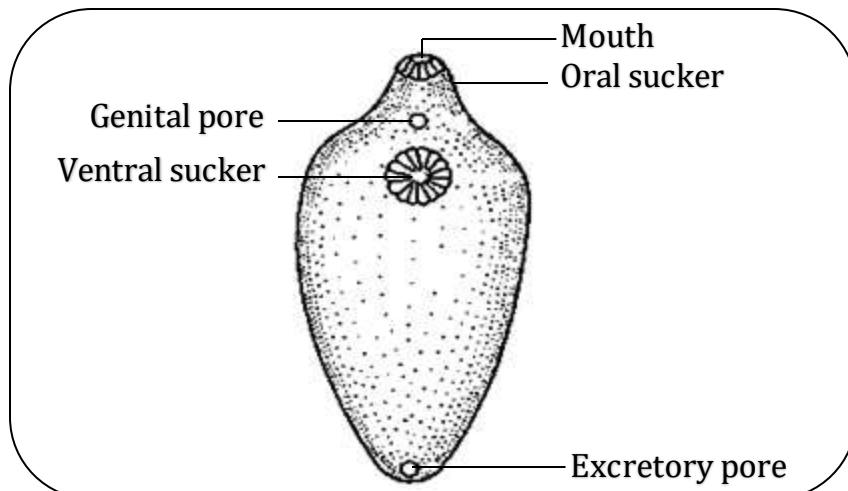
CONTROL OF TAPEWORM INFESTATION

- 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



3. 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

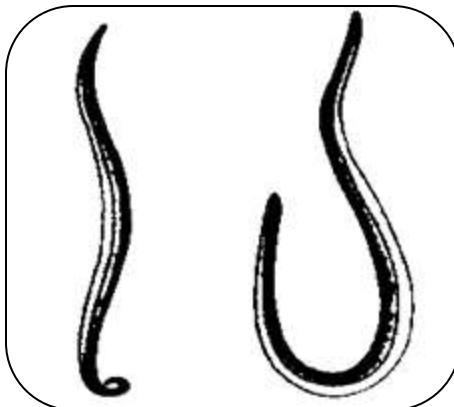
SYMPTOMS OF ROUNDWORM INFESTATIONS

- 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

How do hookworms enter our bodies?

- By penetrating through the bare skin

EFFECT 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 / MOLLUSKS

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

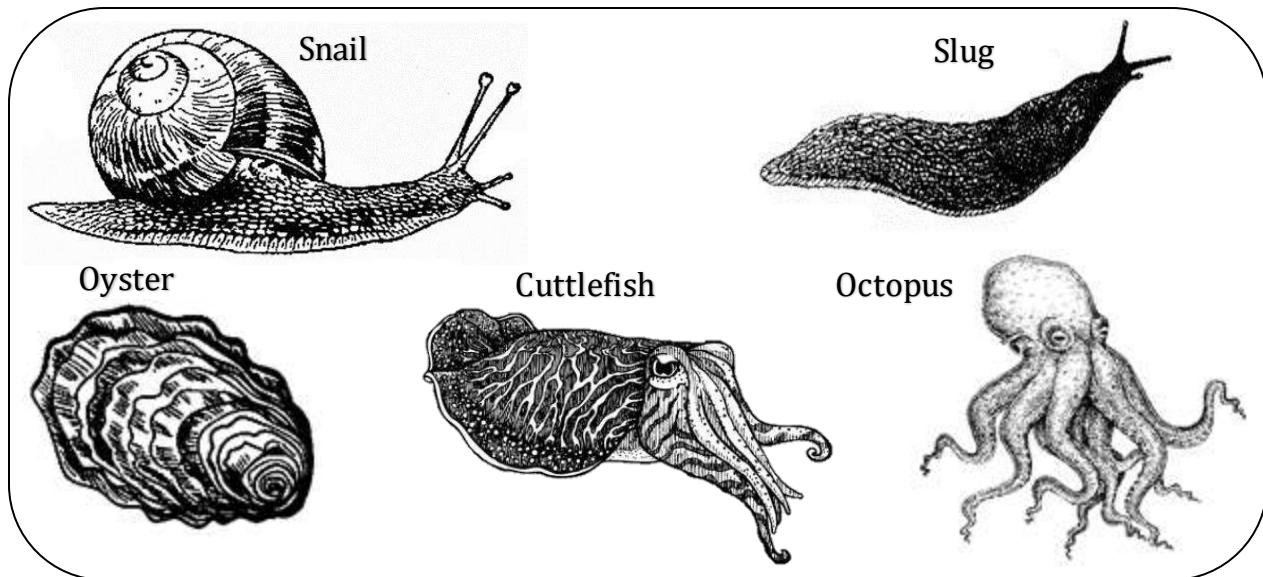
CHARACTERISTICS OF MOLLUSCS

- 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
- Clam
- Oyster
- Mussel
- Scallop
- Mussel
- Cuttlefish
- Chiton
- Nautilus
- Conch
- Cowrie
- Shipworm
- Cockle

DIAGRAMS SHOWING MOLLUSCS



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

How does a cuttlefish protect itself from predators?

- By using its beak
- By camouflaging

UNIVALVE MOLLUSCS

- These are molluscs with a shell having one piece

Examples of univalves

- Snail
- Slug
- Conch

BIVALVE MOLLUSCS

- These are molluscs with a shell having two hinged pieces

Examples of bivalves

- Scallop
- Clam
- Mussel
- Oyster

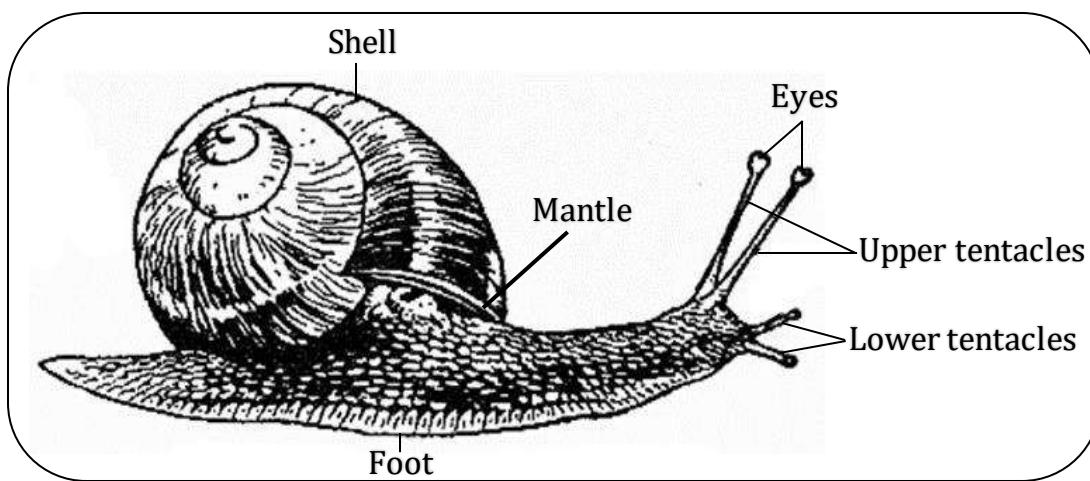
SNAIL

- 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 prevents the snail from drying up

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

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

NOTE

- Arthropods are the most abundant invertebrates because they can live and survive in a greater range of habitats than any other group of invertebrates

EXAMPLES OF ARTHROPODS

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

GROUPS (CLASSES) OF ARTHROPODS

1. Insects
2. Arachnids
3. Crustaceans
4. Myriapods

MYRIAPODS

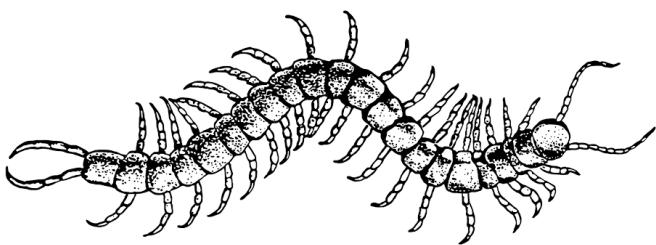
- These are arthropods with many legs and many segments
- They have 20 or more legs
- They can regrow new legs if they lose some legs

GROUPS OF MYRIAPODS

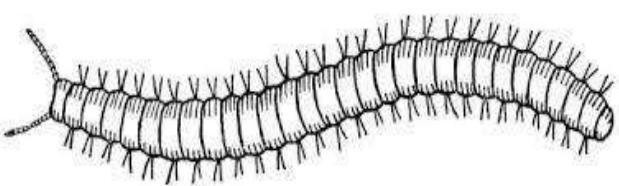
- Centipedes (chilopoda)
- Millipedes (diplopoda)

DIAGRAMS SHOWING MYRIAPODS

CENTIPEDE



MILLIPEDE



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

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 move slowly

How do millipedes protect themselves?

- By curling (coiling)
- By producing bad smell

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

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

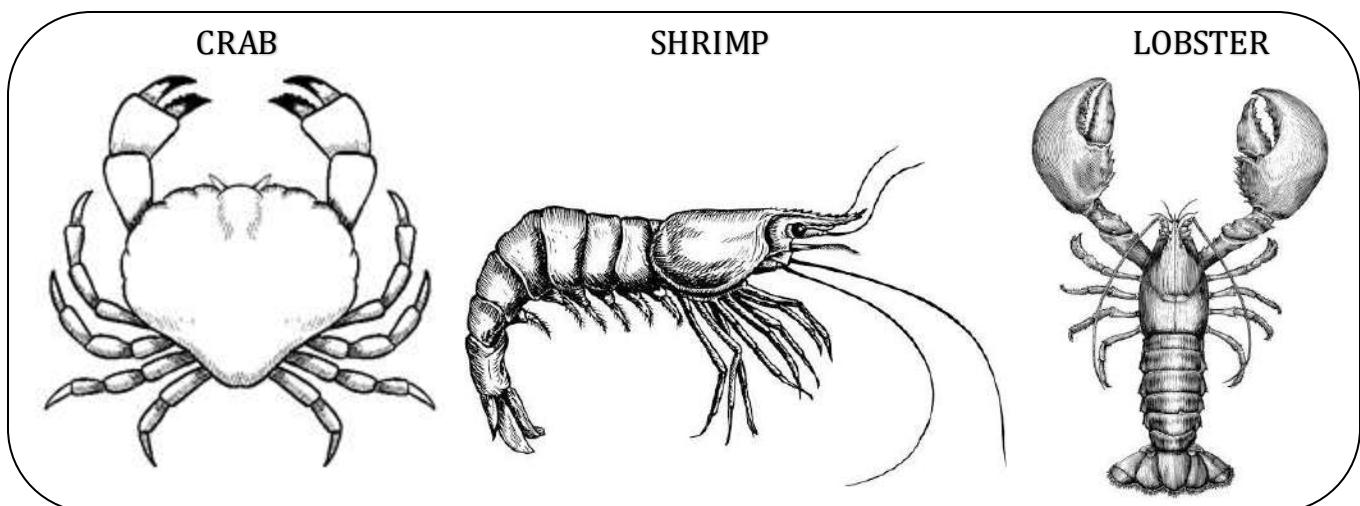
CHARACTERISTICS OF CRUSTACEANS

- 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 | ▪ Barnacle |
| ▪ Prawn | ▪ Crayfish |
| ▪ Lobster | ▪ Water flea |
| ▪ Shrimp | ▪ Sand flea (sandhopper) |
| ▪ Woodlice | ▪ Krill |
- ✓ Some crustaceans feed on worms and insects while others feed on vegetation

DIAGRAMS SHOWING CRUSTACEANS



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

USES OF APPENDAGES TO CRUSTACEANS

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

USES OF SWIMMERETS TO CRUSTACEANS

- For swimming
- They move over the gills for respiration
- For holding the larvae

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

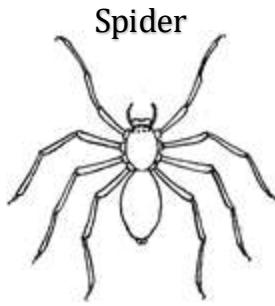
EXAMPLES OF ARACHNIDS

- 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

DIAGRAMS SHOWING A SPIDER AND A SPIDER WEB



Spider



Spiderweb

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

- To trap their prey (insects)
- For movement
- For protection
- To encase egg sacs

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

IMPORTANCE OF SPIDERS TO PEOPLE

- They eat insect vectors e.g mosquitoes and houseflies

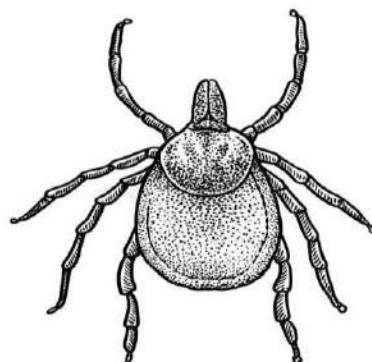
TICK AND MITE

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

How are ticks and mites harmful to cattle keepers?

- Ticks and mites are ectoparasites on cattle

A DRAWING SHOWING A TICK



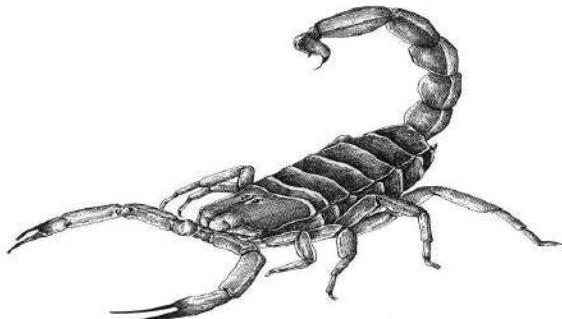
EXAMPLES OF TICKBORNE DISEASES

IN PEOPLE	IN LIVESTOCK (FARM ANIMALS)
<ul style="list-style-type: none"> ▪ Lyme disease ▪ Relapsing fever ▪ Typhus fever 	<ul style="list-style-type: none"> ▪ Heart water ▪ East coast fever ▪ Anaplasmosis ▪ Red water

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 jointed legs.
- They breathe through spiracles.

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

- Bees (worker bee, carpenter bee, bumble bee)
- Wasps
- Fire ants
- Hornets
- Yellow jackets

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 which 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

Wings

- For flight

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

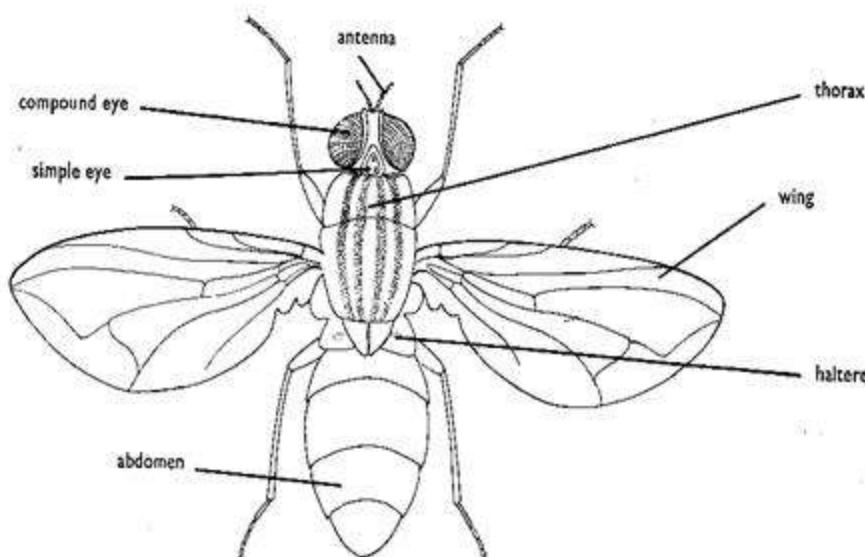
DIPTERANS (DIPTEROUS INSECTS)

- ❖ 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
- Black fly
- Cranefly
- Mosquito
- Sandfly
- 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

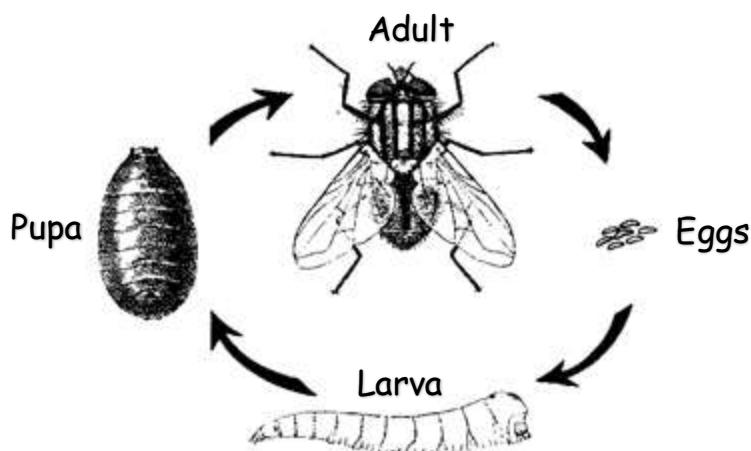
EXAMPLES OF INSECTS WHICH UNDERGO COMPLETE METAMORPHOSIS

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

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 | ▪ Typhoid | ▪ Dysentery |
| ▪ Cholera | ▪ Trachoma | |

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

- All adult mosquitoes feed on nectar and fruit juices.
- They use the proboscis to suck nectar
- Male mosquitoes don't suck blood (don't bite) and so they do not transmit diseases
- Female mosquitoes suck blood to get proteins for development of 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 a **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**

TYPES OF MOSQUITOES

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

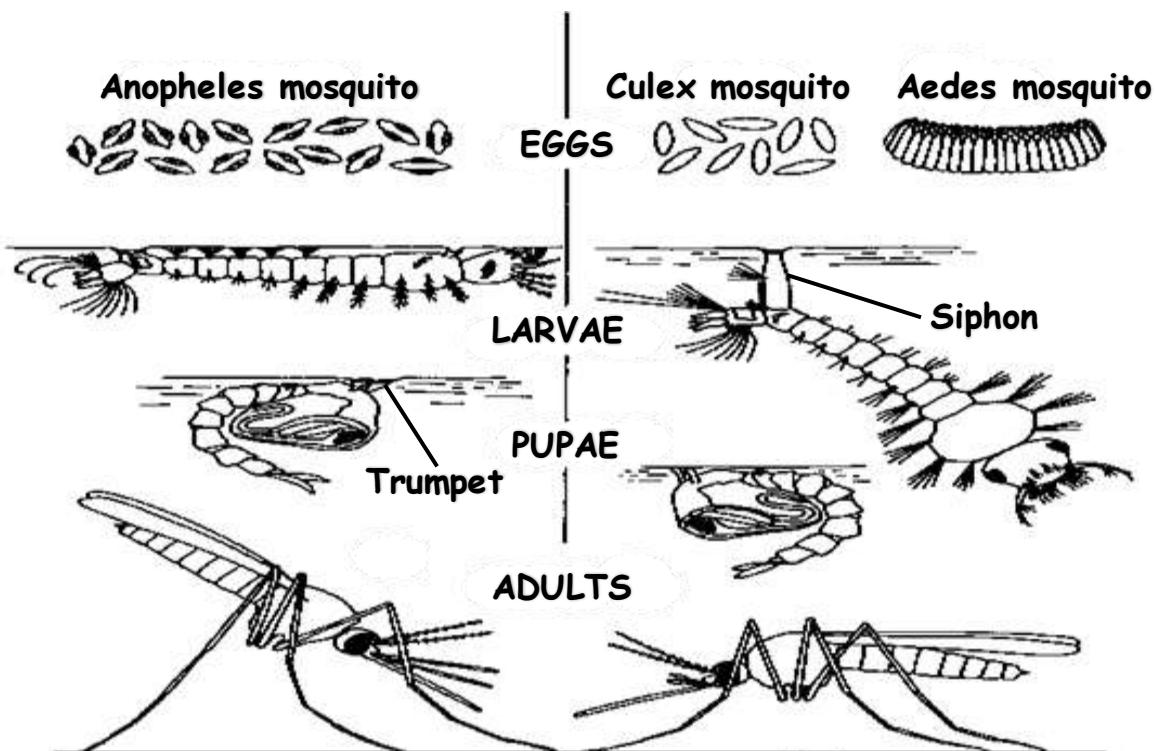
LIFE CYCLE OF A MOSQUITO

- It lays eggs in stagnant water (breeds from stagnant water)
- Its larva stage is called **wiggler**
- The larva (wiggler) 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

DIAGRAMS SHOWING LIFE CYCLES OF ANOPHELES AND CULEX MOSQUITOES



DIFFERENCES BETWEEN ANOPHELES AND CULEX MOSQUITOES

Anopheles mosquito	Culex mosquito / Aedes mosquitoes
Lays eggs with an air floats; to enable them float on water	Lays eggs in rafts / Lays eggs singly
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 is Aedes mosquito sometimes called tiger mosquito?

- It has white and black colour pattern.

MOSQUITO BORNE DISEASES.

- These are diseases that spread through bites of infected mosquitoes.

EXAMPLES OF MOSQUITO BORNE DISEASES.

Type of mosquito	Mosquito borne disease	Germ
Anopheles mosquito	Malaria	Plasmodium
Culex mosquito	Elephantiasis / filariasis	Filarial worm
Aedes (tiger) mosquito	Yellow fever	Yellow fever virus
	Dengue fever	Dengue virus
	Zika fever	Zika virus
	Chikungunya fever	Chikungunya virus

How do mosquitoes spread diseases?

- Through bites

How are mosquitoes able to detect people at night?

- They have a good sense of smell

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

WAYS OF CONTROLLING MOSQUITOES AND MOSQUITO BORNE

DISEASES;

Biological control methods

- Keep fish in ponds to eat on mosquito larvae
- Put mosquito repellent plants in the compound

Chemical control methods

- Pour oil on stagnant water to kill mosquito larvae
- ✓ Oil cuts off oxygen supply to mosquito larvae
- Spray with insecticides to kill adult mosquitoes

- Sleep under treated mosquito nets
- ✓ To prevent mosquito bites
- ✓ To kill mosquitoes
- Apply mosquito repellent vaseline on your body
- Use of mosquito coils

Mechanical control methods

- Drain stagnant water around homes
- ✓ To destroy breeding places for mosquitoes
- Clear all bushes around homes
- ✓ To destroy hiding places for mosquitoes
- Use of electric mosquito traps
- ✓ To electrocute mosquitoes / to shock mosquitoes to death
- Close doors and windows early in the evening
- Burn broken plastic tins and bottles where mosquitoes can breed

WAYS OF CONTROLLING MOSQUITOES AND MOSQUITO BORNE DISEASES WITHOUT USING DRUGS.

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

DRUGS USED TO TREAT MOSQUITO BORNE DISEASES

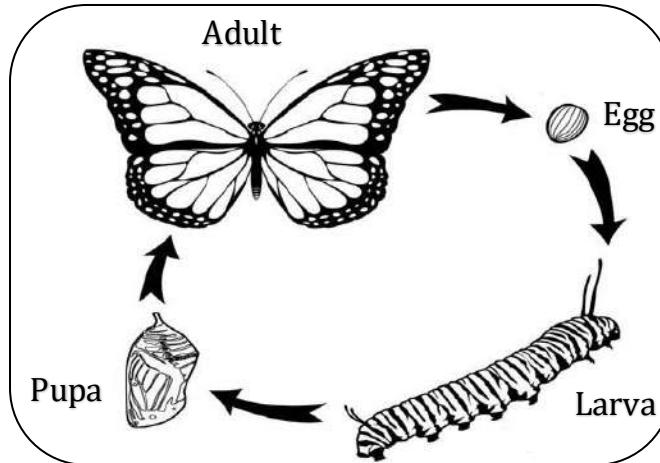
- | | |
|---------------|---------------------|
| ▪ Chloroquine | ▪ Aloe vera |
| ▪ Quinine | ▪ Bitter leaf juice |
| ▪ Coartem | ▪ Neem leaf juice |

BUTTERFLIES AND MOTH

- They undergo complete metamorphosis
- ✓ Eggs - Larva (caterpillar) - Pupa (chrysalis) - Adult (imago)
- Female butterflies and moths lay eggs on the surface of leaves
- The eggs hatch into larvae called caterpillars
- Caterpillars feed on leaves
- The larvae develop into pupae called chrysalis

- Pupae (chrysalis) are protected by **cocoon**
- The pupa neither feeds nor moves (it is dormant)
- The pupae develop into adults called **imago**
- The adult breaks the cocoon and comes out when it is fully grown
- Moths are **nocturnal insects** (then are mostly active at night) while butterflies are **diurnal insects** (active during day time)

A DIAGRAM SHOWING LIFE CYCLE OF A BUTTERFLY



Why butterflies and moths lay their eggs on leaves

- To enable their larvae get food

How are moths able to pollinate scented flowers at night?

- They have a good sense of smell

Besides moths, name other nocturnal insect pollinators

- Beetles (ladybirds)

How do moths and butterflies protect themselves against predators / enemies?

- By camouflaging to confuse predators

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

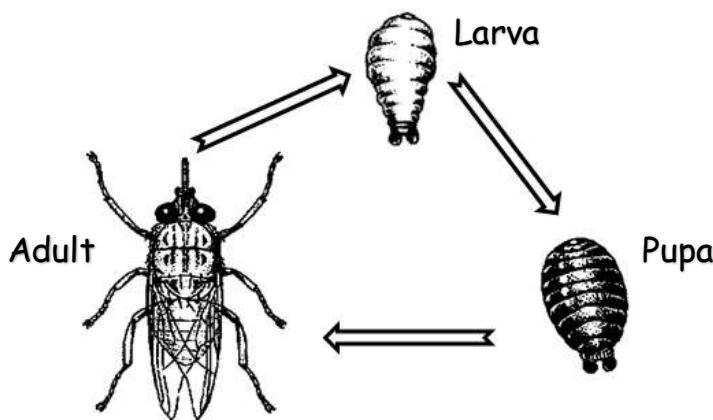
Why are tsetse flies called ovoviparous insects?

- 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 are tsetse flies commonly found?

- 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.

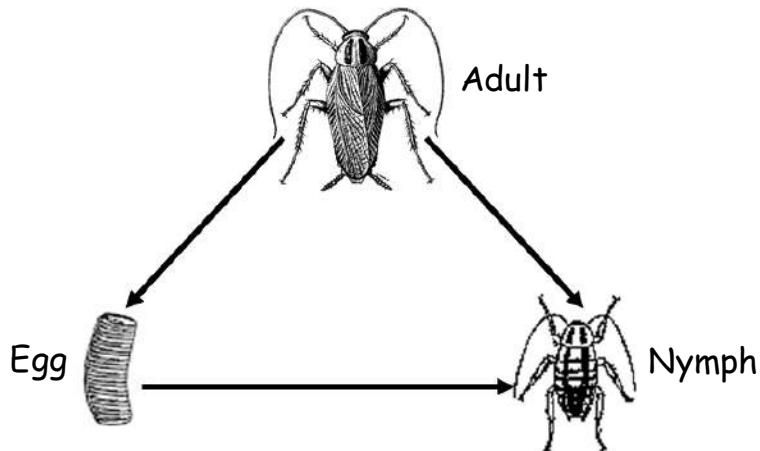
DIFFERENCES BETWEEN NYMPH AND ADULT

- 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 | ▪ White ant | ▪ Aphid |
| ▪ Grasshopper | ▪ Cricket | ▪ Praying mantis |
| ▪ Dragonfly | ▪ Locust | ▪ Walking sticks |
| ▪ Bedbug | ▪ Termite | ▪ Katydid |
- ✓ Cockroaches are **nocturnal insects** (active at night)

A DIAGRAM SHOWING LIFE CYCLE OF A COCKROACH



DISEASES TRANSMITTED BY COCKROACHES:

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

IMPORTANCE OF INSECTS

- Some insects pollinate flowers of crops e.g. moths, beetles, bees and butterflies.
- Some insects are eaten as food (are edible) e.g. white ants, grasshoppers and crickets.
- Bees provide honey and beeswax
- Grasshoppers are sold for income
- Silk moths provide silk to textile industries

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 celled organisms)

- This is a kingdom of simple organisms with one cell / 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
- Protozoa
- Euglena

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

- | | |
|-------------------------|----------------------------------|
| ▪ Giant kelp / Seaweeds | ▪ Volvox |
| ▪ Spirogyra | ▪ Brown algae (Fucus / Rockweed) |
| ▪ Stonewort | ▪ Diatom |

TYPES OF ALGAE

- Red algae
- Green 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

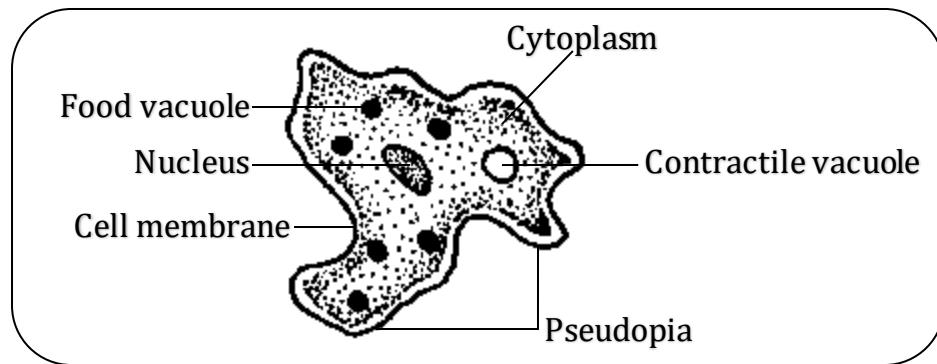
- These are unicellular organisms with nucleus and cytoplasm.
- Protozoa are microscopic **because** they can only be seen using a microscope
- Protozoa are unicellular **because** they have one cell

- 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

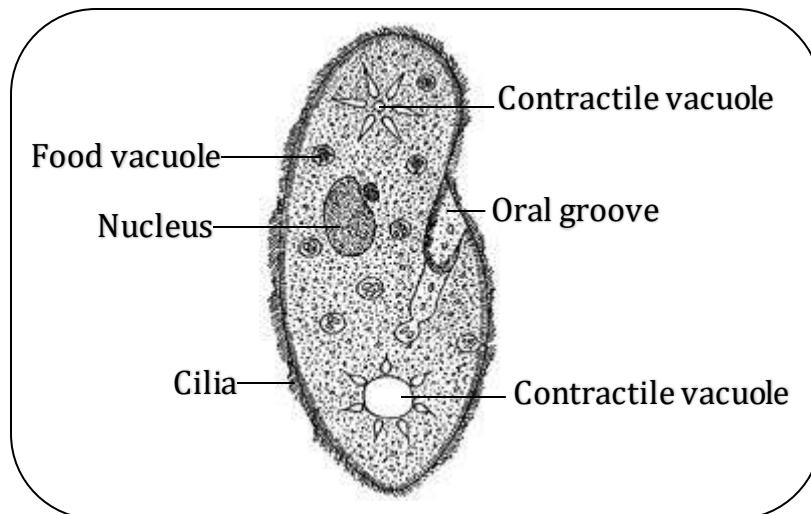
- Amoeba
- Plasmodium
- Paramecium
- Trypanosome

A DIAGRAM SHOWING AN AMOEBA



- 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

DIAGRAM SHOWING PARAMECIUM

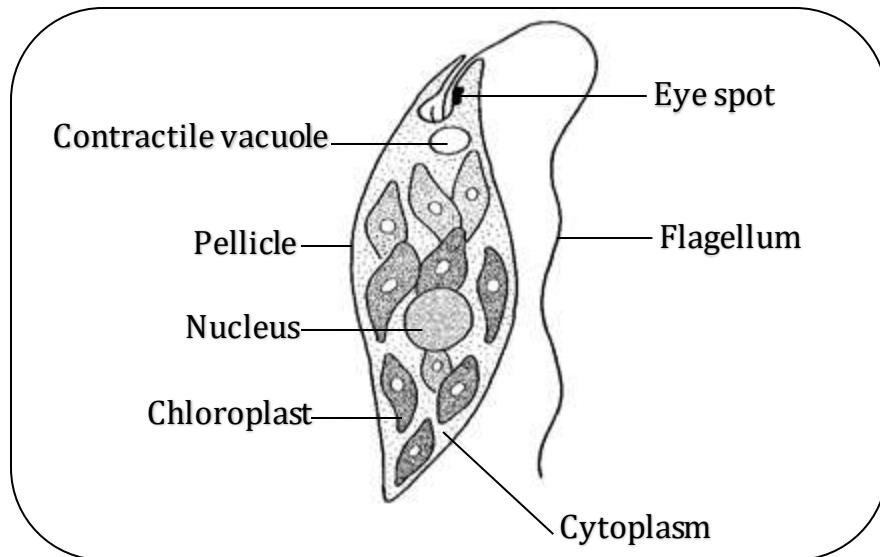


EUGLENA

- 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

- Euglena have chlorophyll as plants and have flagella but do not have cell wall as animals
- It uses **flagella** for locomotion (movement) and feeding
- It is microscopic and lives in ditches and ponds.

A DIAGRAM SHOWING EUGLENA



PROTOZOAN DISEASES IN HUMANS

PROTOZOA	PROTOZOAN DISEASE
Plasmodium	Malaria
Trypanosome	Sleeping sickness
Amoeba	Amoebic dysentery

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 enough water to support growth of fungi
- There is a lot of rotting matter on which fungi feed

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

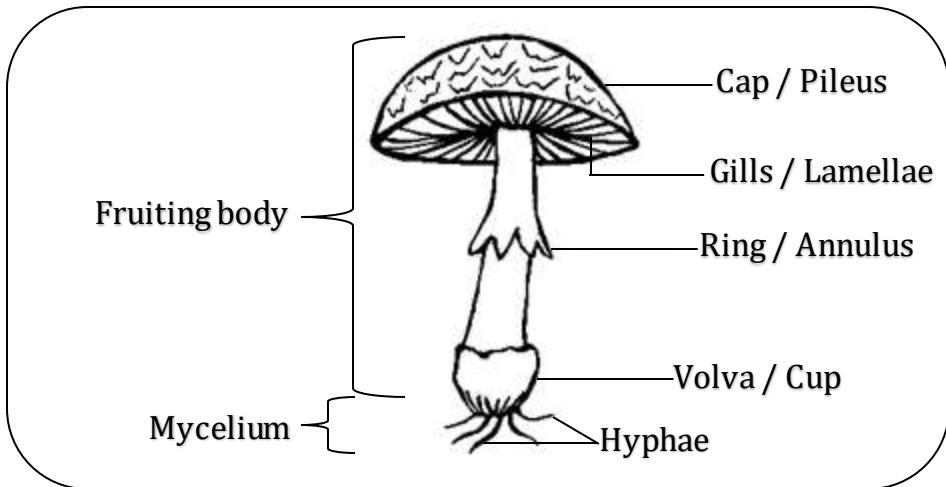
EXAMPLES OF FUNGI

- | | |
|--------------|-------------------|
| ▪ Mushrooms | ▪ Mildews |
| ▪ Toadstools | ▪ Puffballs |
| ▪ Yeast | ▪ Clubroot fungus |
| ▪ Moulds | ▪ 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 feeds on rotting 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 | ▪ Barber's itch |
| ▪ Candidiasis | ▪ Jock itch |
| ▪ Athlete's foot | |

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)

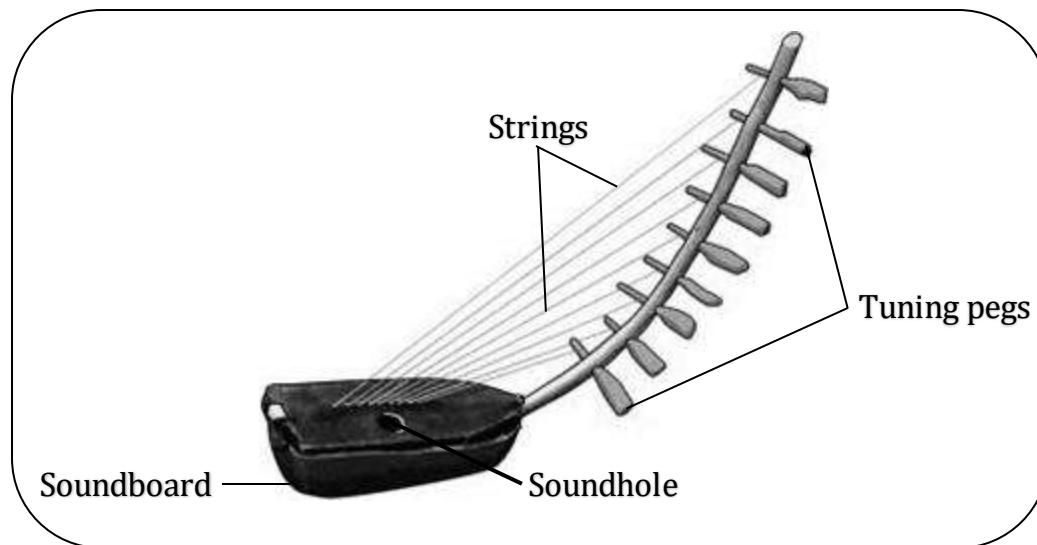
STRING INSTRUMENTS (CHORDOPHONES)

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

EXAMPLES OF STRING MUSICAL INSTRUMENTS

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

A DIAGRAM SHOWING BOW HARP



SOUNDBOARD

- It amplifies sound

SOUNDHOLE

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

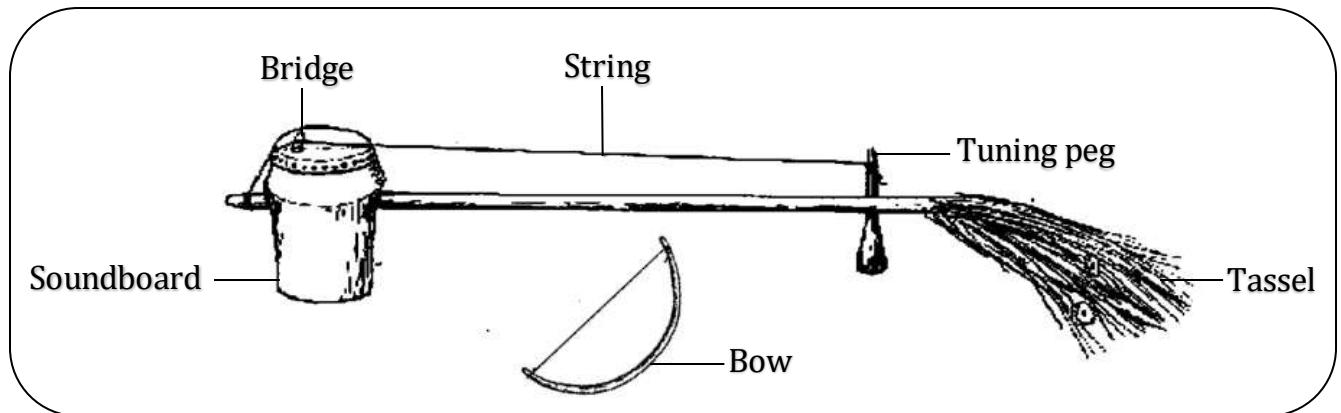
TUNING PEGS

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

STRINGS

- They vibrate to produce sound when plucked

A DIAGRAM SHOWING A TUBE FIDDLE



STRING

- It vibrates to produce sound when stroked

TUNING PEGS

- 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

BOW

- For stroking the string of a tube fiddle to produce 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

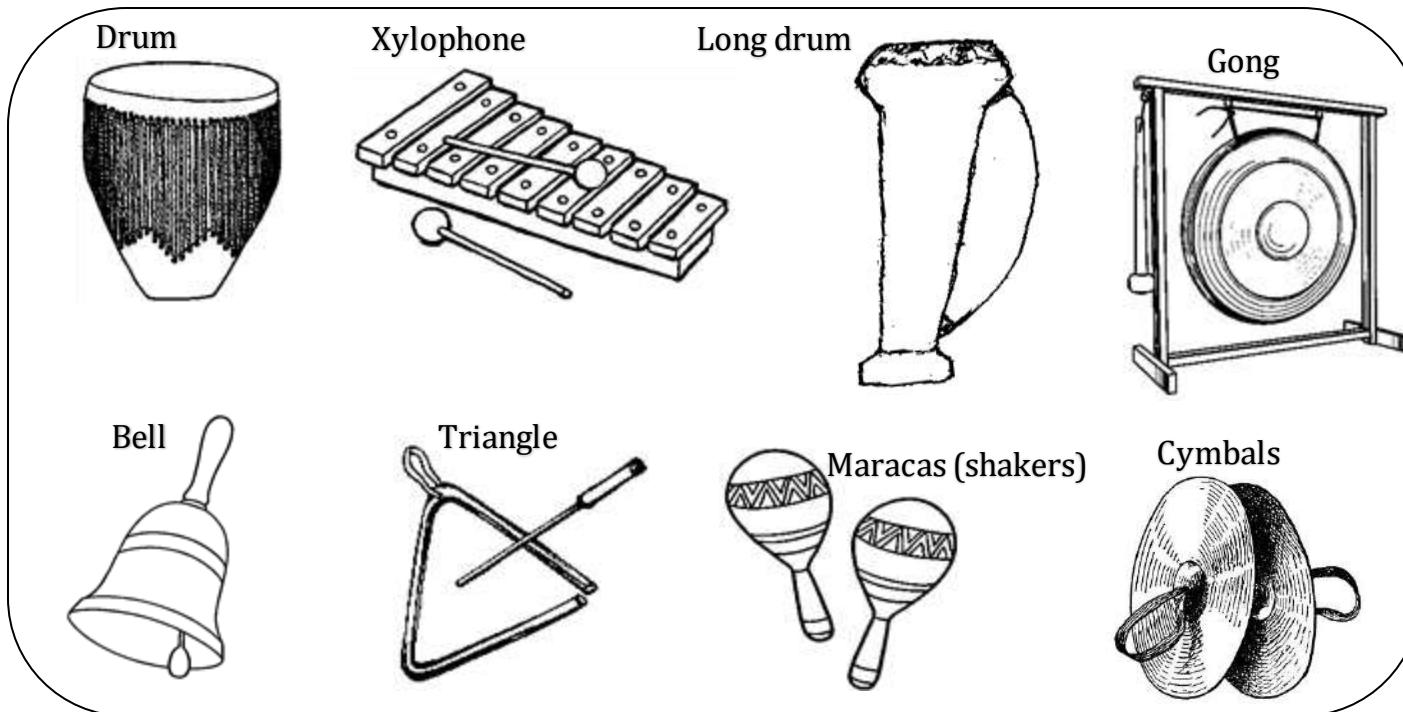
PERCUSSION INSTRUMENTS

- 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 / maracas
- Cymbals
- Shakers
- Rattles
- Timpani
- Castanet
- Triangle
- Bell
- Tambourine
- Gong
- Celesta

DIAGRAMS SHOWING PERCUSSION INSTRUMENTS



How do the following percussion instruments produce sound?

PIANO

- By vibration when its own hammer hits the strings

SHAKER

- By vibration of its skin and the objects inside it 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

BELL

- 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 | ▪ Trumpet |
| ▪ Oboe | ▪ Panpipes |
| ▪ Flute | ▪ Horn |
| ▪ Bugle | ▪ Vuvuzela |
| ▪ Clarinet | ▪ Tuba |
| ▪ Saxophone: By vibration of the reed on the mouth piece when blown | |

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 through 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) to transmit sound waves

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
- Altitude
- Wind
- 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 than 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

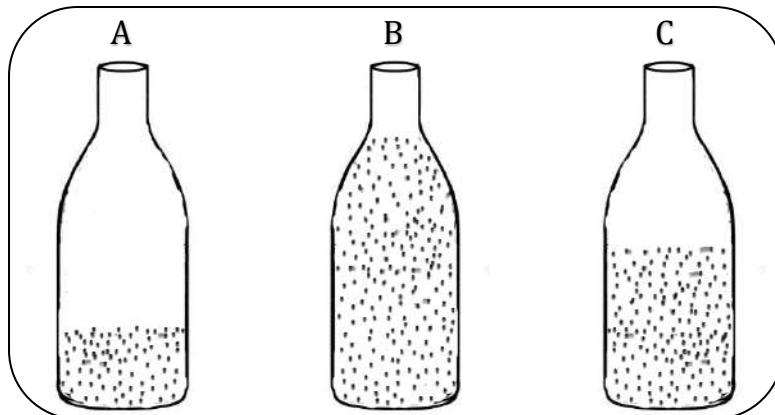
- ✓ Thin surfaces produce high pitch while thick surfaces produce low pitch

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

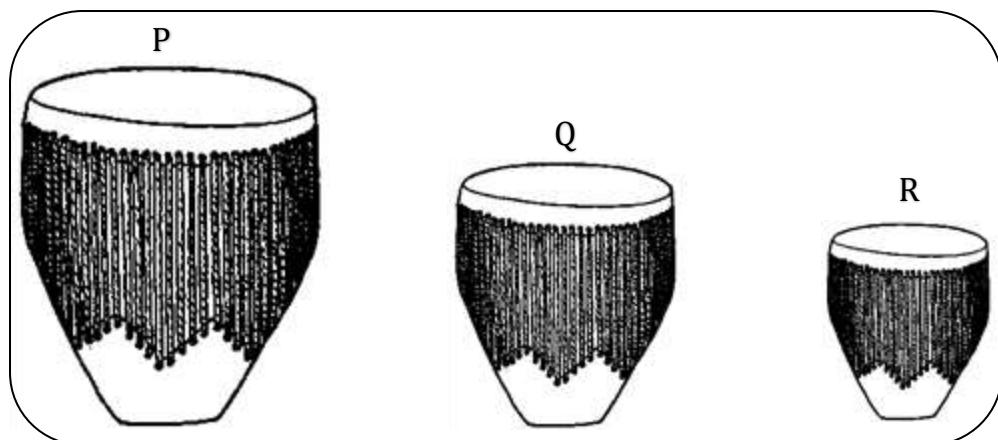


- Bottle B will produce sound of the highest pitch
- ✓ It has the smallest vibrating space
- Bottle C will produce sound of the higher pitch
- ✓ It has the bigger vibrating space
- Bottle A will produce sound of the lowest pitch
- ✓ It has the biggest vibrating space

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

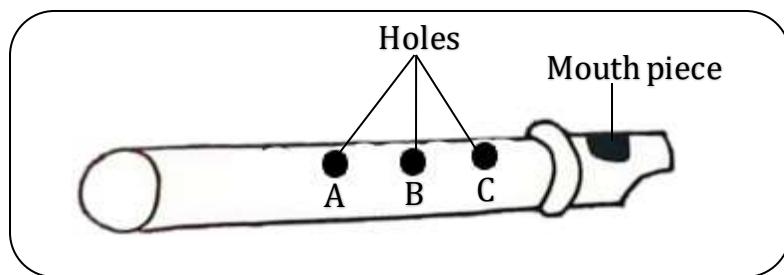


- Drum P will produce the lowest pitch
- ✓ It has the biggest vibrating surface
- Drum Q will produce the lower pitch
- ✓ It has the smaller vibrating surface
- Drum R will produce the highest pitch
- ✓ It has the smallest vibrating surface

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

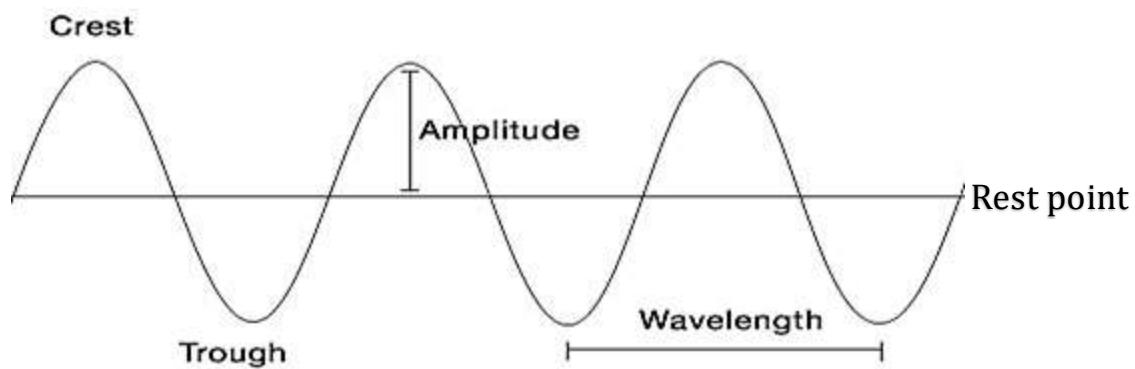
UNITS FOR MEASURING FREQUENCY

- Hertz (Hz)

FACTORS THAT DETERMINE FREQUENCY (F) OF SOUND

- Mass of the object
- Force that shakes the object

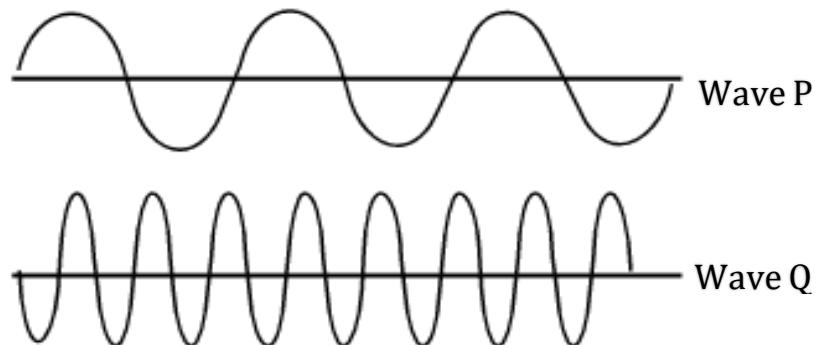
A DIAGRAM SHOWING A SOUND WAVE



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
- They are impermeable

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)

$$D = S \times T$$

$$D = 330 \text{ m/s} \times 4 \text{ s}$$

$$D = (330 \times 4) \text{ m}$$

$$D = 1320 \text{ m}$$

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 (Going to the cliff and coming back from the cliff to Mutaawe)

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

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

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

$$D = 1650 \text{ metres}$$

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)

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

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

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

$$D = 495\text{m}$$

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

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

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

$$T = 2 \times 2$$

$$T = 4 \text{ seconds}$$

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 = 165

330

T = 0.5 seconds

STORAGE OF SOUND

- This is the 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
- Staff 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
- Using a xylophone to play sound notes

RECORDING OF SOUND

- This is the act of making an audio record

DEVICES USED TO STORE RECORDED SOUND

- | | |
|------------------------------|-----------------------------------|
| ▪ Memory cards | ▪ Digital Video Discs (DVDs) |
| ▪ Video Compact Discs (VCDs) | ▪ 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

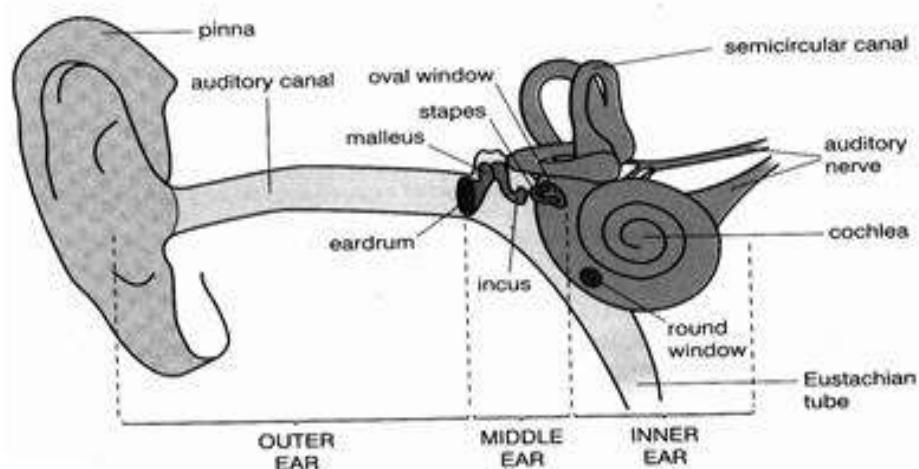
THE INNER EAR (LABYRINTH)

- 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

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?

- Semi-circular canals

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

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

Name two parts of the human ear that maintains body balance

- Semicircular canals
- Vestibule

Mention three body organs that maintain body balance

- Ears
- Eyes
- Brain

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
- Ear pain (earache)
- Mild hearing loss

SIGN OF INFECTED EARS

- Pus discharge from the ears

EAR DEFECTS (DISORDERS OF THE HUMAN EAR)

- Deafness
- Anotia
- Presbycusis

DEAFNESS (HEARING LOSS)

- This is the partial or total inability to hear

TYPES OF DEAFNESS

- Permanent deafness
- Temporary (partial) deafness
- Sensory 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

PRESBYCUSIS

- This is the gradual loss of hearing in both ears due to old age
- ✓ It affects people above the age of 65
- ✓ It is caused by changes in the inner ear to aging

ANOTIA

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

METHODS USED DURING COMMUNICATION WITH DEAF PEOPLE

- | | |
|-----------------|-----------------------|
| ▪ Sign language | ▪ Cued speech |
| ▪ Lip-reading | ▪ 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 a group of cells that work together to perform a specific function

ORGAN

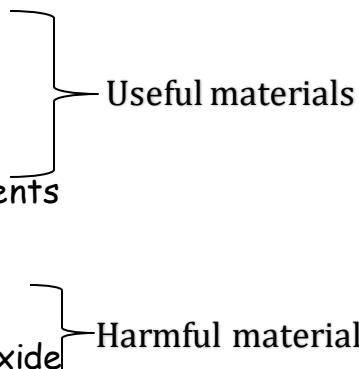
- This is a group of tissues that work together to perform a specific function

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
- ✓ Urea
- ✓ Carbon dioxide
- ✓ Poison



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

1. 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?

- Blood flows twice to the heart in a complete cycle.

2. 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**

HEARTBEAT

- This is the contraction and relaxation of the heart

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**

FACTORS THAT CAN INCREASE HEARTBEAT OR PULSE

- Excitement
- Fright
- Physical exercises
- High temperature
- Sickness
- Increased level of adrenaline hormone
- ✓ **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
- Diastole phase

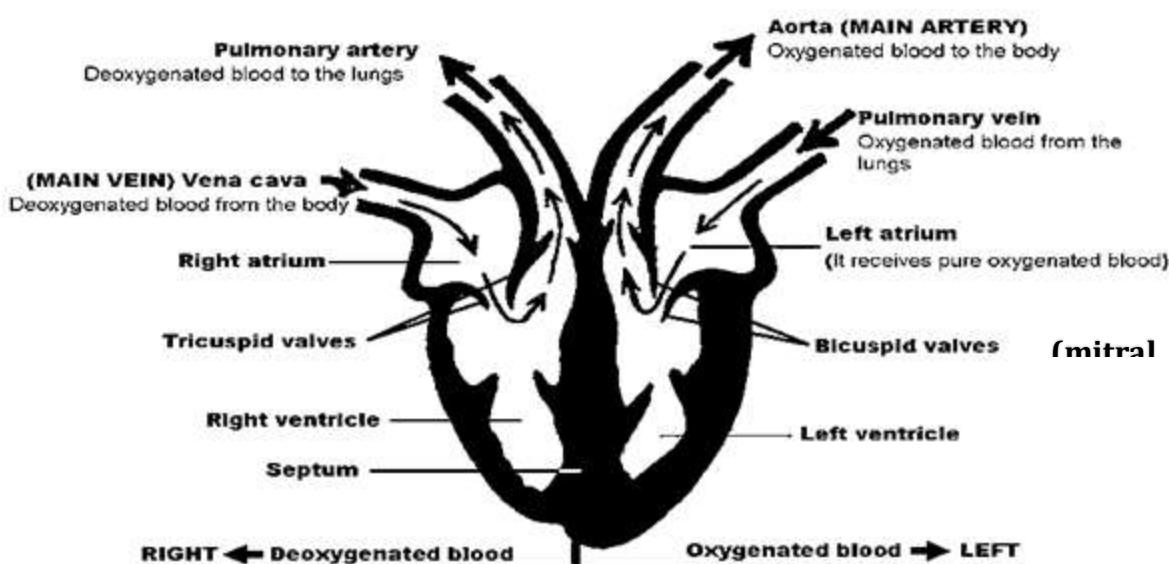
1. SYSTOLE PHASE

- This is contraction of the ventricles to push blood into the arteries.
- During this phase, the auricles are filled with blood

2. 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

- **Mitral (bicuspid) valves and tricuspid valves**

They prevent the back flow of blood into the atria

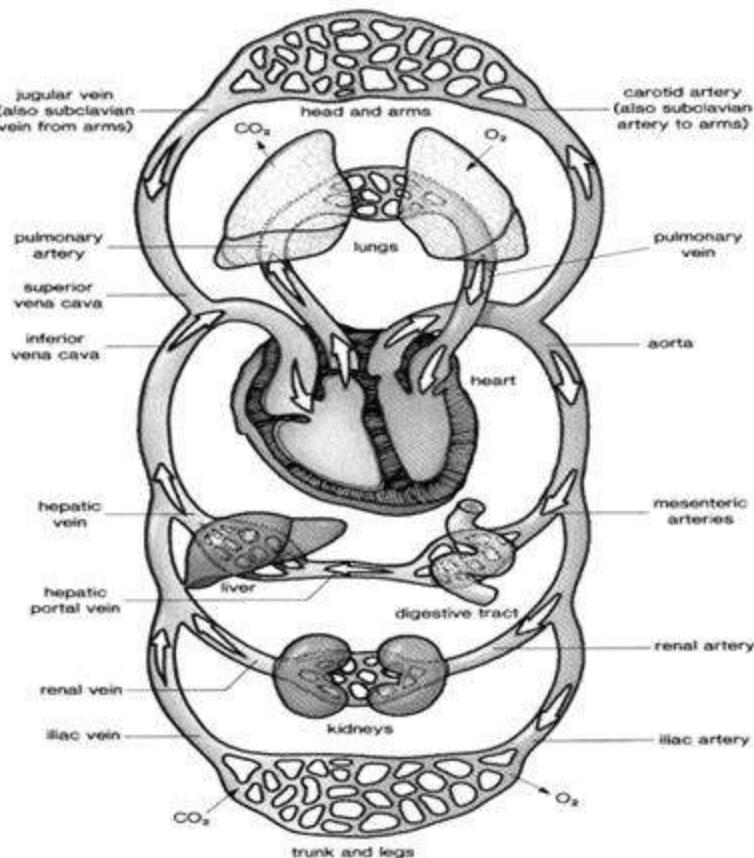
- **Semilunar valves**

They prevent the back flow of blood from the arteries into the ventricles

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

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

THE DIAGRAM TO SHOW CIRCULATION OF BLOOD



BODY ORGANS RELATED TO BLOOD CIRCULATION

KIDNEYS

- They filter blood (they purify blood)
- They balance salt and water level in 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

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

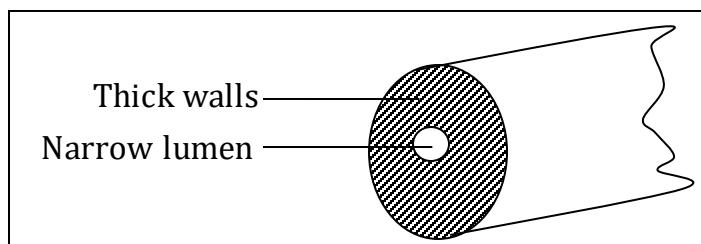
CHARACTERISTICS OF ARTERIES

- 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 back 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

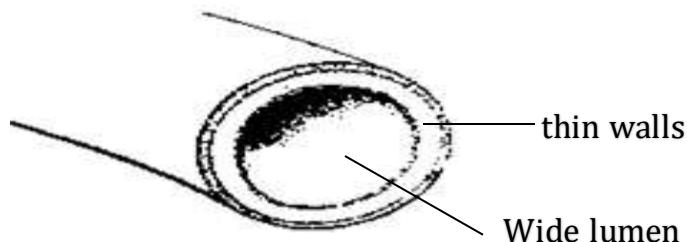
CHARACTERISTICS OF VEINS

- 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 wide 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

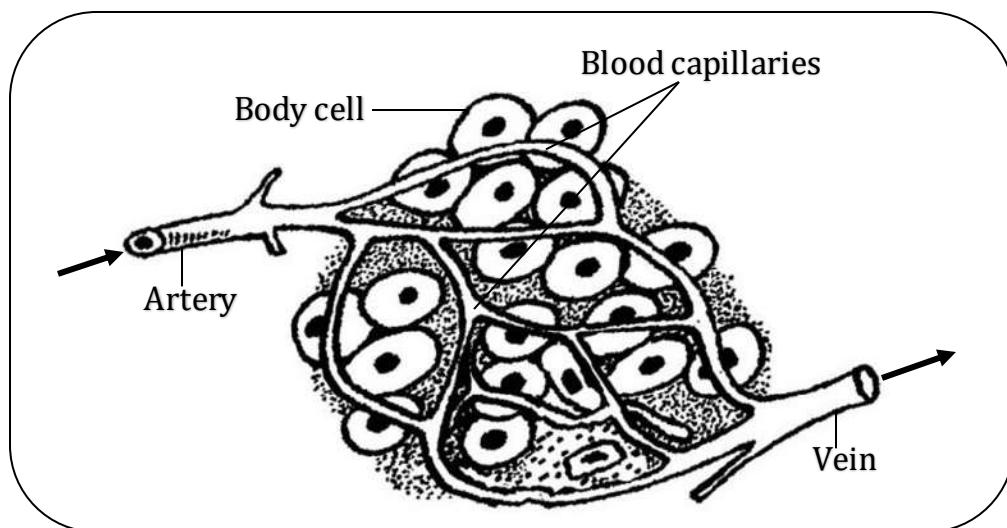
CHARACTERISTICS OF CAPILLARIES

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

FUNCTIONS OF CAPILLARIES

- They allow exchange of materials between blood and body cells
- They connect arteries and veins
- They take waste products away from the body cells / tissues

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 valves
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
- Deoxygenated 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

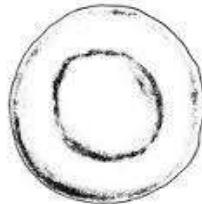
In which form is oxygen transported in blood?

- 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

In which body parts are white blood cells made?

- Bone marrow of long bones
- Lymph nodes
- Spleen

Function of white blood cells

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

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 person 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

NOTE

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

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

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
- 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
- Artherosclerosis (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

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

State the importance of the cold water and heat in the process above

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

NOTE

- The boiling point of alcohol is 78°C
- The boiling point of alcohol is 100°C

EXAMPLES OF DISTILLED ALCOHOLIC DRINKS

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

Advantage of distillation

- Concentrated alcohol is collected

Disadvantages of distillation

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

Why is alcohol collected by distillation very concentrated?

- It does not contain water

USES OF ALCOHOL

- 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 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 clean (sterilize) clinical thermometers
- It is used to mix some drugs in hospitals
- It is used in hand sanitizers to kill germs on hands

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
- To break boredom
- To show that they are rich.
- To be brave
- Young people drink to show that they are mature

Misconceptions (myths) about alcohol

- Alcohol improves mental performance
- Alcohol solves social problems

ALCOHOLISM

- Alcoholism is a condition where a person totally depends on alcohol.
- Alcoholism is a condition that results from prolonged use of alcohol.

Who is an alcoholic?

- This is a person addicted to alcohol.

Addiction

- This 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 background
- Seductive advertisements
- Social environment
- Idleness
- Stress

EFFECTS OF ALCOHOLISM TO AN INDIVIDUAL

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

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

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

EFFECTS OF ALCOHOLISM ON THE COMMUNITY

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

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/HEALTHY 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

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.

SMOKER

- This is a person who inhales tobacco smoke frequently.

KINDS / GROUPS OF SMOKERS

- Active smoker

✓ This is a person who inhales smoke directly from burning cigarette or smoking pipe.

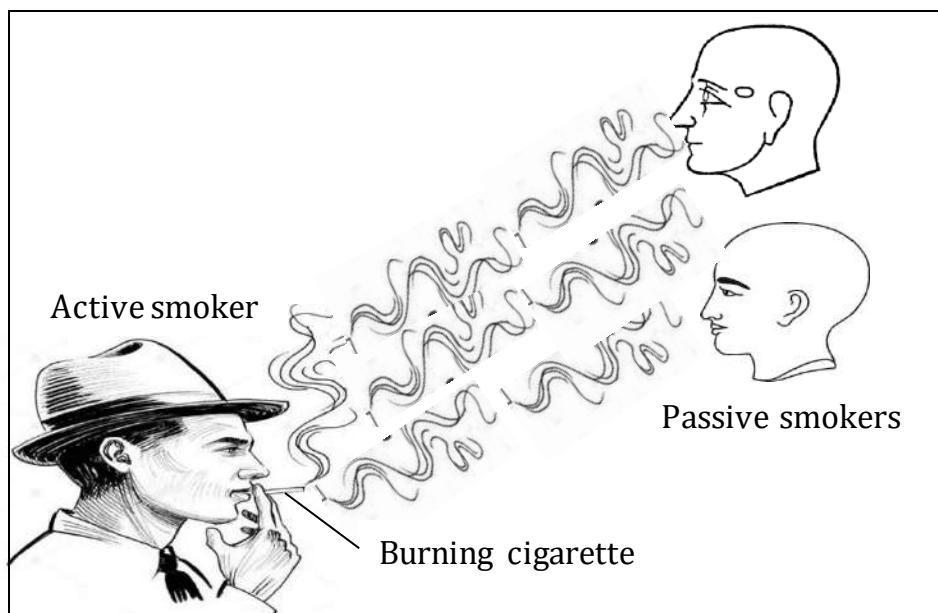
- Passive Smoker

✓ This is a person who inhales tobacco smoke from an active smoker.

Who is an exsmoker?

✓ This is a person who has smoked more than 100 cigarettes in his or her life but has not smoked in the last 28 days.

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

REASONS WHY PEOPLE SMOKE

- To pass time/ to relax
- To concentrate on work
- To feel warm
- To fit in groups of smokers (peer influence)
- To feel confident
- To look mature
- To look attractive
- Due to seductive advertisements on radios and televisions.

FACTORS / CONDITIONS WHICH LEAD TO SMOKING AND ALCOHOLISM

- Ignorance
- Seductive advertisements
- Family background
- Peer pressure
- Boredom
- Stress (frustration)
- Idleness

Effects of smoking to an individual (to the human body)

- It causes some respiratory diseases
- It worsens some respiratory diseases
- It spoils the colour of teeth
- It worsens stomach ulcers
- 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)

Respiratory diseases caused by smoking

- Lung cancer
- Emphysema
- Chronic bronchitis

Respiratory diseases not caused by smoking

- Asthma
- Pneumonia
- Tuberculosis

Effects of smoking to pregnant women

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

Effects of smoking to the family

- 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

Effects of smoking to the community

- 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

How to avoid smoking

- 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

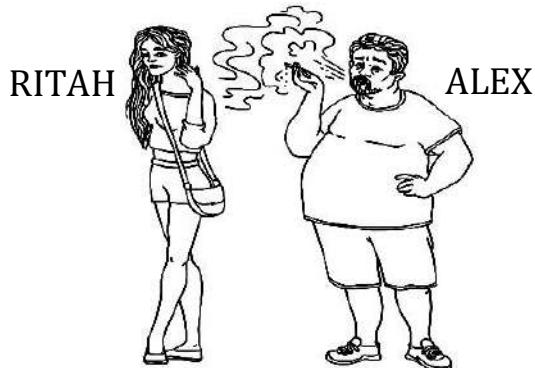
Note. The irritant substance in cigarettes is called Carcinogen.

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.*



(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.

Examples of people's health needs

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

QUALITIES/CHARACTERISTICS OF ESSENTIAL DRUGS

- 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

EXAMPLES OF ESSENTIAL DRUGS

- 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
- Mululuza
- Lweza
- Nnalongo
- Enkejje

GROUPS OR TYPES OF ESSENTIAL DRUGS

- Laboratory manufactured drugs
- Traditional (herbal) drugs

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 | ▪ Hedex |
| ▪ Chloroquine | ▪ Panadol |
| ▪ Quinine | ▪ Coartem |
| ▪ Fancida | ▪ Mebendazole |

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 and dewormers.

Examples of preventive drugs

Vaccines	Dewormers for children
BCG vaccine	Mebendazole
Measles vaccine	Albendazole
Polio vaccine	
Yellow fever vaccine	
DPT 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

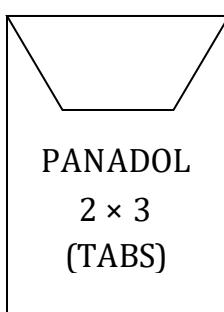
- Name of the drug
- Dosage

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.

Reasons why people take underdose (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

- Manufacture date
- Composition of the drug
- Method of taking a drug e.g injection, swallowing or ointment

MANUFACTURE 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

TERM TWO

CLASSIFICATION OF PLANTS

Plants are living things with chlorophyll and can make their own food.

They belong to plant kingdom of living things

Characteristics of plants

They have chlorophyll

They make their own food (they are autotrophs)

They are multicellular organisms

They breathe through stomata

Plant cells have cell walls

They have leaves, roots and stems

How do plants benefit from animals?

Plants get carbon dioxide from animals.

Plants get manure from animals.

Some animals help in pollination.

Some animals help in seed dispersal.

Some plants get care from some animals.

How do animals benefit from plants?

Some animals get food from plants.

Animals get oxygen from plants.

Some animals get herbal medicine from plants.

Some animals get shelter from plants.

State the importance of plants in the environment.

Plants provide food.

Plants provide herbal medicine.

Plants provide wood fuel.

Plants provide timber.

Plants provide poles for building houses.

Plants purify air.

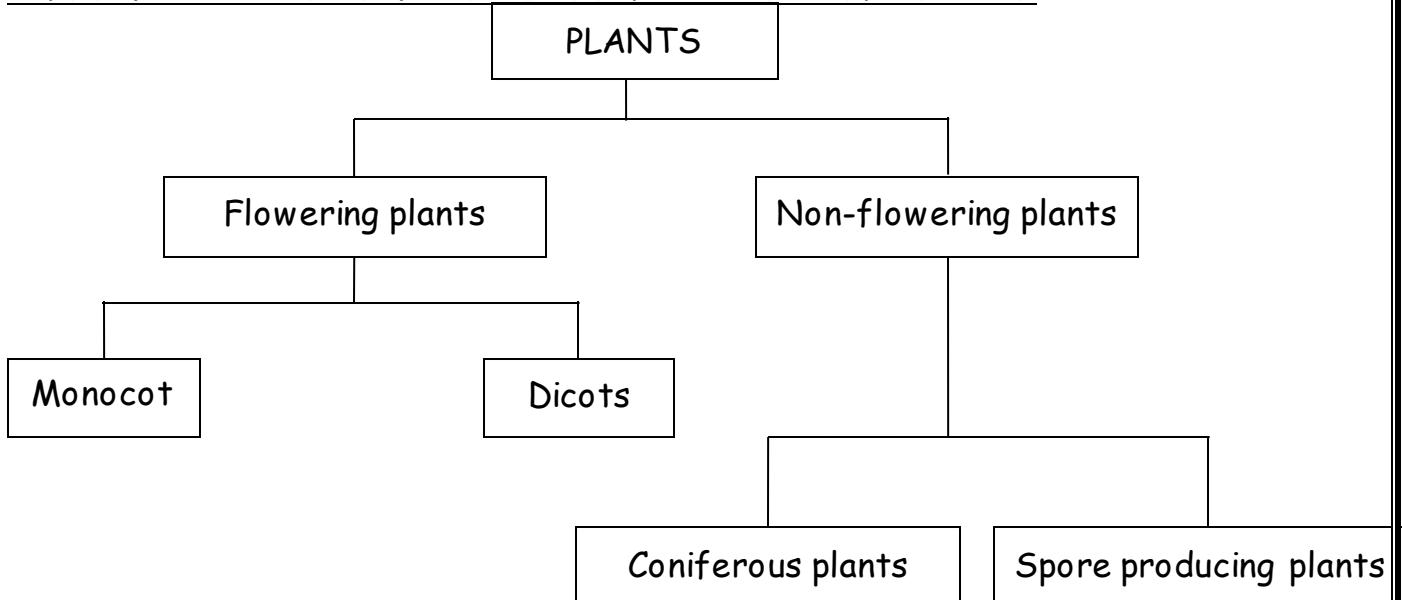
Plants help in water cycle.

GROUPS OF PLANTS:

Non flowering plants

Flowering plants

A FLOW CHART SHOWING CLASSIFICATION OF PLANTS



NON-FLOWERING PLANTS

These are plants which do not bear flowers.

Groups (classes) of non-flowering plants

Spore producing plants

Coniferous plants/conifers

SPORE BEARING PLANTS

These are plants that reproduce by means of spores.

Examples of spore producing plants:

Ferns

Horsetails

Mosses

Hornworts

Liverworts

What is a spore?

This is a reproductive cell that can develop into a new organism without fusion with another reproductive cell.

Spores in plants are produced and stored by the **sporangium (spore case)**.

Mature spores are always dispersed by **wind or insects**

FERNS

They have chlorophyll and can make their own food

They have proper leaves, roots and stems.

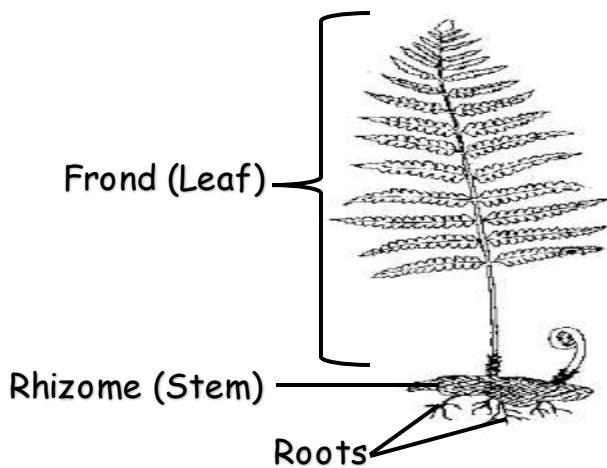
They reproduce by means of spores.

Their spores are produced on the lower side of the leaves in brown spore cases.

They grow in shady moist places (damp places).

They dry when exposed to direct sunshine

Diagrams showing ferns



A leaf of a fern is called a **frond** while the stem is called **rhizome**.

Why is the fern regarded as the most advanced spore producing plant?

It has proper leaves, roots and stems.

MOSSES

These are small green plants.

They have stalk, leaves and rhizoid

They grow in areas of high humidity and in cold regions

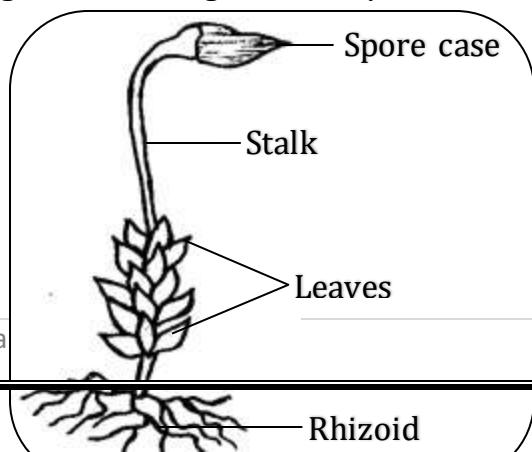
They grow on house roofs, veranda, and tree trunks, on rotting logs, damp rocks, and soil in damp places.

Spores are produced and stored by the spore case (sporangium)

Reproduce by means of spores.

Contain chlorophyll and makes its own food.

A diagram showing a moss plant

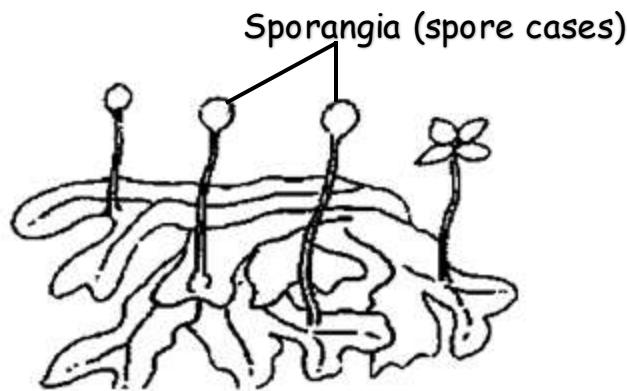


Importance of mosses

Their rhizoids hold soil to prevent soil erosion.

Peat moss is used to make organic fuel e.g peat moss.

3. Liverworts



They have flat liver like shape of their main body

They have plate-like or leaf like structures with chlorophyll to make food

They grow in warm moist places

They reproduce by means of spores.

Its spores are produced in a bulb like spore case (sporangium)

4. Hornworts

These are the smallest group of bryophytes

They grow in damp areas such as ditches, along edges of streams and near the shores of lakes

They look like liverworts

Reasons why mosses, liverworts and ferns are called plants

They have chlorophyll

They can make their own food

They have leaves, stems and roots

CONIFERS

These are non-flowering plants that reproduce by means of seeds

They store their seeds in cones

Most conifers have small needle-like leaves.

They are evergreen trees

EXAMPLES OF CONIFERS

Pine	Juniper	Hemlock
Spruce	Larch	Podocarpus (podo)
Fir	Cypress	
Cedar	Redwood	

Why is pine called a conifer?

It doesn't bear flowers but reproduces by means of seeds.

How do conifers reduce the rate of transpiration?

Most conifers have small needle-like leaves; to reduce the surface area for transpiration.

They cover their leaves with a waxy layer.

They have a thick cuticle on the upper surface of their leaves.

Economic importance of conifers

Some conifers are sold for income.

Some conifers act as tourist attractions.

They provide soft wood timber.

Other importance of conifers.

Some conifers act as live fences.

Some conifers act as wind breaks on compounds.

They help in rain formation.

They act as natural habitat for wild animals.

They help to control soil erosion.

They purify air in the environment.

Some conifers provide food e.g pine nuts.

Uses of soft wood timber.

For making papers.

For making match sticks.

For making plywoods.

ORGANISMS RELATED TO PLANTS:

Algae

Euglena

Lichens

ALGAE

They belong to kingdom protista.

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.

They can also live in moist soil, on tree barks, moist rocks and inside hydra cells.

What is algal bloom?

This is the rapid increase in population of algae on a water body.

EXAMPLES OF ALGAE

Giant kelp / Seaweeds

Spirogyra

Stonewort

Volvox

Brown algae (Fucus / Rockweed)

Diatom

TYPES OF ALGAE

Red algae

Green 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)

EUGLENA

This is a unicellular organism with features of both plants and animal.

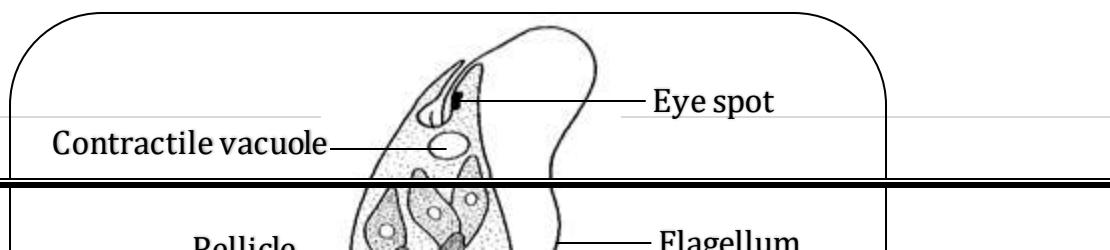
It has chlorophyll so makes its own food.

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.

A DIAGRAM SHOWING EUGLENA



LICHENS

These are organisms which are partly algae and partly fungi.

Lichen is a symbiosis feeding relationship between fungus and alga.

It reproduces by means of spores.

Have chlorophyll and can make its own food.

The alga makes food while the fungus absorbs water from the atmosphere this enables lichen to grow on dry rocks.

FLOWERING PLANTS

These are plants that bear flowers.

They reproduce by means of seeds.

GROUPS OF FLOWERING PLANTS

Monocotyledonous plants (monocots)

Dicotyledonous plants (dicots)

MONOCOTYLEDONOUS PLANTS

These are plants whose seeds have one cotyledon

Characteristics of monocots

They have seeds with one cotyledon

They undergo hypogeal germination

They have fibrous root system

They have parallel leaf venation

Examples of monocots

Millet

Barley

Maize

Wheat

Sorghum

Oats

Rice

Sugar cane

Rye

Onion

Grass

CEREALS

These are plants which produce grains (corns).

Examples of cereals

Maize

Sorghum

Wheat

Barley

Millet

Rye

Rice

Oat

Points to note about cereals

They produce grains

They are annual crops

These are crops which mature within one year.

Tall cereals develop prop roots (maize, millet, sorghum and wheat) during flowering stage.

To provide extra support to the plant.

They are wind pollinated (since they have flowers without petals).

They have green leaf-like scales instead of petals

To protect the inner parts of the flower.

Uses of cereals

They are used as food by man (they are sources of carbohydrates)

They are used to make alcoholic drinks

They are used as animal feeds

They are used to make corn oil (e.g maize)

DICOTYLEDONOUS PLANTS

These are plants whose seeds have two cotyledons.

Examples of dicots

Beans

Mango

Soybeans (soya beans)

Orange

Peas

Cassava

Groundnuts

Pawpaw

Characteristics of dicots

They have seeds with two cotyledons

They undergo epigeal germination

They have tap root system

They have network leaf venation

LEGUMES

These are plants with root nodules

They store their seeds in pods

Examples of legumes

Beans

Soybeans (soya beans)

Peas

Groundnuts

Uses of legumes

They are used as food (they are source of plant proteins)

They improve soil fertility

By fixing nitrogen in the soil

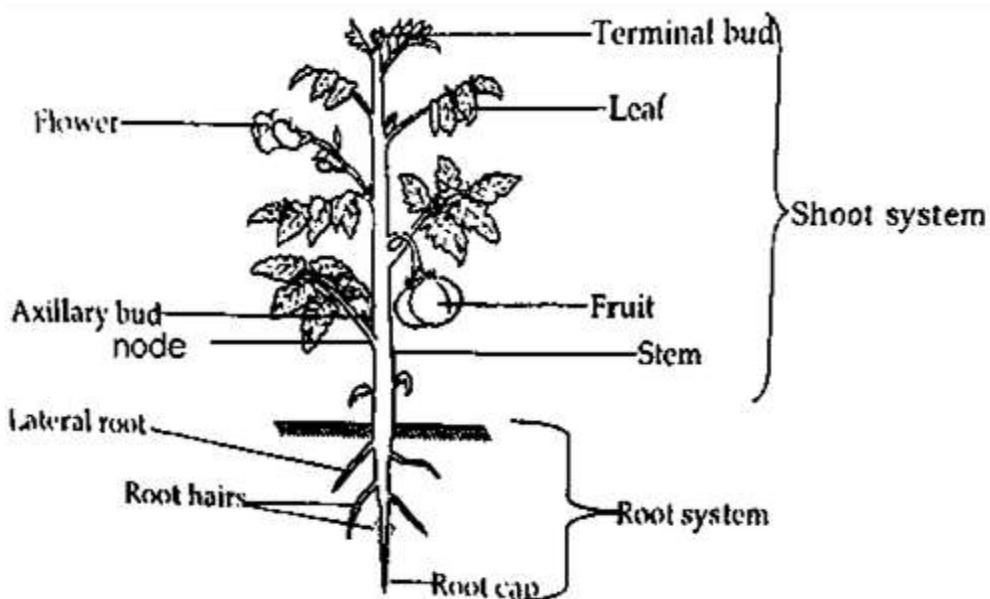
They are source of income when sold

Some legumes can be used to make oil e.g groundnuts

DIFFERENCES BETWEEN DICOTS AND MONOCOTS.

MONOCOTS	DICOTS
Have seeds with one cotyledon	Have seeds with two cotyledons
Have fibrous root system	Have taproot systems
Have parallel leaf venation	Have network leaf venation
Undergo hypogeal germination	Undergo epigeal germination

PARTS OF A FLOWERING PLANT



SYSTEMS OF A FLOWERING PLANT

Shoot system

Root system

SHOOT SYSTEM

This is the system of a plant that grows above the ground.

It consists of; the stem, leaves, lateral/axillary bud, terminal bud, flowers, fruits nodes and internodes

ROOT SYSTEM

This is the part of a plant that grows below the soil.

It consists of; main (tap root), root hairs, lateral root and root cap

TYPES OF ROOT SYSTEMS

Fibrous root system

Tap root system

TAP ROOT SYSTEM

This is where the radicle forms a main (tap) root with lateral roots

It is found in dicotyledonous plants

Examples of plants with tap root system

Bean plant

Orange

Soybeans (soya beans)

Cassava

Peas

Pawpaw plant

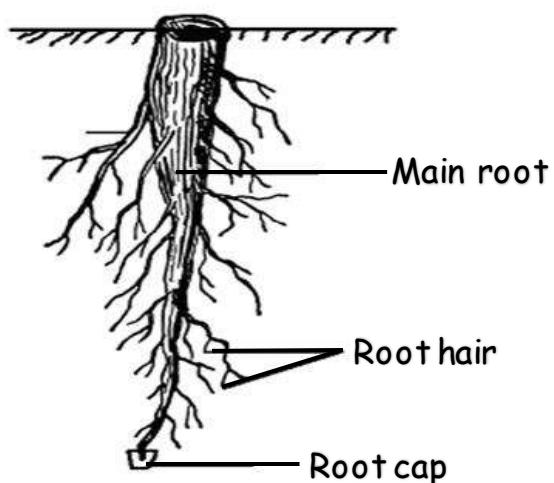
Groundnuts

Avocado plant

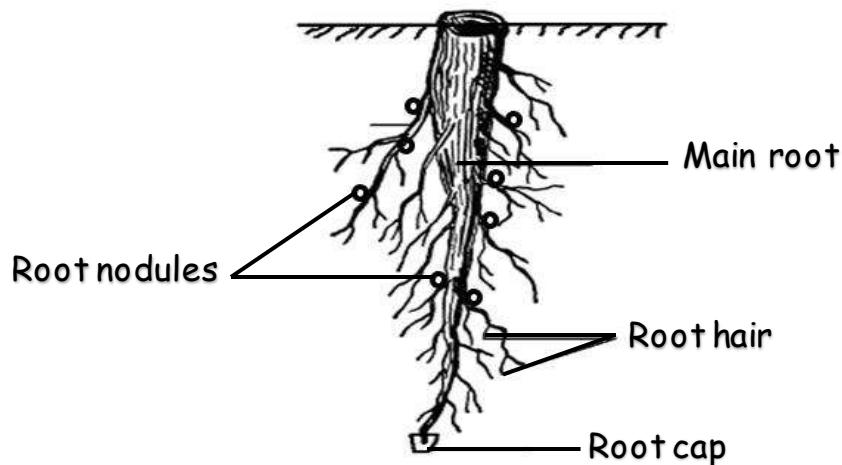
Mango

Jack fruit plant

Structure of a tap root system



A diagram showing the tap root system of legumes (e.g bean plant or cow peas)



FUNCTIONS OF THE PARTS

Main root

To hold the plant firmly in the soil.

Lateral roots

They increase water uptake.

They provide support to the plant in the soil.

Root hairs

They absorb water and mineral salts from the soil

Root hairs absorb water and minerals salts from the soil by a process called Osmosis.

Root cap

It protects the tip of the growing root from damage

Root nodules

They store nitrogen fixing bacteria (rhizobia)

State the importance of nitrogen fixing bacteria stored in root nodules

They fix nitrogen in the soil

They help in formation of root nodules

State the importance of planting legumes in the garden.

They improve soil fertility (they fix nitrogen in the soil)

FIBROUS ROOT SYSTEM

This is where many roots of the same size and length grow from the radicle.

It is common in monocotyledonous seeds

Examples of plants with fibrous root system

Millet

Maize

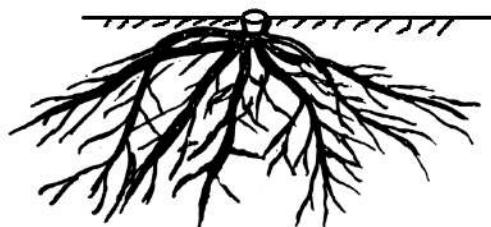
Sorghum

Rice

Rye
Barley
Wheat
Oats

Sugar cane
Onion
Grass

Diagram showing fibrous root system



TYPES OF ROOTS

Primary roots

Adventitious roots (secondary roots)

PRIMARY ROOTS

These are roots which develop from the radicle.

Examples of primary roots

Tap root e.g in bean plant and groundnuts

Fibrous roots: e.g maize, wheat, rice and in grasses

ADVENTITIOUS ROOTS (SECONDARY ROOTS)

These are roots which grow from any part of the plant but not from the radicle.

Examples of adventitious roots

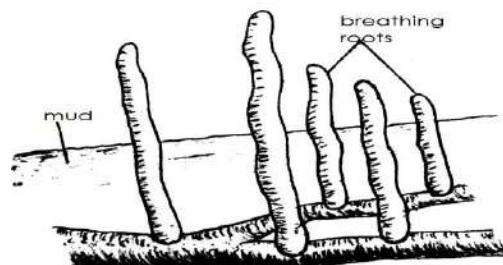
BREATHING ROOTS.

They grow upwards above the ground.

They are common in plants in waterlogged areas e.g mangrove

They help the plant to breathe

Diagram showing breathing roots



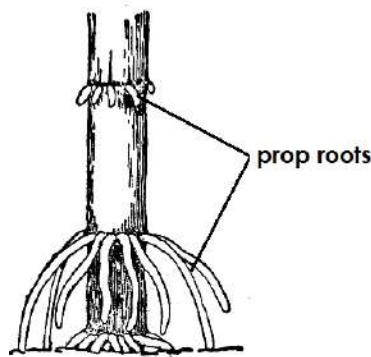
PROP ROOTS.

They grow from the nodes of the stem.

They are mainly found in monocot plants e.g maize, sorghum, millet and sugarcane.

They grow in tall cereals during the flowering stage to provide extra support e.g maize, sorghum and millet.

Diagram showing the prop roots.



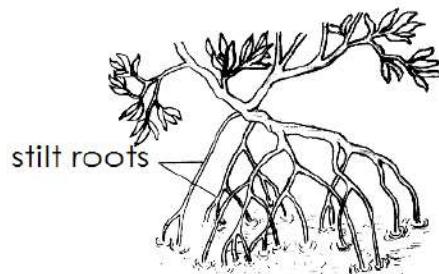
Buttress roots: e.g silk cotton trees and mahogany

STILT ROOTS.

They are found on plants which grow in swamps.

They give extra support to a plant.

Diagram showing stilt roots



Clasping roots

Roots of rhizomes

Roots of bulbs

Roots of corms

Roots of yam

Storage roots: store food for the plant

They are swollen because they store starch.

Examples of storage roots (root tubers)

Carrots

Parsnip

Cassava

Beetroot

Sweet potatoes

Swede

Turnip

Dahlia

Diagrams showing a carrot and sweet potato root tubers

Carrots are rich in vitamins e.g vitamin A

Diagram

Qn. What are aerial roots?

These are adventitious roots which grow above the ground

Examples of adventitious roots which grow above the ground /aerial roots

Prop roots

Stilt roots

Clasping roots

Buttress roots

Breathing roots

Functions of roots to the plant

Absorb water and mineral salts from the soil by **osmosis**

Hold the plant firmly in the soil.

Some roots store food for the plant.

Some roots help the plant to breathe.

Uses of roots to man

Some roots are sold to get income.

Some roots are source of food.

Some roots are used as herbal medicine.

Some roots provide wood fuel.

Dangers of roots to man

Some roots are poisonous when eaten

Some roots damage people's houses

OSMOSIS

This is the movement of water molecules from a region of low salt concentration to a region of high salt concentration through a semi-permeable membrane.

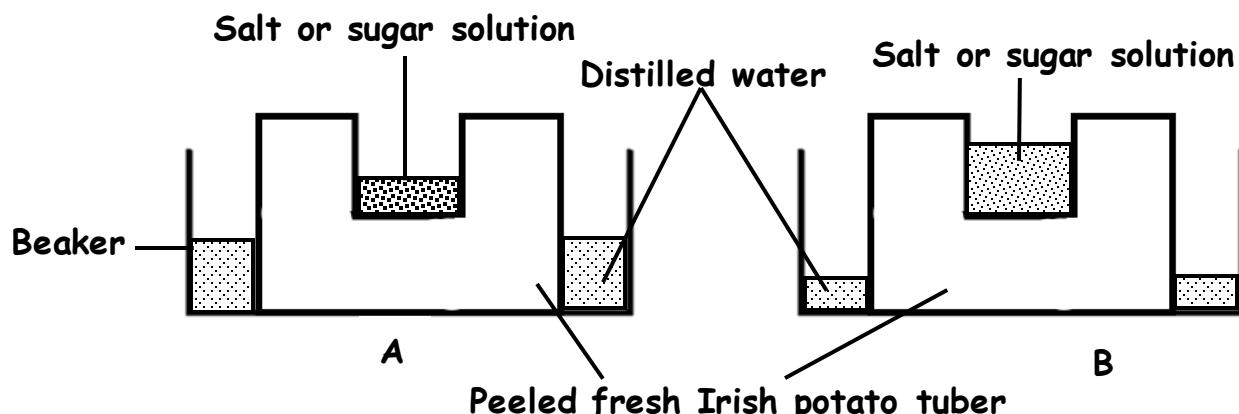
Absorption of water and mineral salts (mineral salt solution) by roots is by **osmosis**

Absorption of water by plant roots is by **osmosis**.

Absorption of mineral salts by roots is by **active transport**.

Water moves from the roots to other plant parts (stems and leaves) by **capillary action**

An experiment showing osmosis



What is the experiment above about?

Osmosis

State the role played by peeled fresh Irish potato in the experiment above.

It acts as a semi-permeable membrane

It allows movement of water molecules from distilled water in the beaker into the sugar or salt solution.

Why is salt or sugar solution placed in the cavity drilled into the Irish potato?

To act as an area of high salt concentration.

Why did the water level in the beaker decrease as shown in diagram B?

Some water molecules moved from the beaker towards salt or sugar solution.

Water molecules moved from a region of low salt concentration to the region of high salt concentration.

What can't osmosis occur in a boiled Irish potato?

A boiled Irish potato has dead cells yet osmosis can only occur in living cells.

Importance of osmosis to plants

It enables absorption of water and mineral salts by the plant roots.

It enables transportation of water from roots to other plant parts.

It enables movement of water from one plant cell to another.

How do animals benefit from osmosis?

It enables re-absorption of water in the medulla of the kidney.

A DIAGRAM SHOWING A STEM

Functions of each part of the stem

Node: it is where a leaf or flower is fixed (grows from)

Internode: it is the region between two nodes

Terminal bud: it is the growing tip of the plant

Axillary/lateral bud: it grows into branch or leaf or flower

An axillary bud is found in the axil

Axil: the angle between each leaf and the stem

FUNCTIONS OF THE STEMS TO PLANTS

They transport water and mineral salts from the roots to the leaves

They transport glucose/starch from the leaves to other parts of a plant (they help in translocation)

They hold up the leaves to get sunlight

They hold the flower for pollination

They hold fruits for proper dispersal

Green stems make food for the plant

Some stems store food for the plant.

Translocation

This is the movement of food (glucose) from the leaves to other parts of a plant

FUNCTIONS OF STEMS TO MAN

Some stems provide food to man

Some stems provide herbal medicine

Some stems are sold for income

Some stems provide timber

Some stems provide wood fuel

Some are used in vegetative propagation

TYPES OF STEMS

Upright stems

Weak stems

Underground stems

With diagrams

Weak stems

These are stems which cannot support themselves upright.

Groups of weak stems

Creeping stem

Climbing stems

REASONS WHY PLANTS CLIMB OTHERS (WHY DO PLANTS CLIMB OTHERS?)

To get enough sunlight

To get extra support

WAYS HOW PLANTS CLIMB OTHERS (HOW DO PLANTS CLIMB OTHERS?)

Use of tendrils e.g passion fruits, cucumber, watermelon, gourd, pumpkin and cowpeas

Use of hooks e.g strawberry

Hooks are pointing downwards to prevent the climbing plant from slipping off the plant.

By twining or clasping e.g morning glory, tomato, vanilla and some beans

UNDERGROUND STEMS

They have buds, scale leaves and adventitious roots

They are swollen because they store food (starch)

Why are underground stems sometimes called storage stems?

They store food (starch)

Groups of underground/storage stems

Stem tubers

Rhizomes

Bulbs

Corms

STEM TUBERS

These are swollen underground stems that store food

We eat the stem tuber

Examples of stem tubers

White yam

Irish potatoes

A diagram showing a stem tuber (e.g Irish potato)

Scale leaf: it protects the axillary bud

Axillary bud: it develops into a shoot

Stem tuber: it stores starch

How are white yams and Irish potatoes propagated?

By means of stem tubers

Why is a sugarcane plant not called a stem tuber?

Its storage stem is above the ground while that of a stem tuber is found underground

Its storage stem is not found underground

BULBS

These are swollen underground stems with swollen fleshy leaves

They have adventitious roots

Examples of bulbs

Onion

Shallot

Garlic

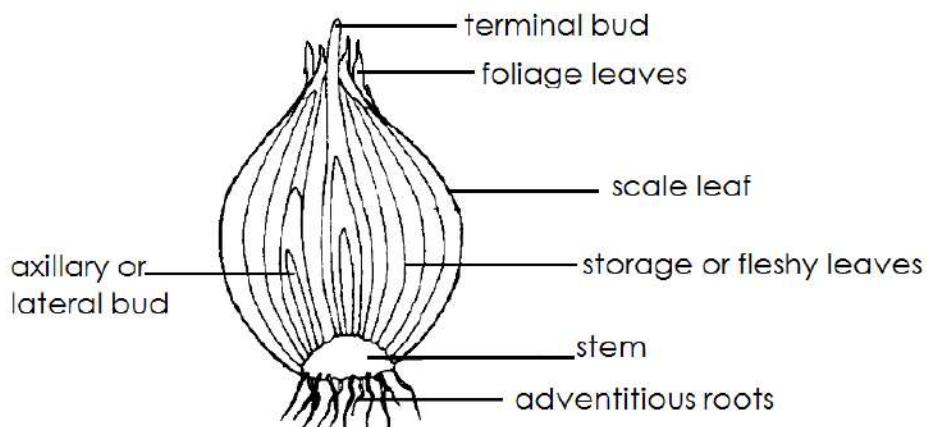
Spider lily

Tulip

Daffodil (Narcissus)

Amaryllis

A diagram showing a bulb (e.g onion)



Foliage leaves: to make food

Fleshy leaves: to store food

Scale leaves: to protect the fleshy leaves

Stem: to hold the fleshy leaves / to conduct water and mineral salts from the roots to the leaves

Adventitious roots: to provide extra support / to absorb water and mineral salts from the soil

Terminal bud: to enable the plant grow taller

Axillary bud: to develop into a new shoot

How are onions propagated?

By means of bulbs

By means of seeds

RHIZOMES

These are horizontal underground stems that store food

They have adventitious roots which grow from nodes of the stem

Examples of rhizomes

Ginger

Canna lily

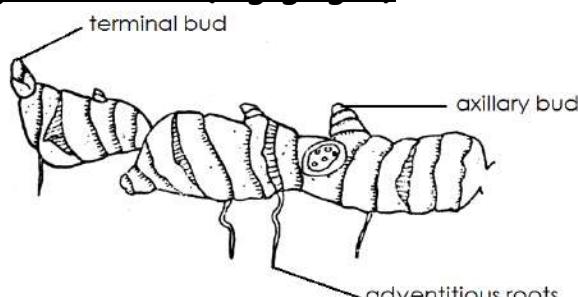
Turmeric

Couch grass

Zoxya

Spear grass

A diagram showing a rhizome (e.g ginger)



How is ginger propagated?

By means of rhizomes

CORMS

These are short vertical underground stems that store food

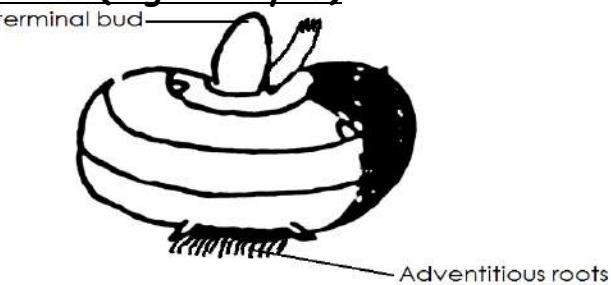
Examples of corms

Coco yam

Crocus

Gladiolus

A diagram showing a corm (e.g coco yam)



How is coco yam propagated?

By planting of corms

THE STRUCTURE OF A LEAF

FUNCTIONS OF EACH PART OF A LEAF

Leaf blade/lamina

For photosynthesis/ It helps in making of starch

For respiration

It is where transpiration mainly takes place

It is where the breathing organs (stomata) are found

Apex

It is the sharpest tip of the leaf

It provides protection to the leaf

Stomata

For breathing

Allow out water during transpiration

Let in carbon dioxide by diffusion during day time and oxygen during night time.

Veins

They transport water and mineral salts in the leaf

They transport food from the leaf blade to the main vein (midrib)

Leaf stalk (petiole)

It holds a leaf

It transports water from the stem to the leaf

It transports food from the leaf to the stem

Leaf base

It attaches the leaf to the stem

Leaf blade (lamina)

It is where photosynthesis occurs

FUNCTIONS OF LEAVES TO PLANTS

They make food for the plant (carry out photosynthesis)

They plants in breathing

They carry out transpiration

Some leave store food for the plant e.g cabbage and onion

FUNCTIONS OF LEAVES TO PEOPLE

Some leaves are eaten as food

They are sold for income

They are used as herbal medicine

They are used as animal feeds

Dry leaves can be used as mulches

Some leaves can be used for plant propagation e.g bryophyllum

They are used for thatching houses

For decoration

Tea leaves can be used on beverages

TYPES OF LEAVES

Simple leaves

Compound leaves

SIMPLE LEAVES

These are leaves with one leaf blade and leaf stalk

They have one leaflet on the stalk

They have one leaf stalk

They have one margin

Their leaf blade (lamina) is undivided or not completely divided

Examples of simple leaves

Simple entire e.g mango, avocado and jack fruit

Simple serrated e.g black jack

Simple divided entire

Simple lobed

Simple palmate e.g pawpaw and castor oil

Monocotyledons leaf (simple lanceolate leaf) e.g maize, sorghum, millet, elephant grass, rice and reeds

Diagrams of simple leaves

COMPOUND LEAVES

These are leaves with more than one leaflet on the stalk.

They have many leaflets

They have many leaf stalks

EXAMPLES OF COMPOUND LEAVES

Compound pinnate e.g acacia and eucalyptus

Compound bipinnate e.g jacaranda

Compound digitate e.g cassava and silk cotton leaves

Compound trifoliate e.g beans and soya beans

Compound bifoliate e. g bryophyllum

Diagrams of compound leaves

LEAF VENATION

This is the arrangement of veins in the leaf

Types of leaf venation

Network leaf venation (reticulate leaf venation)

Parallel leaf venation

NETWORK LEAF VENATION

This is when veins form something like a net in a leaf

It is found in dicotyledonous plants

A diagram showing network leaf venation

Examples of plants with network leaf venation

Beans

Soybeans (soya beans)

Peas

Groundnuts

Mango

Orange

Cassava

Coffee

PARALLEL LEAF VENATION

This is when the veins are parallel to each other

It is common in monocotyledons plants

A diagram showing parallel leaf venation

Examples of plants with parallel leaf venation

Millet

Rye

Maize

Barley

Sorghum

Wheat

Rice

Oats

Sugar cane

Grass

Onion

PROCESSES THAT OCCUR IN LEAVES

Photosynthesis

Transpiration

Breathing (gaseous exchange)

Guttation: loss of water in form of water droplets from the plant leaves

PHOTOSYNTHESIS

This is the process by which plants make their own food (glucose/starch)

It is a biochemical process in plants

It mainly takes place in the leaves

It can also occur in green stems and in cotyledons of seedlings

Photo - means light

Synthesis - means to build up (to make)

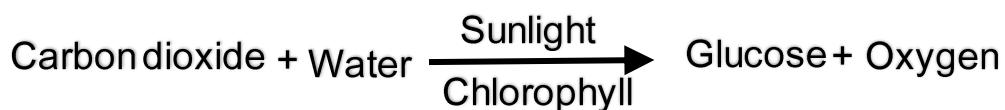
On which part of a plant does photosynthesis mainly occur?

Leaves

Where in the plant leaves does photosynthesis occur?

In the chloroplasts

EQUATION SHOWING PHOTOSYNTHESIS



RAW MATERIALS FOR PHOTOSYNTHESIS.

Water

Carbon dioxide

CONDITIONS FOR PHOTOSYNTHESIS

Chlorophyll

Sunlight

PRODUCTS OF PHOTOSYNTHESIS

Glucose/starch (it is the main/useful product)

Oxygen (it is the byproduct/waste product)

REQUIREMENTS FOR PHOTOSYNTHESIS

Water

Carbon dioxide

Chlorophyll

Sunlight

IMPORTANCE OF THE REQUIREMENTS FOR PHOTOSYNTHESIS

Water

Water is got from the soil

It provides the hydrogen needed to form glucose

Carbon dioxide

Carbon dioxide is got from air in the atmosphere

It provides carbon needed to form glucose

By what process does carbon dioxide enter the stomata of the leaf?

By diffusion

Chlorophyll

This is the green pigment in plants

It traps sunlight

Sunlight

It helps to splits water into hydrogen and oxygen

Why can't photosynthesis occur at night?

There is no sunlight

Importance of glucose produced by plants during photosynthesis

It is used for respiration to produce energy.

It is used to make insoluble starch for storage.

It is used to make cellulose which builds cell walls.

ADAPTATIONS OF LEAVES FOR PHOTOSYNTHESIS

They are broad and flat
To trap sunlight easily
They have thin walls
To allow easy diffusion of carbon dioxide
They have chlorophyll
To trap sunlight
They have stomata
To allow in carbon dioxide
They have veins
To transport water to all leaf cells
They are well arranged on the stem
To get sunlight easily

FACTORS THAT AFFECT PHOTOSYNTHESIS

Light intensity
Carbon dioxide concentration
Optimum temperature

How do plants benefit from photosynthesis?

Plants get food

How do animals benefit from photosynthesis?

Animals get oxygen for respiration
Some animals get food e.g herbivores and omnivores

How does photosynthesis purify air (control global warming)?

It uses carbon dioxide and gives out carbon dioxide

STEPS OF TESTING A GREEN LEAF FOR STARCH

Boil the leaf in water for some minutes
To kill the cells
To break the cell wall of a leaf
Boil the leaf in alcohol (ethanol/methylated spirit)
To remove chlorophyll
Wash the leaf with hot water
To remove alcohol and soften the leaf
Put drops of iodine solution on a leaf
If starch is present, iodine turns blue black (dark blue)
If starch is absent, iodine will remain brown

POINTS TO NOTE

Killing the cells helps to stop all the chemical reactions in a leaf

Breaking the cell wall enables easy removal of chlorophyll

Removing chlorophyll enables clear observation of colour changes of iodine solution

Making the leaf soft enables easy diffusion of iodine

TRANSPIRATION

This is process by which plants lose water in form of water vapour to the atmosphere

Types of transpiration

Lenticular transpiration: in the **lenticels**

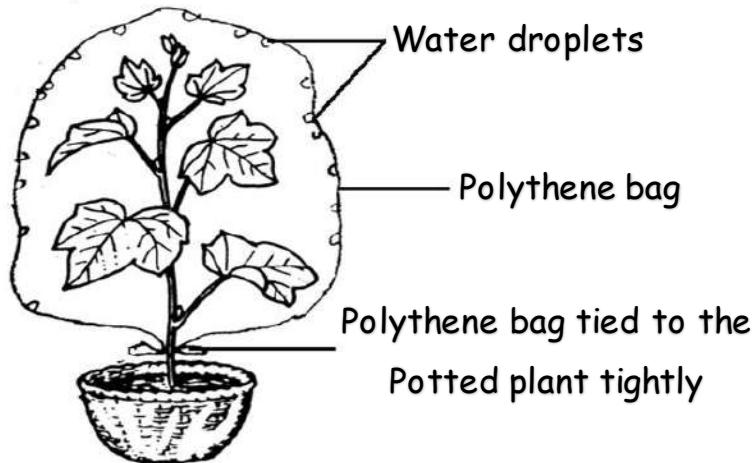
Stomatal transpiration: in the **Stomata**

Cuticle transpiration: in the **cuticle of the stem**

Transpiration occurs in the leaves and some stem.

Most transpiration occurs in the **leaves**

An experiment showing transpiration



Potted plant

To carry out transpiration.

Polythene bag

To trap and condense water vapour.

Why is the polythene bag tied to the stem of the potted plant tightly?

To prevent water vapour from escaping.

Why are water droplets formed inside the polythene paper?

Due to condensation.

Importance of transpiration to plants

It cools the plant

It pulls up water and mineral salts to the leaves

Dangers of transpiration (transpiration as an evil process in plants).

It can lead to wilting

It lowers crop yields due to less water left in the plant

Give the similarity among these processes; transpiration, sweating and panting

All are cooling processes (they cool living things)

Importance of transpiration in the environment

It helps in the water cycle

FACTORS THAT AFFECT THE RATE OF TRANSPERSION

These are conditions that either increase or decrease the rate of transpiration;

Temperature

Light intensity

Wind

Humidity

Surface area (size) of the leaf

Number of stomata on the leaf

Temperature

The higher the temperature, the higher the rate of transpiration and vice versa

Light intensity

High light intensity opens the stomata, lenticels and cuticle which increases transpiration

Wind

Strong wind increases the rate of transpiration.

It blows off water molecules on the plant giving space for more vapour to come out.

Surface area (size) of the leaf

The larger the surface area, the higher the rate of transpiration and vice versa

Humidity

Humidity is the amount of water vapour in the atmosphere

High humidity lowers the rate of transpiration and vice versa

Number of stomata on the leaf

The higher the number of stomata, the higher the rate of transpiration and vice versa

Factors that increase the rate of transpiration

- High temperature
- High light intensity
- Low humidity
- High number of stomata
- Large size of the leaf
- Strong wind

Factors that lower the rate of transpiration

- Low temperature
- Low light intensity
- High humidity
- Few number of stomata
- Small size of the leaf
- Gentle wind

Ways through which plants reduce the rate of transpiration.

- Some plants shed their leaves during dry season e.g deciduous trees (mvule, fig tree, elk, basswood, beech, maple and oak)
- Some plants cover their leaves with a layer of wax e.g banana.
- Some plant leaves are modified into thorns e.g cactus and aloe-vera.
- Some stems have tough lenticels and cuticle to prevent water loss.
- Some plants grow very small leaves (leaves with small surface area).
- Some plants develop needle shaped leaves.
- Some plants have few stomata on their leaves.
- Some plants fold their leaves during the dry seasons.

How do farmers reduce transpiration among their crops?

- By cutting off leaves from suckers while planting
- By transplanting seedlings in the evening
- By putting a shade on a nursery bed

XEROPHYTES

- These are plants that can grow in places with very little water
- They can live in deserts and snow-covered areas.

EXAMPLES OF XEROPHYTES

- Euphorbia
- Cactus
- Pineapple
- Prickly pear
- Aloe vera
- Sisal

Cactus

- It is a flowering plant
- It is a perennial xerophyte
- It is commonly found in deserts

ADAPTATIONS OF CACTUS TO ITS SURVIVAL IN DESERTS (DRY PLACES)

- It has a fleshy stem; to store water and make food.
- It has wide and deep roots; to absorb rainwater on the surface and underground deep water.
- Its leaves are modified as spines; to reduce the rate transpiration.
- It has a thick waxy layer on the stem; to reduce the rate of transpiration.
- It has sunken (deep-layer) stomata; to reduce the rate of transpiration.
- It has a short growing season

How does a cactus benefit from the following parts?

Stem

- It stores water
- It makes food

Spines

- They reduce the rate of transpiration
- They protect the cactus from being eaten by animals (for self-defense)

How does a thorn differ from a spine?

- A thorn is a modified sharp-pointed stem while a spine is a modified sharp-pointed leaf.

POINTS TO NOTE

Lime water is used to test for the presence of carbon dioxide.

It turns milky (cloudy white) if carbon dioxide is present.

Cobalt chloride paper is used to test for the presence of water.

It turns from blue to pink if water is present.

Iodine solution is used to test for the presence of starch.

It turns from brown to blue-black if starch is present.

TYPES OF REPRODUCTION IN FLOWERING PLANTS

Asexual reproduction

Sexual reproduction

Asexual reproduction; does not involve union of gametes.

Examples

Vegetative propagation

Spore formation

Sexual reproduction; involves union of gametes.

Example

Seed propagation

THE FLOWER

It is the reproductive part of the flowering plant

Uses of flowers to people

For decoration

Making of insecticide

Are used as wreath (sign of respect to death)

Used to make perfumes

Used as sign of welcome (bouquet)

Are sold for income

Are used to get dyes

Act as sign of love.

Some flowers can be eaten as food e.g cauliflower

PROCESSES WHICH OCCUR IN THE FLOWER

Pollination

Fertilization

USE OF A FLOWER TO THE PLANT

For reproduction

Help a plant to form seeds and fruits

NOTE

A flower has gametes and gonads.

The male gonads in flowers are **pollen**.

The male gametes in flowers are **anthers**.

The female gonads in flowers are the **ovaries**.

The structure of a flower.

FUNCTIONS OF EACH PART

Petals

A group of petals on a flower is called **corolla**.

Petals are brightly coloured to attract living pollinators like insects, birds and fruit bats.

Insects and birds feed on nectar.

Petals have nectaries or nectar glands at their base.

Nectary glands produce a sweet juice called **nectar**.

Pistil or Carpel

The pistil is the female part of a flower

It is made up of three main parts; namely

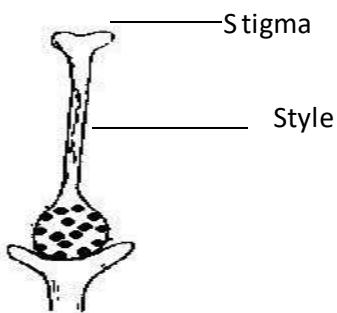
Ovary: It contains undeveloped seeds called ovules.

An ovule is a female gamete

Stigma: It receives pollen grains from the anthers.

Style: It holds the stigma in position.

Illustration



C. The Stamen

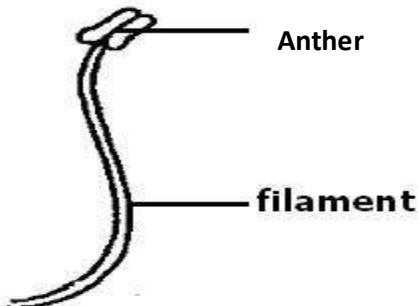
The stamen is the male part of a flower.

It is made up of the anther head and filament.

The anther head produces and stores pollen grains.

The filament supports the anther head

Illustration



D. Sepals

A group of sepals is called calyx.

Sepals protect the flower during the bud stage.

E. Flower stalk

It holds the flower in a position for easy pollination

POLLINATION

This is the transfer of pollen from anthers to the stigma.

Types of pollination

Cross pollination

Self-pollination

1. SELF POLLINATION

This is the transfer of pollen from anthers to the stigma of the same flower or another flower on the same plant.

Characteristics of self-pollinated flowers

Filaments are longer than the style

Do not have scent

Have heavy pollen grains

Their anthers are above the stigma

Have dull coloured petals

Produce small quantity of nectar

How some flowers are adapted to self-pollination?

They are hermaphrodites/bisexual

The flower remains closed until self-pollination has taken place

Some flowers are buried in the ground

The stamen and pistil mature at the same time e.g tomato

The filaments are longer than the style

The anthers are above the stigma

Examples of plants with self-pollination

Tomato

Vanilla

Wandering jew: its flower does not open

Ground nut: its flower grow at the ground

Disadvantages of self-pollination

The new plants and seeds produced are generally weak

The plants produced are vulnerable to diseases

The chances of introducing new characteristics in new plants is minimized.

Diagram showing self-pollination.

2. CROSS POLLINATION

This is the transfer of pollen from anthers of one flower to stigma of another flower on different plants but of the same kind

Characteristics of cross pollinated flowers

How are some flowers adapted to cross pollination?

The male and female flowers grow on the same plant but mature at different time e.g the maize and the coconut

In some plants, the male and female flowers grow on different plants e.g the pawpaw

In some plants, pollen grains cannot germinate on the stigma of the same flower e.g the passion fruit

Examples of plants with cross pollination

Passion fruit

Maize plant

Coconut plant

Pawpaw plant

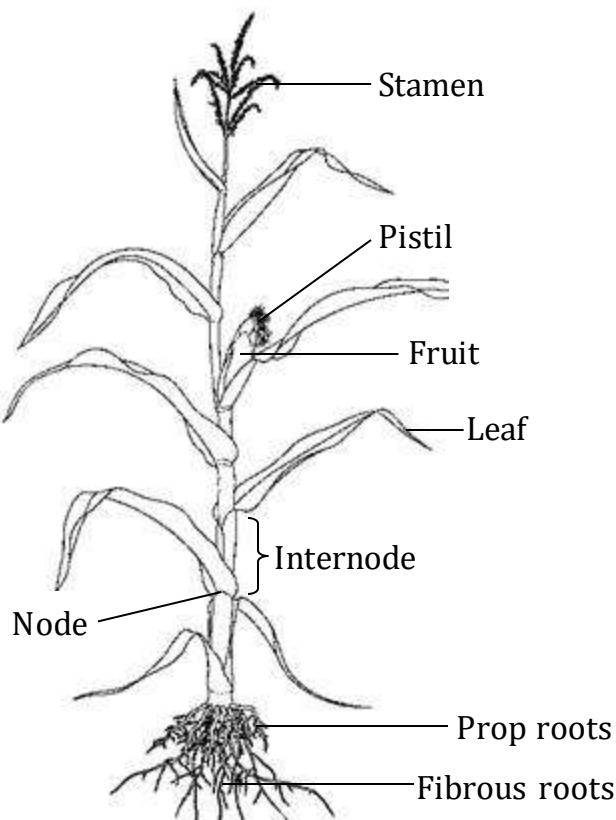
Advantages of cross pollination

Healthier plants are produced

The seeds and fruits produced are larger in size

Disease resistant varieties are produced

A diagram showing a maize plant



AGENTS OF POLLINATION

Insects e.g bees, butterfly, beetles (ladybird) and moths
Wind
Water
Birds e.g sunbirds and humming birds
Bats e.g fruit bats: have hairy body on which pollen is attached

Characteristics wind pollinated flowers

- Have no nectar
- Have dull coloured petal
- Produce a lot of pollen grains
- Are small in size
- Have no scent
- Have feathery stigma to trap pollen floating in air
- Have light pollen grains.

Examples of plant flowers pollinated by wind

- Maize
- Wheat
- Grass flowers

Characteristics of insect pollinated flowers

- Have nectar
- Have brightly coloured petals
- Are big in size
- Anthers produce few pollen grains
- Have good scent
- Have heavy sticky pollen grains
- The style is longer than the filament

Importance of pollination

- It allows fertilization to take place in crops
- Leads to high yields in farmers harvest.

FERTILISATION IN PLANTS

This is the union of male and female gametes to form a zygote

It is a biological process that occurs in the ovary of a flower

After pollination, the pollen grains form a pollen tube.

The pollen tube grows downwards through the style to take pollen to the ovary to meet the ovules.

Fertilisation in plants occurs in the flowers

In flowers, fertilisation occurs in the ovary

After fertilisation,

Ovules become seeds

Ovary develops into a fruit.

The calyx, corolla, stamen and style wither away.

Ovary wall becomes the pericarp

Note:

A banana plant forms a fruit by parthenocarpy (a fruit develops without fertilization)

Diagram

SEEDS

A seed is a mature fertilized ovule.

It has one scar

Classes/ groups of seeds

Monocotyledonous seeds

Dicotyledonous seeds

MONOCOTYLEDONOUS SEEDS

These are seeds with one cotyledon.

Examples of monocotyledonous seeds / grains

Maize

Sorghum

Most grass

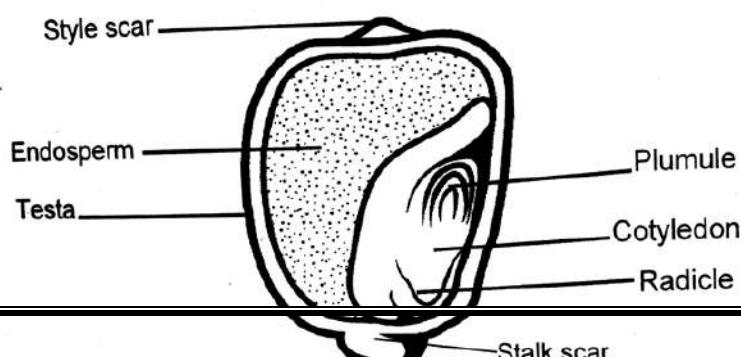
Rice

Barley

Millet

Oats

A diagram showing a monocotyledonous seed e.g maize grain.



Functions of the parts of a maize grain.

Testa

It protects the inner parts of a maize grain.

Plumule

It develops into shoot system

Radicle

It develops into root system.

Endosperm

It stores food for the embryo.

Cotyledon

It supplies food to the embryo.

Stalk scar

It holds (attaches) the maize grain to the cob.

Style scar

It is where the style of a flower was attached.

Embryo

It grows into a seedling.

Why is a maize grain called a fruit?

It has two scars.

Why is a maize grain not called a seed?

A maize grain has two scars while a seed has one scar.

Name the two parts that form the embryo of a seed

Radicle

Plumule

Name the two scars of a maize grain (fruit).

Style scar

Stalk scar

DICOTYLEDONOUS SEEDS

These are seeds with two cotyledons.

Examples of dicotyledonous seeds

Beans

Ground nuts

Tomatoes

Peas

Oranges

Coffee

Avocado

Soya bean

Structure of a bean seed

Give two differences between a maize grain and a bean seed.

Maize grain has two scars while a bean seed has a one scar.

A maize grain stores food in the endosperm while a bean seed stores food in the cotyledon.

GERMINATION

This is the development of a seed embryo into a seedling.

Types of germination

Epigeal germination

Hypogeal germination

Viviparous germination: it is found in mangrove

EPIGEAL GERMINATION

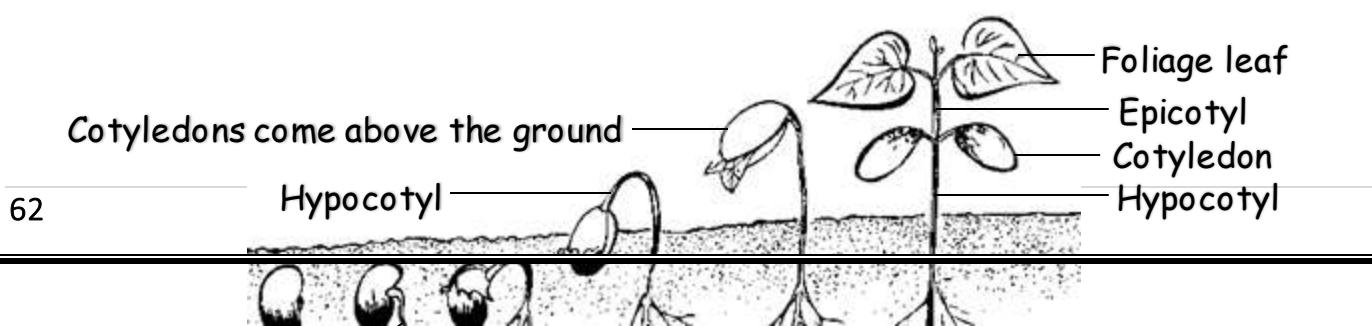
This is the type of germination where the cotyledons come above the ground level.

It occurs in all dicotyledonous plants e.g beans, peas and ground nuts.

NOTE:

Simsim is the only monocot that undergoes epigeal germination.

A DIAGRAM SHOWING EPIGEAL GERMINATION.



Hypocotyl

The region of a seedling stem below the cotyledons.

Epicotyl

The region of a seedling stem above the cotyledons.

HYPOGEAL GERMINATION

This is the type of germination where the cotyledons remain below the ground level.

It occurs in all monocotyledonous plants e.g wheat, maize and sorghum

A diagram showing hypogeal germination.

Conditions necessary for germination

Oxygen:

It aids in respiration

Water:

It softens the testa

It dissolves stored food in the seed

It activates the protoplasm of seed cells

Warmth:

It activates enzymes that initiate seed germination

Experiment to show the conditions necessary for germination

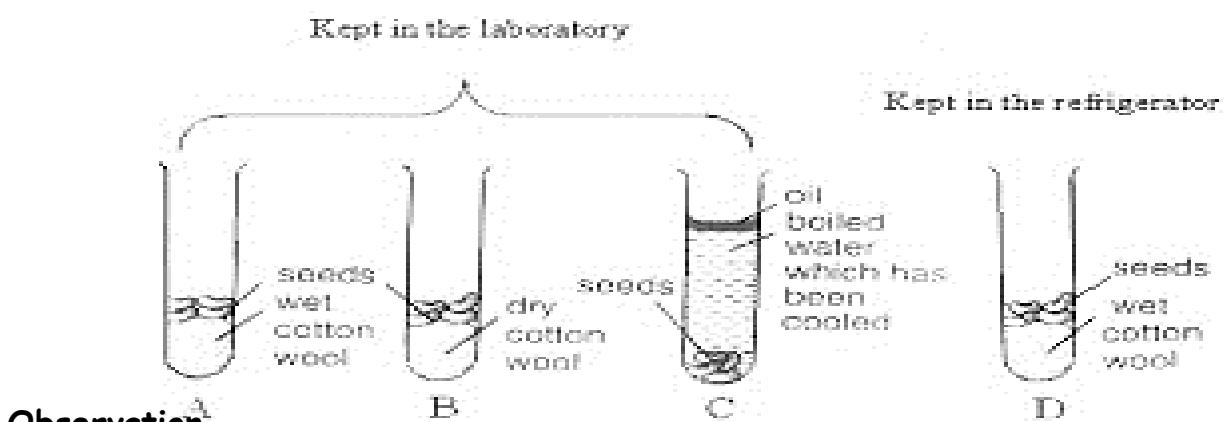
Seeds are placed in four test tubes labeled A, B, C and D as shown below.

Seeds in test tube A are placed in wet cotton wool and kept in a room

Seeds in test tube B are placed on dry cotton wool and kept in a room

Seeds in test tube C are placed in cool boiled water mixed with oil and kept in a room

Seeds in test tube D are placed in wet cotton wool and kept inside a refrigerator



Observation

Seeds in test tube A will germinate

They have water, oxygen and warmth

Seeds in test tube B will not germinate

They lack water

Seeds in test tube C will not germinate

They lack oxygen

Seeds in test tube D will not germinate

They lack warmth

Why is oil poured on water in test tube C?

To cut off oxygen supply to the seeds

Why is test tube D place in a refrigerator?

To prevent seeds from getting warmth

SEED VIABILITY

This is the ability of seeds to germinate under favourable conditions.

Qualities of viable seeds

They should be mature.

They should be dry.

They should be healthy (free from diseases).

- They should not be broken.
- They should be free from pest damages.
- They should not have overstayed.
- They should be of a suitable size.
- They should have a high germinating rate.

SEED DORMANCY

This is the inability of a seed to germinate under favourable conditions.

Factors that can lead to seed dormancy

- Planting diseased seeds.
- Planting premature seeds.
- Planting broken seeds.
- Too much heat in the soil.
- Dampness of seeds during storage.

Ways of protecting seeds from dormancy

- Proper drying of seeds before storage.
- Keeping seeds in a dry place.
- Putting rat guards on granaries.
- Dusting seeds.
- Seed dressing.

What is meant by seed dressing?

This is the applying of chemicals on seeds to prevent infections and pests

TROPISM

Tropism is a growth response of a plant towards stimuli

Stimuli

These are things in the environment to which living things are sensitive

EXAMPLES OF STIMULI FOR PLANTS

Water	Chemical
Light	Touch
Gravity	

KINDS (TYPES) OF TROPISM

Phototropism

Hydrotropism

Chemotropism

Thigmotropism

Geotropism

PHOTOTROPISM (HELIOTROPISM)

This is a growth response of a plant towards light

The plant shoot is positively phototropic while the roots are negatively phototropic

Diagrams showing phototropism.

Diagram I

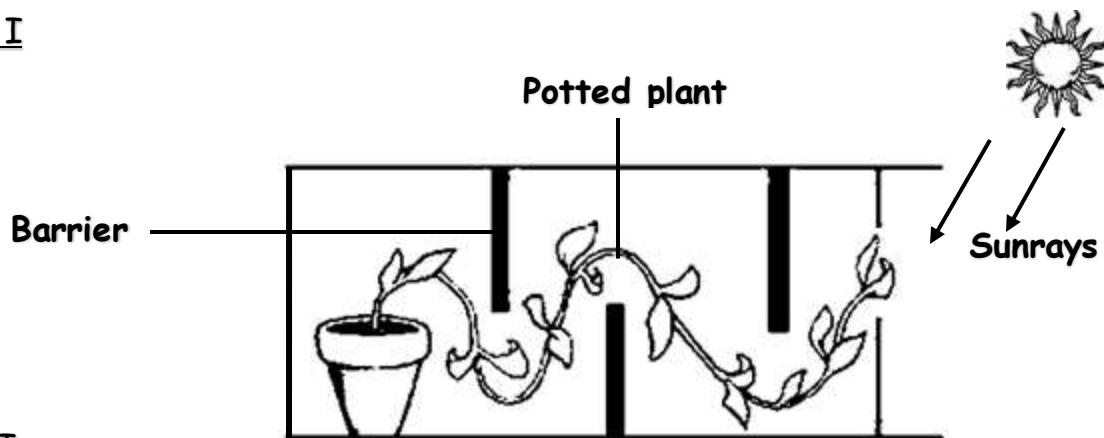
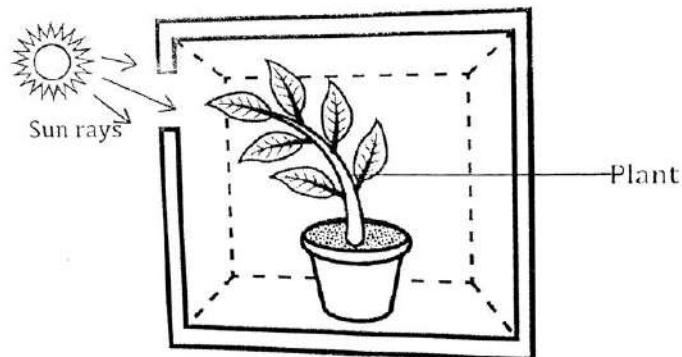


Diagram II

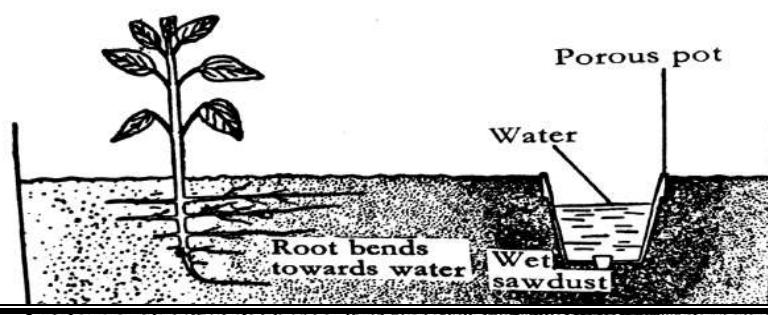


HYDROTROPISM.

This is the growth response of a plant towards the water source

Plant roots are positively hydrotropic because they grow towards the source of water

A diagram showing hydrotropism



GEOTROPISM

This is the growth response of a plant towards gravity

Plant roots grow downwards due to geotropism

Plant roots are positively geotropic because they grow towards gravity

Plant shoot is negatively geotropic because it grows while opposing gravity

A diagram showing geotropism.

Chemotropism

This is a growth response of a plant towards chemicals

Give an example of chemotropism in plants.

Growth of pollen tubes towards the ovules

Conversion of a flower into a fruit

A diagram showing chemotropism.

THIGMOTROPISM (HAPTOTROPISM)

This is the growth response of a plant towards touch

How is thigmotropism important to climbing plants such as some beans, tomatoes and morning glory?

It helps climbing plants to twine (clasp) other plants
A diagram showing thigmotropism.

SUMMARY OF TROPISM.

Tropism	Stimulus
Phototropism	sunlight
Geotropism	Force of gravity
Hydrotropism	Water and moisture
Thigmotropism/ Haptotropism	Touch
Chemotropism	Chemicals

FRUITS

A fruit is a developed ovary.

Fruits have two scars i.e. style stalk and stalk scar.

Importance of fruits to plant

Fruits protect seeds.

Fruits assist in seed dispersal.

Importance of fruits to people

Some fruits are eaten as food.

Some fruits are sold for income.

Some fruits act as herbal medicine.

DIFFERENCES BETWEEN SEEDS AND FRUITS

A seed is a fertilized ovule while a fruit is a developed ovary.

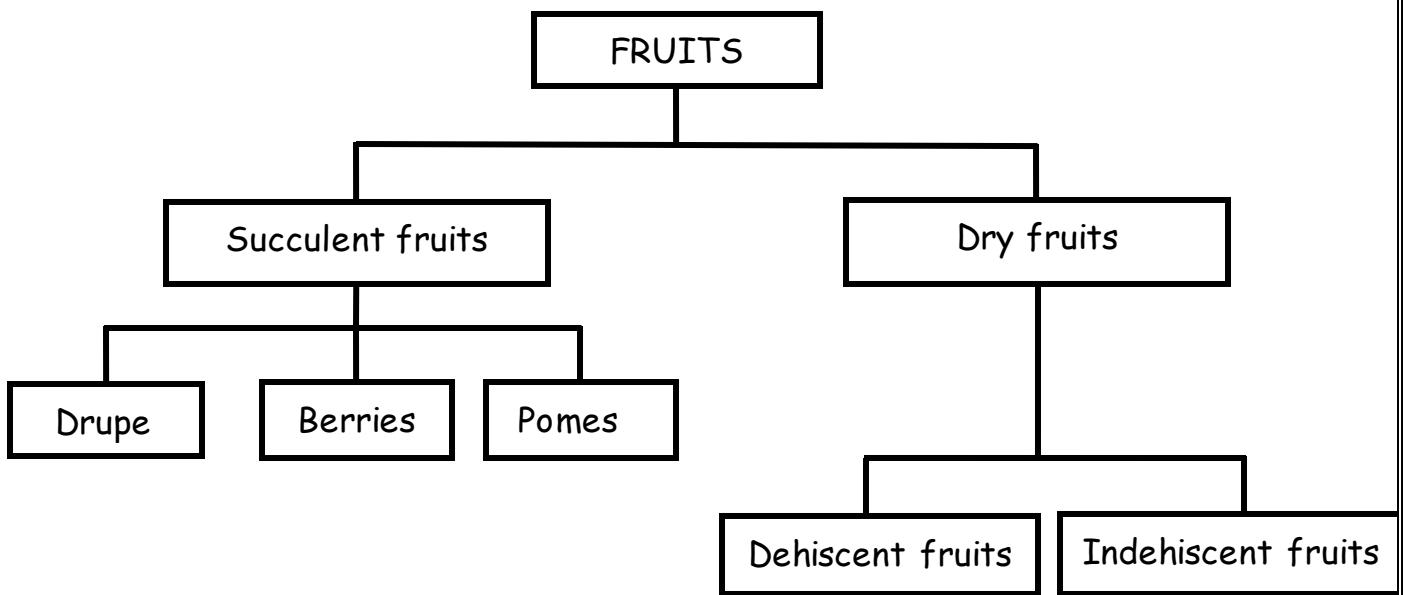
A seed has one scar while a fruit has two scars.

TYPES OF FRUITS

Succulent fruits (fleshy fruits or juicy fruits)

Dry fruits

A FLOW CHART SHOWING CLASSIFICATION OF FRUITS



SUCCULENT FRUITS / JUICY FRUITS/ FLESHY FRUITS

These are fruits with juicy pericarp.

Pericarp:

These are layers of a fruit

Parts which make up the pericarp

Exocarp (Epicarp): outermost layer

It protects the inner layers

It attracts living agents of dispersal

Mesocarp: middle juicy layer

It is responsible for the colour of both ripe and unripe fruits

Endocarp: innermost layer

It protects the seeds

Groups of succulent fruits

Berries

Drupes

Pomes

BERRIES

These are fleshy fruits with many seeds.

Berries have a fleshy endocarp

Examples of berries

Oranges

Tomatoes

Pawpaw

Passion fruit

Grapes

Guavas

Thorn apple

Sodom apple

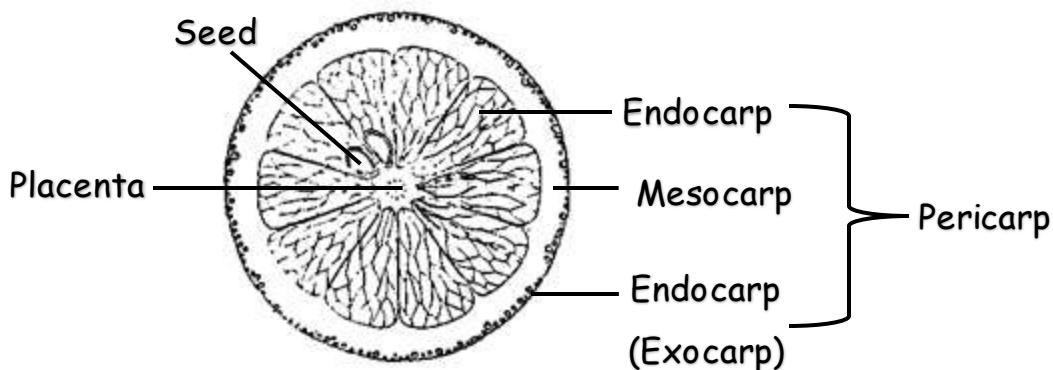
Watermelon

Pumpkin

Lemon

Banana

A diagram of an orange fruit.



DRUPES.

These are fleshy fruits with one seed inside a hard endocarp.

Examples of drupes.

Mango

Peach

Cherry

Olive

Dates

Coconut

Oil palm

Cashew nut

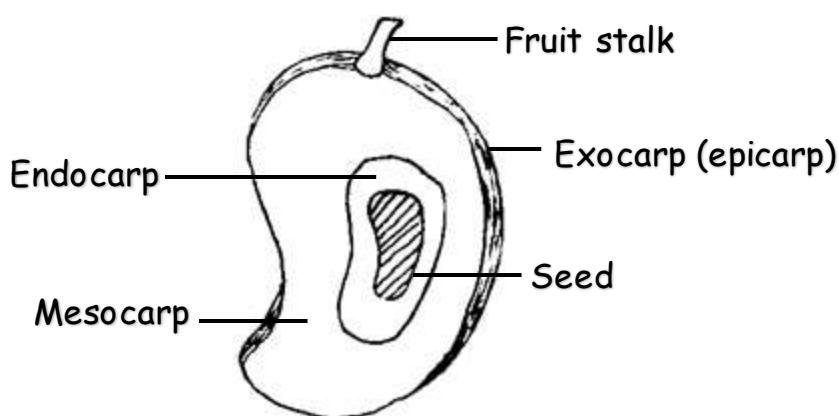
Walnut

Pecan

Plum

Sabal

A diagram showing a drupe.



Why is avocado not regarded as a drupe yet it has one seed?

Avocado has a fleshy endocarp yet drupes have a hard endocarp

Why is avocado called a single-seeded berry?

Avocado has a fleshy endocarp

POMES

These are fruits formed from the swollen receptacle

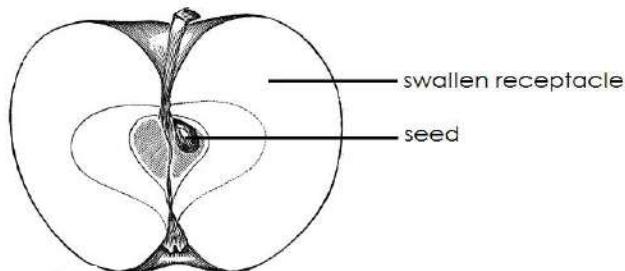
Its inner core is the pericarp.

Examples of pomes

Apples

Pears

A diagram of an apple.



Why is an apple called an accessory fruit (false fruit)?

It develops from the receptacle other than the ovary

DRY FRUITS

These are fruits with a dry pericarp

Groups of dry fruits

Dehiscent fruits /splitting fruits

Indehiscent fruits /non splitting fruits

Dry dehiscent fruits

These are dry fruits which split to disperse the seeds

Examples of dry dehiscent fruits

Beans

Cassia

Desmodium (tick

Peas

Tobacco

clover)

Castor oil

Sodom apple

Poppy

A structure of a dehiscent fruit

The fruit splits along the lines of weakness

Dry indehiscent fruits

These are dry fruits which do not split to disperse the seeds

Examples of dry indehiscent fruits

Sunflower

Tridax

Black jack (*bidens pilosa*)

Maize

Cashew nuts

OTHER FRUITS

Multiple fruits

Aggregate fruits

AGGREGATE FRUITS.

These are fruits that develop from multiple ovaries of a single flower.

Examples of aggregate fruits

Blackberry

Dewberry

Raspberry

Strawberry

MULTIPLE FRUITS.

These are fruits that develop from ovaries of multiple flowers fused together into a larger fruit.

Examples of multiple fruits

Jack fruit

Pineapple

SEED DISPERSAL

This is the scattering of seeds from a parent plant to a new area.

Importance of seed dispersal to plants

It enables plants to colonise new areas.

It prevents overcrowding of plants

It reduces competition for plant nutrients, water and sunlight.

It prevents extinction of plant species (it increases chances of survival of plant species)

Importance of seed dispersal to animals.

It increases food for herbivorous animals

It creates natural homes for wild animals

Disadvantage of seed dispersal

- It leads to growth of weeds.
- It exposes seeds to pests.
- It exposes fungal infections.

What is an agent of seed dispersal?

This is anything that scatters seeds from a parent plant to a new area.

AGENTS OF FRUIT AND SEED DISPERSAL

- Wind
- Animals (e.g birds, bats, monkeys and people)
- Water

TYPES / METHODS / MECHANISMS OF FRUIT AND SEED DISPERSAL

- Water dispersal
- Animal dispersal
- Wind dispersal
- Explosive mechanism (self-dispersal or mechanical dispersal)

CHARACTERISTICS / ADAPTATIONS OF SEEDS AND FRUITS DISPERSED

BY:

WIND.

- Some seeds are small and light to float in air e.g orchid.
- Some seeds have hairy structures (tuft of hair) e.g cotton seed, Calotropis and silk cotton
- Some seeds have parachute like structure e.g dandelion and tridax
- Some seeds have wing like structures to float in air e.g jacaranda, moringa, pinus, shorea, Tacoma and terminalia
- Some seeds have balloon like structure e.g physalis and cardiospermum
- Some seeds are dispersed when wind blows and shakes the porous capsule e.g aristolochia and poppy

Examples of seeds dispersed by wind.

Orchid	Jacaranda	Calotropis
Tridax	Dandelion	
Poppy	Cotton seed	

Diagrams showing seeds dispersed by wind.



WATER.

They are light to float on water

Some seeds have air spaces e.g water lily

Some fruits are water proof (have a hard testa)

Some fruits have air-tight epicarp

Some fruits have a fibrous mesocarp; to enable them float on water e.g coconut fruit

Some fruits are spongy e.g lotus fruit

Examples of seeds dispersed by water.

Coconut

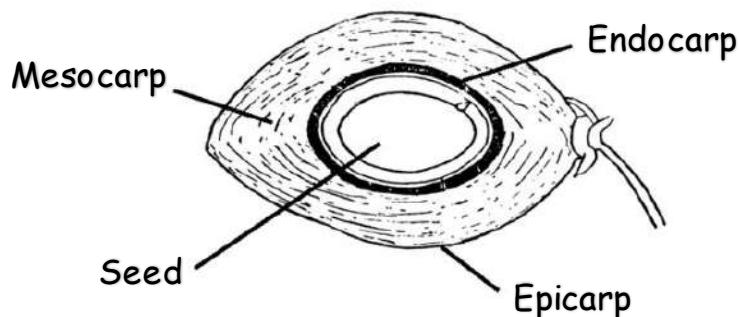
Water lotus

Mangrove

Oil palms

Water lily

Diagrams showing seeds and fruits dispersed by water e.g coconut fruit



Of what importance is a fibrous mesocarp to a coconut fruit?

It enables the fruit to float on water for dispersal

ANIMALS.

Some have hooks to attach on animal's fur or clothing e.g black jack

Some seeds are sticky e.g aegle and boerhaavia

Some seeds have a hard testa to protect them from digestive juices e.g passion fruits, tomato and guava

Some seeds are found in fruits with bright colours when ripe e.g mangoes

Some seeds are found in fruits with good scent when ripe e.g jackfruit

Some seeds are found in edible fleshy fruits e.g apple, mango, pomegranate and papaya (pawpaw)

Examples of seeds dispersed by animals.

Passion fruit

Tomato

Watermelon

Guava

Pawpaw

Pineapple

Jack fruit

Orange

Apple

Mango

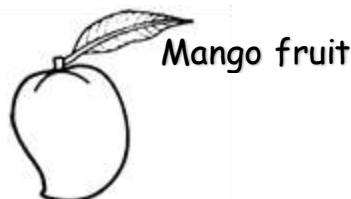
Blackjack

Lemon

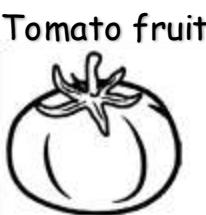
Avocado

Pumpkin

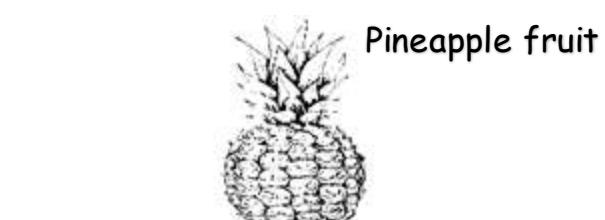
Diagrams showing seeds and fruits dispersed by animals.



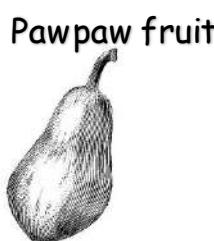
Mango fruit



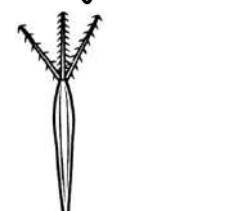
Tomato fruit



Pineapple fruit



Pawpaw fruit



Blackjack seed

How is a black jack adapted to its mode of dispersal?

It has hooks that attach on the animal's body

State the importance of hooks to a black jack seed.

To attach the blackjack seed on the animal's body

EXPLOSIVE MECHANISM (SELF DISPERSAL).

The fruit/pod/capsule bursts and throws away the seeds as it dries

It is common in dry dehiscent fruits

Characteristics of seeds dispersed by explosive mechanism

They are found in dry dehiscent fruits.

They are found in pods or capsules.

Their pods have lines along which they split (burst) when dry.

Their pods burst to throw away the seeds when dry

Examples of seeds with explosive mechanism

Beans

Soybean (soya

Phlox

Castor oil

beans)

Geranium

Lupin

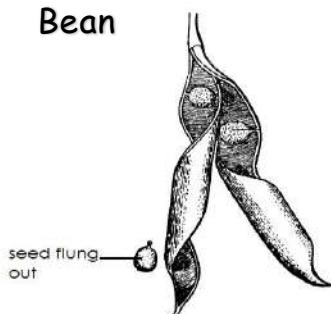
French beans

Peas

Mahogany

Diagrams showing self-dispersal (explosive mechanism)

Bean



Castor oil



PLANT PROPAGATION

Plant propagation refers to the methods used in growing certain plants

This is the method of making plants multiply in the environment

This is the way how plants can be grown

Basic methods (types) of plant propagation

Seed propagation

Vegetative propagation

SEED PROPAGATION

This is the growing of a new plant by means of seeds

It is common in most flowering plants and coniferous plants.

Examples of plants which are grown by means of seeds

Beans

Mango

Avocado

Pine

Cedar

Cypress

Seed propagation is an example of sexual reproduction in plants

Advantages of seed propagation (sexual reproduction in plants)

New varieties are produced

Seeds are always able to survive bad weather

Good offsprings are produced

Plants have high chances of colonising new areas

There is little or no competition for nutrients among parent plants and the new plants

Disadvantages of seed propagation

It is a slower means of reproduction

It requires the agents of pollination

It requires the agents of seed and fruit dispersal

Parental food supply to the new plant is limited

VEGETATIVE PROPAGATION.

This is the growing of a new plant using other parts of a parent plant rather than seeds

This is the form of asexual reproduction in which a new plant is grown from other plant parts but not from the seeds.

Vegetative propagation is an example of asexual reproduction in plants

What is a sexual reproduction?

This is the type of reproduction that does not involve the use of gametes (reproductive cells).

Besides vegetative propagation, give three forms of asexual reproduction.

Spore formation.

Binary fission.

Parthenogenesis

Budding.

Fragmentation.

Types of vegetative propagation

Natural vegetative propagation

Artificial vegetative propagation

NATURAL VEGETATIVE PROPAGATION

Examples of natural vegetative propagation	Plant
Use of corms	Coco yam, crocus, gladiolus
Use of bulbs	Onion, garlic, spider lily, shallot
Use of rhizomes	Ginger, turmeric, zoyzia, canna lily
Use of leaves	Bryophyllum, begonia
Use of suckers	Banana , pineapple, sisal
Use of stem tubers	White yam, Irish potato
Use of crowns	Pineapples
Use of slips	Pineapples
Use of roots	Dahlia, asparagus
Use of runners (stolons)	Strawberry

Parts of plants used in natural vegetative propagation.

Corms	Suckers	Roots
Bulbs	Stem tubers	Runners
Rhizomes	Crowns	
Leaves	Slips	

ARTIFICIAL VEGETATIVE PROPAGATION

This involves use of special skill and techniques to produce high quality and high yielding crops which are resistant to diseases

Example of artificial vegetative propagation

a) Stem cutting

Sweet potatoes

Cassava

Sugarcane

Hibiscus

Sweet potatoes can also be propagated using vines

Description & Diagram

b) Layering
Description & Diagram

c) Grafting
Description & Diagram

d) Budding
Description & Diagram

e) Marcotting
Description & Diagram

Advantages of vegetative propagation (asexual reproduction in plants)

The new plants mature quickly

Only one parent plant is needed to produce a new plant

The new plant is exactly similar to the parent plant

The new plant gets food from the parent plant until it is well settled

No agents of pollination or seed dispersal are needed to produce a new plant

It becomes easy to get hybrids without using seeds

Disadvantages of vegetative propagation (asexual reproduction in plants)

No new varieties are produced

Why? There is no mixing of characteristics

There is easy spread of crop diseases

The new plant may not be resistant to diseases

The new plant competes with the parent plant for sunlight, water and nutrients

ECONOMIC VALUES OF PLANTS TO MAN

Plants provide food to man.

Plants help in controlling soil erosion

Plants are need in construction and building industry.

They provide raw materials for agro based industries

Agricultural industry is a source of revenue for government

ANIMAL HUSBANDRY

Animal husbandry is the care and management of livestock (farm animals)

Animal husbandry is the keeping of farm animals (livestock)

Livestock are all kinds of farm animals

Examples of farm animals (livestock)

Goats	Pigs	Cattle
Rabbits	Sheep	Poultry

CATTLE KEEPING

Cattle keeping is the rearing of cows and bulls.

TERMS USED IN CATTLE KEEPING.

Cattle

This refers to cows and bulls

Bull

This is a male animal of cattle family

Cow

This is an adult female animal of cattle family

Calf

This is a young one of a cow

Heifer

This is a young female cattle that has not yet had a calf

Oxen

These are castrated bulls kept for doing work

Bullock

This is a young castrated bull

Steer

This is a castrated bull kept for meat production

Note

A bull protects itself by **goring**

Reasons why farmers rear cattle

- For meat production
- For milk production
- For income after sale
- For provision of labour

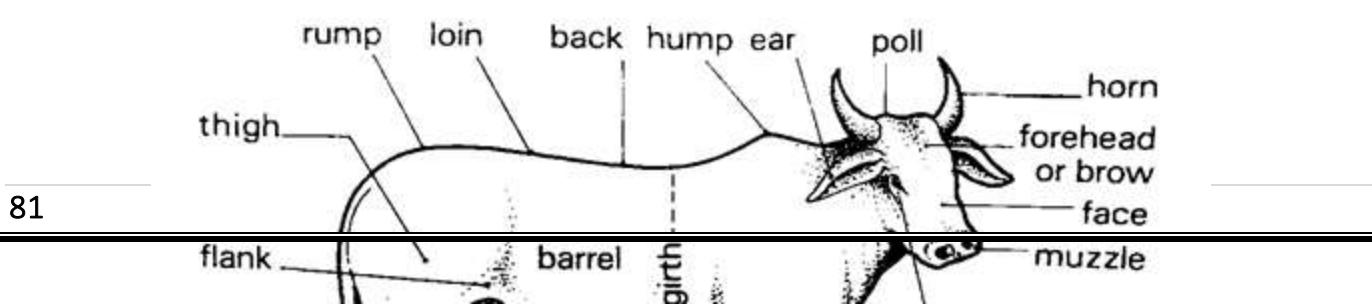
Importance of cattle keeping.

- Cattle provide us with meat
- Cattle provide us with milk
- Cattle are source of income when sold
- Bulls and oxen are used for ploughing and transport
- Cow dung and urine are used to make manure
- Cattle provide hides used for making leather
- Their bones, horns and hooves are used to make glue and animal feeds.
- Cattle are used to pay dowry or bride price.
- Their horns are used to make buttons

CATTLE PRODUCTS

- Meat
- Fats
- Blood
- Hides
- Bones
- Milk
- Horns and hooves
- Cattle dung and urine

A diagram showing the external parts of a cow.



Functions of some parts of a cow

Eyes

For sight

Ears

For hearing

For body balance

For beating insects around the head.

Muzzle

The muzzle is the protruding part of the nose.

The muzzle is cold and moist when the cow is healthy and warm when the cow is sick.

Hooves

To protect the toes from external damage.

Udder

To stores milk produced by mammary glands.

Teats

To let out milk from the udder.

Switch

To chase away insect from animals.

Horns

For protection

TYPES OF CATTLE

A type of cattle is a group of cattle kept for a specific purpose.

Beef cattle

Dual purpose cattle

Dairy cattle

Draught cattle

BEEF CATTLE

These are cattle mainly kept for meat production.

Characteristics of beef cattle

- They grow and mature quickly
- They have a rectangular block shape
- They have small heads
- They have short legs with broad backs.
- They have small udders
- They produce a lot of meat
- They have thick muscles
- They are more resistant to high temperature

Examples of exotic breeds of beef cattle

American Brahman	Aberdeen Angus
American beef master	Charolais
Galloway	Santa Gertrudis
Hereford	

Diagram of beef cattle as seen from above and from sides

Seen from sides

Seen from above

DAIRY CATTLE

These are cattle kept mainly for milk production

Characteristics of dairy cattle

- They have triangular body shape
- They produce a lot of milk
- They have well set legs to support their weight
- Their hind legs are wide apart
- They are usually docile (calm)
- They have small necks (long flexible necks)
- They have big udders
- They have wide hind quarters
- They have four large teats

Examples of exotic breeds of dairy cattle

Friesian	Guernsey
Brown Swiss	Ayrshire
Jersey	Jamaica hope

Danish Red cattle

Diagram of a dairy cow as seen from above and aside

Seen from above

Seen from sides

DUAL PURPOSE CATTLE

These are cattle kept for both meat and milk production.

Examples of dual purpose cattle

Red Poll

Short horn

Sahiwal

DRAUGHT CATTLE

These are cattle mainly kept for providing labour on a farm (ploughing and transport).

They are used to plough soil, pull carts and transporting harvested crops from gardens.

Examples of draught cattle

Oxen

BREEDS OF CATTLE

Cattle breed

This is a group of cattle that have similar characteristics.

Characteristics of a type of breed of cattle are determined by:

Colour of cattle

Size of cattle

Milk yield of cattle

Body shape of cattle

TYPES OF BREEDS OF CATTLE

Local breeds

Exotic breeds

Cross breeds

LOCAL BREEDS

These are breeds that have existed in Uganda for a very long time.

They are also called **native breeds or indigenous breeds**.

External features of local breeds of cattle

They have different colours.

They have big humps.

They have dewlaps.

They always have long horns.

Examples of indigenous breeds

Ankole cattle

Boran cattle: for meat production

Zebu cattle: for milk production

Karimojong cattle

Nganda cattle

Nsagala (sanga) cattle: for milk production

Intermediate cattle: for milk production

Advantages of local breeds of cattle

They are resistant to diseases.

They can survive on poor pasture and little water.

They are resistant to bad weather

They need less care.

They produce high quality meat and milk

Disadvantages of local breeds of cattle

They mature slowly

They produce little milk

They produce less meat

EXOTIC BREEDS

These are breeds which were imported from outside countries.

Examples of exotic breeds of cattle

Friesian

Hereford

Jersey

Guernsey

Ayrshire

Aberdeen Angus

Note

Exotic breeds of cattle are mainly beef and dairy cattle.

External features of exotic breeds.

- They have specific colours
- They have very small humps.
- They have thin dewlaps.
- They have short or no horns

Advantages of exotic breeds of cattle

- They mature fast
- They produce much meat
- They produce a lot of milk

Disadvantages of exotic breeds of cattle

- They are vulnerable (not resistant) to diseases
- They need good pasture and water.
- They are not resistant to harsh weather
- They need a lot of care.
- They are expensive to manage.

Differences between local and exotic breeds of cattle

Local Breeds	Exotic Breeds
They have different colours	They have specific colours.
They mature slowly.	They mature quickly.
They produce less meat and milk.	They produce more meat and milk.
They need less care.	They need a lot of care.
They are more resistant to diseases.	They are less resistant to diseases.
They can survive on poor pasture and water.	They need good pasture and water.

CROSS BREEDS

These are breeds got when a local breed mates with an exotic breed.

Advantages of cross breeds over local and exotic breeds.

- They grow faster than the local breeds.
- They produce more meat than the local breeds.
- They produce more milk than local breeds.
- They are more resistant to diseases than the exotic diseases.

BREEDING OF CATTLE

Breeding

This is the keeping (maintaining) of inherited characteristics in cattle.

Examples of inherited characteristics in cattle;

Colour

Growth

Resistance to diseases

Milk production

Ability to live long

Types of breeding

- | | | |
|------------------|-------------------|-----------------------|
| 1. In-breeding | 3. Out breeding. | 5. Upgrading |
| 2. Line breeding | 4. Cross breeding | 6. Selective breeding |

In Breeding

This is the mating of very closely related animals

Example of in-breeding

Mating of brother and sister

Mating of mother and son

Mating of father and daughter

OR. The mating of near relatives in animals

Advantages of in breeding

It strengthens good quality of animals

Disadvantages

It leads poor quality animals

It leads to poor production of animals

It leads to inherited diseases

It can lead to sterility in animals

It can lead to inheritance of bad traits.

Line-breeding

This is the mating of closely related animals

It is common in chicken and rabbits because they grow faster

Examples of line-breeding

Mating of cousins

Mating granddaughter and grandson

Advantage of line-breeding

It maintains animals related to their ancestors

Disadvantage of line breeding

Leads to inheritance of bad traits

Leads to poor production of animals

Out breeding

This is the mating of distantly related animals.

Example of out-breeding

Mating of animals of the same breed but from different herds

Advantage of out-breeding

It restores good qualities that may be disappearing in a breed

Cross breeding

This is the mating of unrelated animals of different breeds.

Example of cross breeding

Mating of exotic breeds with local breeds

The off springs after cross breeding are called **cross breeds**.

Advantages of cross breeding

It improves the quality of local breeds

It creates a hybrid

Cross breeds have better performance than their parents or relatives.

Upgrading

This is the improving of quality of one breed by using a breed of superior quality several times.

Advantages of upgrading

Offsprings are of good quality

It increases the quantity of farm products

Young ones produce good yields

Selective Breeding

This is the mating of selected good breeds in a herd.

OR. This is the allowing of certain animals to be parents of future generation

Poor breeds in a herd are sold off.

MATING

This is the sexual union of the male and female animals.

Mating of a bull and a cow occurs only when a cow is on heat.

During mating, **insemination** takes place.

A heifer is ready for mating at the age of **18 months**.

A cow or heifer ready for mating shows signs of heat.

HEAT PERIOD /ESTRUS PERIOD

This is the time when a female animal is in need of a male animal for mating.

OR

This is the time when a female animal is ready to mate with a male animal.

Oestrus cycle

This is a period when a female animal can conceive if it mates.

Signs of a cow on heat

The cow mounts cattle.

The cow loses appetite to graze.

Mucus discharge from the vulva.

It makes a lot of noise (frequent bellowing)

It stands still when the bull is mounting it

Slight rise in the body temperature of a cow.

The vulva swells and turns red.

The cow urinates frequently.

The cow becomes restless

Milk production in lactating cows drops.

The cow stands while others are lying down

Three weeks after the period of service, if the cow shows no more signs of heat, we say it has conceived.

INSEMINATION/SERVICE

This is the depositing of sperms into the vagina of a cow/female animal.

Types of service/insemination

Natural Insemination

Artificial Insemination

Natural Insemination

This is when a bull deposits sperms into the vagina of a female animal using its penis

Systems of natural insemination

Hand mating

Pasture mating

Hand mating

This is when a bull is kept separate from cow and it is only brought to mate with a cow on heat.

Pasture Mating

This is when a bull is allowed to move with cows so that it mates easily with those on heat.

Advantages of natural insemination

It saves time.

It does not require a skilled cattle keeper to carry it out.

It is easy for a bull to inseminate the cow

It is cheap for a farmer since semen is not bought.

It is easy for a bull to notice the signs of heat in cows.

Both animals enjoy their natural sexual rights.

Disadvantages of natural insemination

Controlling venereal diseases is difficult.

Small cows can be injured by heavy bulls.

It leads to venereal diseases in animals

It is expensive to buy and maintain a bull

It encourages inbreeding.

It is difficult to control hereditary diseases

Once a bull dies, the sperms are lost

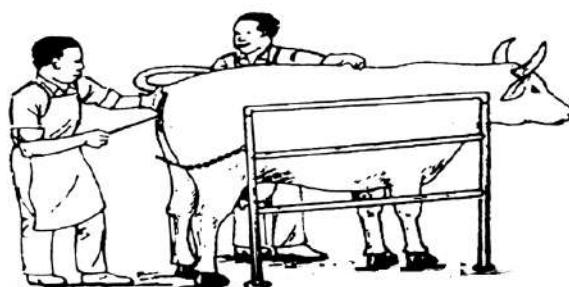
ARTIFICIAL INSEMINATION.

This is the act of depositing sperms into the vagina of a cow using syringe or an artificial insemination gun.

An **inseminator** is a trained person who uses a syringe to deposit sperms into the vagina of the cow

Artificial insemination gun is a farm tool used to deposit sperms into the cow's vagina

A diagram showing artificial insemination.



Advantages of artificial insemination

- It controls inbreeding.
- It controls easy spread of venereal diseases in animals.
- It prevents injuries caused on small cows by heavy bulls.
- Semen is not wasted.
- Semen can easily be transported.
- Semen can be stored and used even after death of a bull.
- It enables the farmer to only use semen from good breeds of cattle.
- It is cheaper than keeping a bull.

Disadvantages of artificial insemination

- It needs an expert to carry it out.
- It is difficult to store sperms.
- It may be difficult for a farmer to identify the cow on heat.
- It denies the animals their natural sexual rights
- It may not give good results.

REPRODUCTION IN CATTLE

Reproduction is the process by which living things multiply in number.

Reproduction is the ability to produce off springs and increase in number.

Forms of reproduction

Sexual reproduction: involve gametes

Asexual reproduction: does not involve gametes

Examples of the asexual reproduction

Budding e.g in yeast and coelenterates

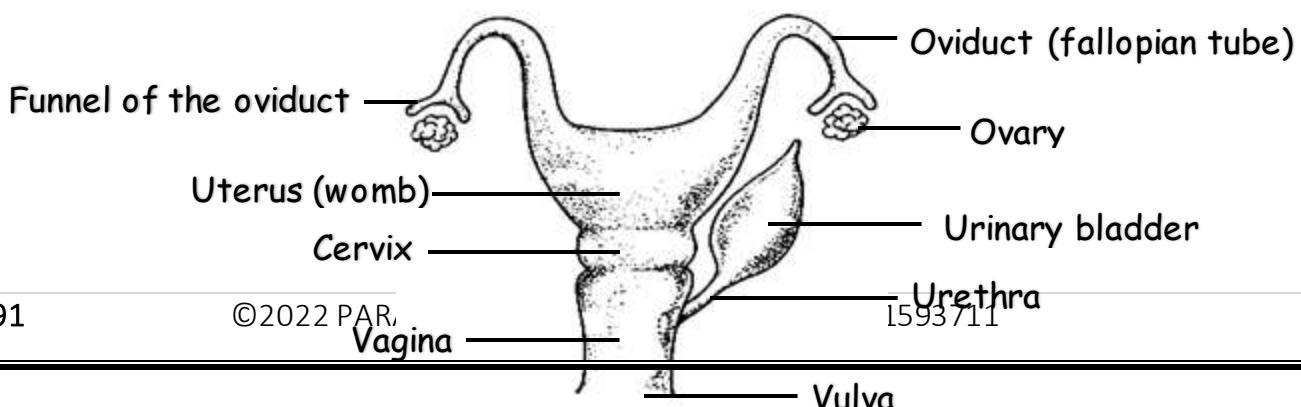
Cell division (binary fission) e.g in bacteria and amoeba

Spore formation e.g in most fungi, algae, ferns, liver warts and algae

Fragmentation e.g flatworms and algae

Vegetative propagation e.g grafting, marcotting and layering

THE REPRODUCTIVE SYSTEM OF A COW.



USES OF EACH PART OF THE REPRODUCTIVE SYSTEM OF A COW.

OVARIES.

These are the female gonads

A cow has two ovaries

They produce and store ova /eggs / female gametes

They produces female sex hormones (oestrogen and progesterone)

Ova (eggs).

These are the female gametes (female reproductive cells)

FUNNEL OF THE OVIDUCT.

It directs the ovum (egg) into the oviduct

oviduct (Fallopian tube/uterine tubes).

It is where fertilization and conception take place.

It passes an egg from the ovary to the uterus.

UTERUS.

It is where implantation takes place.

It is where the fetus develops from.

CERVIX.

It closes the lower end of the uterus during pregnancy.

It prevents the fetus from coming out before it is time.

VAGINA.

It is where sperms are deposited.

It is a birth canal.

How is the vagina adapted to its function as a birth canal?

It has elastic muscular walls.

How is mucus important in the vagina?

It lubricates the vagina.

It keeps the vagina moist (prevents the vagina from drying up).

VULVA.

It protects the vagina.

It directs the penis to the vagina.

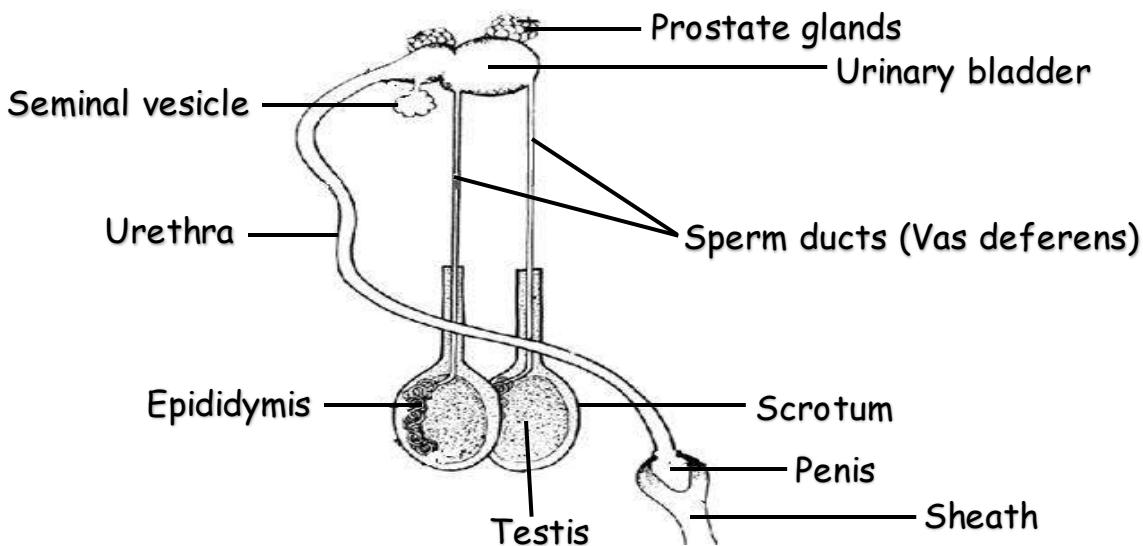
URINARY BLADDER.

It stores urine for a short time before urination.

URETHRA.

It passes out urine from the urinary bladder.

THE REPRODUCTIVE SYSTEM OF A BULL.



USES OF EACH PART OF THE REPRODUCTIVE SYSTEM OF A BULL.

PENIS

It deposits sperms into the vagina

The most sensitive part at the tip of penis is called **glans penis**

How is the penis adapted to its function?

It has an erectile tissue for erection.

It has a sheath which protects its head (glans)

It has urethra to pass out sperms

SHEATH

It protects the glans (head of the penis)

TESTES (TESTICLES)

These are the male gonads.

Bulls have two testes.

They produce the sperms (male gametes).

They produce testosterone hormone.

Testosterone increases sexual desire

EPIDIDYMIS

This is a long coiled tube on the backside of the testes

It stores sperms.

It allows sperms time to mature.

Why is the epididymis coiled?

To provide enough time for sperms to mature.

To delay release of sperms.

How is epididymis adapted to its function?

It is long and coiled.

URETHRA

It passes out sperms from the penis.

SCROTUM

This is the outer covering of the testicles.

It protects the testicles (testes) from harm.

It regulates temperature of the testes (testicles).

Why is the scrotum always hanging between the legs?

To keep the testes at a slightly lower temperature than the rest of the body

How does the scrotum regulate temperature around the testes on the following days?

Cold days.

It contracts for the testes to move up and get warmth from the body.

On hot days.

It relaxes for the testes to move away from the body to cool the temperature.

SPERM DUCT (VAS DEFERENS)

It carries sperms to the urethra

SEMINAL VESICLE

It produces semen that transports semen

PROSTATE GLAND

It produces a fluid that nourishes sperms

It produces a fluid that protects sperms

COWPER'S GLAND

It produces a fluid that neutralizes acids in the urethra.

It produces a fluid that lubricates the urethra

FERTILIZATION IN A COW.

This is the union of male and female gametes to form a zygote.

It occurs in the oviducts (fallopian tubes)

GAMETES.

These are reproductive cells.

The female gamete is called ovum.

The male gamete is called a sperm.

Diagram of a sperm and an Ovum

Sperm Ovum

After fertilization, the zygote (embryo) is formed

Embryo develops into a fetus

Fetus finally into a calf

Embryo (zygote)

This is the developing baby between conception and eight weeks

Fetus

This is the developing baby from 9 weeks after conception to birth

CELL DIVISION

After fertilization in the oviducts, the embryo begins cell division as it passes to the uterus.

When it reaches the uterus, conception (implantation) takes place

IMPLANTATION

This is the attachment of the fertilized ovum onto the uterus walls

Implantation occurs in the uterus (womb)

The embryo is attached to the uterus wall by the placenta.

GESTATION PERIOD

This is the time taken from conception to birth.

The gestation period of an in-calf is 270 days or nine months.

In-calf is a pregnant cow.

Signs of pregnancy in cows

The uterus enlarges
The cervix closes up
The udder increases in size
The cow does not go to heat 21 days after service
The movement of fetus can be seen or felt after 7 months.
There is mucus around the cervix

DRY PERIOD OF A COW.

This is the period before calving that cows are not milked.
A cow is dried 6 to 8 weeks before calving.
During dry period, the in-calf cow is fed on food rich in protein.

Drying off the cow.

This is the practice of not milking a pregnant cow before calving

Importance of drying off in cows

It lengthens the next lactation period
It helps the cow to prepare and produce enough colostrum
It leads to increased milk during next lactation

STEAMING UP

This is the feeding of a pregnant animal on foods rich in protein.
It is done in the last two months before giving birth.

Reasons (importance or advantages) of steaming up

It leads to increased milk rich in colostrum
It enables the fetus to grow healthy.
It builds a cow's body in preparation for calving (parturition)
It prevents low birth weight.
It prolongs milk let down.
It lengthens the lactation period

Lactation period

This is the time a female animal takes while suckling its young ones

Milk-let-down

This is the flow of milk from the udder to the teats of a cow

CALVING (PARTURITION).

This is the act of giving birth in cattle (cows).

Signs of calving.

The vulva swells and becomes red.

The cow becomes restless.

The teats open.

The cow stops grazing.

The udder and teats become swollen.

The cow isolates itself.

Colostrum

This is the first milk got from a cow which has given birth.

Importance of colostrum

It has a lot of nutrients.

It opens up the digestive system of a calf.

It boosts the calf's immunity (it contains a lot of antibodies).

It is easy to digest.

WEANING

This is the gradual introduction of semi-solid food other than breast milk alone

Weaning in calves starts during the **third week**

Types of weaning calves

Early weaning: calves stop suckling at 5 weeks

Late weaning: calves stop suckling at 16 weeks

METHODS OF FEEDING CALVES

Mother cow feeding:

This is the act of allowing a calf to stay with a mother cow for some time.

Nurse-cow feeding:

This is the act of allowing many calves to suckle one cow

Open bucket feeding:

This is the act of feeding the calves on milk in buckets

Teat feeding:

This is the act of feeding calves from teats attached to one bucket

Importance of feeding calves on roughages

Helps in formation of vitamin B

Stimulates rumination process (ability to chew cud)

It quickly develops the digestive system of a calf

MILKING

This is the removal of milk from the udder of a cow through teats.

Milk let down

Milk let down is the flow of milk from the udder of a cow.

Types of milking

There are two types of milking namely;

Hand milking

Machine Milking

Hand milking

Hand milking is the removal of milk from the udder of a cow by squeezing teats using hands.

Hand milking is also called **full hand milking**.

Machine milking

This is the removal of milk from the udder of a cow using a machine.

The parts of a milking machine must be washed to avoid milk contamination.

PREPARATION FOR MILKING

Assemble the clean milking equipment.

Put the cow in a milking place and tie the hind legs with a rope. **This prevents the cow from kicking the person who is milking and to prevent the cow from kicking the milk container.**

Give the cow some feeds to keep it busy and relaxed during milking.

Wash the udder and teats with warm clean water to encourage milk let down.

Wash your hands clean to prevent milk contamination/to remove germs and dirt.

Draw one or two streams of milk from each teat into a strip cup (fore cup) to detect the presence of mastitis in milk.

If the cow has mastitis, bloody milk clots will remain on the wire mesh of a strip cup.

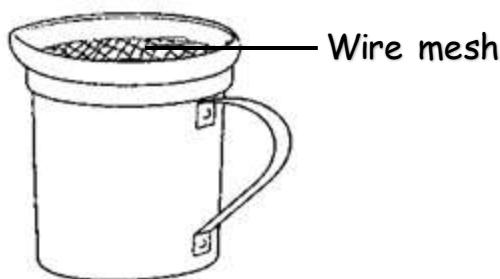
A cow with mastitis should be milked last.

After milking, wash the milking place and equipment using disinfectants. To kill germs which may make milk to go bad

STRIP (FORE) CUP

This is an instrument used to detect the presence of mastitis in milk.

Diagram of a strip cup



LACTOMETER

This is an instrument used to;

Detects whether water has been added to milk

Detects whether fats have been removed from milk.

Detects the purity of milk

Measures specific gravity/density of milk

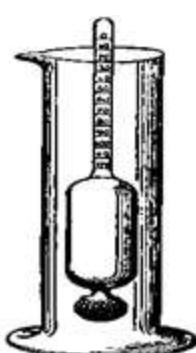
A lactometer is a closed weighed tube graduated to make the level of normal milk.

How a lactometer works

A lactometer is dipped in a container having milk.

If water has been added to milk, it will sink deeper due to lack of support.

Diagram of a lactometer



MILK PRESERVATION

This is the way of keeping milk free from bacteria

Methods of preserving milk

Pasteurization

Sterilization

Refrigeration

Boiling

PASTEURIZATION

This is the heating of milk at controlled temperature and cooling it rapidly.

Heating kills germs.

Rapid cooling prevents the bacteria from entering and multiplying in milk.

Pasteurization of milk was discovered by **Louis Pasteur**, a French Scientist who discovered that milk goes bad due to bacteria.

Advantages of pasteurization

It kills bacteria without destroying nutrients present

It increases the quality of milk

It does not cause change in taste of milk

STERILIZATION

This is the method of killing bacteria in milk by maximum boiling followed by cooling and covering.

Disadvantage of using sterilization in milk preservation

It destroys nutrients (fats and proteins) in milk

REFRIGERATION.

This is the act of putting milk in a refrigerator to lower its temperature to about 4°C .

Low temperature prevents multiplication of bacteria (makes bacteria dormant and unable to multiply).

BOILING METHOD.

It kills germs which enter milk when it is cold

Disadvantage of boiling.

A lot of milk is lost by evaporation.

HOMOGENIZING

This is a way of treating milk so that fats are broken down and the cream is mixed with the rest.

PRODUCTS GOT FROM MILK

Butter	Ice cream	Casein
Cheese	Ghee	
Yoghurt	Whey	

CASEIN

It can be used as food

It is a raw material for making shiny paper.

Whey

It used as sauce to accompany food.

Examples of processed milk

Whole milk	Fortified Milk
Skimmed Milk	Condensed Milk
Pasteurized Milk	

CALF MANAGEMENT PRACTICES ON A FARM

These are ways of caring for calves on the farm

Numbering/identification of cattle

Dehorning/Disbudding

Hoof trimming

Spraying

Castration

Dipping

Dehorning

Dusting

NUMBERING

This means putting a mark or label on the body of animals.

Importance of livestock identification/numbering

Helps a farmer to easily find his animals in case they get lost

Helps a farmer to keep proper records

Ways of numbering/methods of livestock identification

Branding	Use of a number lace
Ear notching	Ear tattooing
Ear tagging	Tail Bobbing

Branding

This means putting marks on the body of animal using hot iron.

It is done on head, on hump and legs because it spoils quality of the hides

Ear notching

This is the cutting of the edge of the ears of animals with marks.

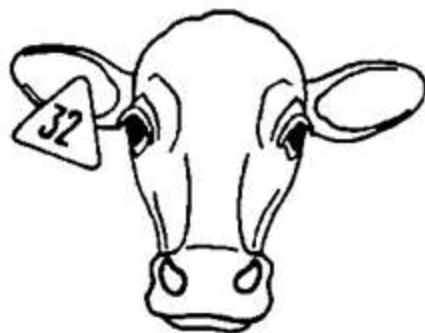
Diagram

Ear Tagging

This means fixing tags with numbers on the ear of animal.

It is done using an applicator

A drawing showing ear tagging



Using a number Lace

This is the putting of a wooden or iron piece of plate around the neck of animals.

A drawing showing use of a number lace as a method of cattle identification



Ear tattooing

This is the putting of permanent mark on the ears of animals using pliers carrying numbers on them.

Diagram

Tail bobbing

This is the trimming long hair on the animals' tail/switch.

NB: Cows are not usually docked i.e. tails are not shortened.

Diagram

HOOF TRIMMING

This is cutting off overgrown hooves of animals.

It is done using a hoof trimming knife or a pair of shears

Advantages

It reduces the risk of injuries among cattle.

It reduces the risk of transmission of diseases.

Note

After hoof trimming, the animal is made to walk in a foot bath **to prevent foot rot disease**

Foot rot is caused by bacteria

CASTRATION

This is the removal or inactivation of testicles of a male animal

Methods of castration

Open castration

Closed castration

Loop castration (band castration)

OPEN CASTRATION

This is when the scrotum is cut to remove the testicles

The sperm ducts are then sealed by burning using a hot metal.

Instruments used in open castration

Sharp knife

Razorblade

Scalpel

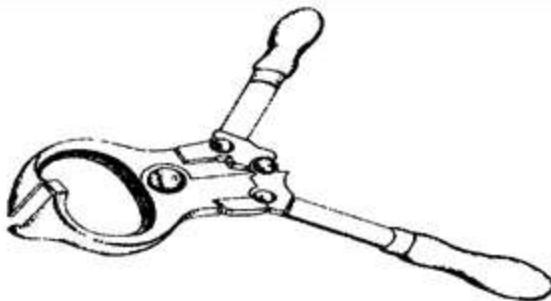
CLOSED CASTRATION

This is the use of burdizzo to crush the sperm ducts and blood vessels

Instrument used in closed castration

Burdizzo

Diagram of a burdizzo



How is a burdizzo useful on cattle farm?

It is used in closed castration of livestock

How is a burdizzo adapted to its function?

It has blunt pincers

Elastration

This is the use of a rubber band to squeeze and break the sperm ducts and blood vessel from the scrotum and testicles.

The scrotum and testicles fall off the body after some time.

Instruments used in elastration

Rubber band

Elastrator

An elastrator is used to apply rubber band to the neck of the scrotum during elastration.

Advantages of castration

It prevents inbreeding

It prevents random mating

It prevents unwanted pregnancies

It makes the male animal humble (docile)

It makes the male animal grow big and fat

It reduces bad smell in male animals

Disadvantages of castration

It is painful

It increases the risk of infections

It can lead to excessive bleeding hence death

- It can lead to swelling
- It denies the male animal its right of reproduction
- It needs a skilled person

DEHORNING (DISBUDDING)

Dehorning is the removal of horn buds from the head of a young animal

Disbudding is the removal of horn buds from the head of a young animal

Methods/ways of dehorning

Use of spoon dehorners: at 2 months of age

Use of chemicals such as common salt and potassium hydroxide: 3 to 14 days

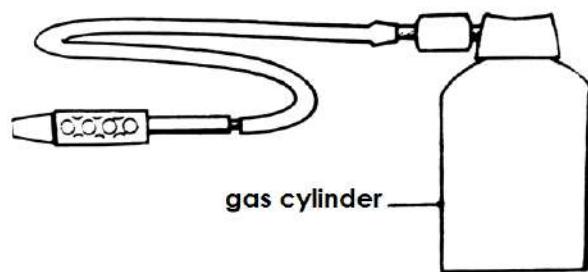
Use of dehorning iron (hot iron rod): 6 to 30 days after calving.

Instruments used in dehorning

Spoon dehorner

Dehorning iron

A diagram showing dehorning iron.



Advantages of dehorning

- It increases space in the Kraal (byre).
- It makes animals easy to handle.
- It prevents animals from destroying farm structures.
- It prevents animals from injuring people and other animals.

Disadvantages of dehorning

- It is painful to the animal
- The animal may lose a lot of blood and die
- The wound may become septic
- The animal loses its defence organs
- It needs skilled person.
- It may lead to mental disturbance of the animal

DEWORMING.

This is the giving of medicine to animals to kill worms (endoparasites)

Why farmers deworm their animals?

To kill endoparasites (worms) in animals.

EXAMPLES OF WORMS (ENDOPARASITES) IN ANIMALS.

Tape worm

Hookworm

Liver fluke

Thread worms

METHODS OF DEWORMING.

Drenching

Dosing

DRENCHING.

This is the giving of liquid medicine through the mouth to kill worms in animals.

Equipment used for drenching

Drenching gun (it is the main tool for drenching)

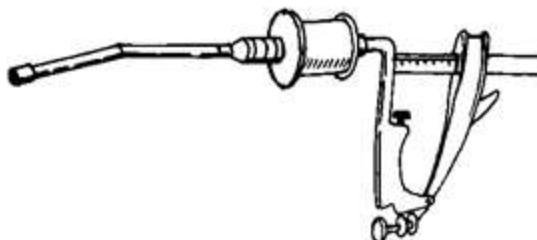
Bottle

Syringe

How does a cattle farmer make use of a drenching gun?

For drenching

A diagram of a drenching gun.



Dosing

This is the giving of solid medicine through the mouth to kill worms in animals.

Forms of solid medicine used for dosing.

Deworming capsules

Deworming tablets

Equipment used for dosing

Bolus gun

How does a cattle farmer make use of a bolus gun?

For dosing

SPRAYING

This is act of sprinkling acaricides on the animal's body.

Why do farmers spray acaricides on their animals?

- To kill ticks and mites
- To prevent tick-borne diseases.

Knapsack sprayer is the farm tool used for spraying acaricides

DIPPING

This is the act of making animals to move through water mixed with acaricides in a dip tank.

Dip tank

This is a farm structure in which acaricides are put for animals to pass through.

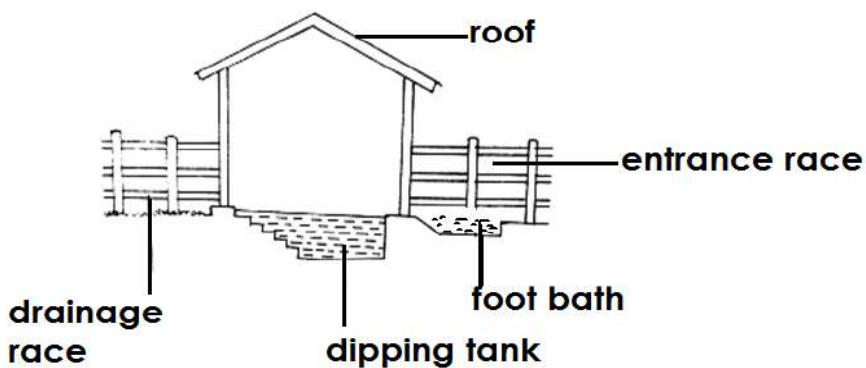
Advantages of using a dip tank

- Less labour is needed
- The animal is well covered by acaricides
- The acaricides can be used again
- It is very useful for farmers with large herds

Disadvantages of using a dip tank

- It requires a lot of capital
- Skilled labour is needed to detect the strength of acaricides

A diagram showing a dip tank



Why should the dip tank be cemented?

To make it last longer

To prevent contamination of acaricides

To prevent drainage of acaricides through the walls

Why should a dip tank be made shallow?

To prevent the animals from drowning.

Why are cattle first given drinking water before dipping?

To prevent farm animals from drinking the acaricides.

Why are farm animals passed through a footbath before dipping?

To prevent contamination of acaricides.

Why is a dip tank and a spray race always made narrow?

To prevent the animal from turning.

Examples of acaricides used in a dip tank

Gumtox

Taktic

Amitraz

Tsetsetick

Triatix

DUSTING

This is the act of smearing the animal with acaricides to kill ticks and mites.

DETICKING

This is the act of using hands to pick ticks from the animal's skin.

Removal of extra teats

This act of cutting extra teats from the udder of a cow.

There should be only four teats.

HOUSING OF CATTLE

This is the constructing of houses for cattle

Reasons for housing of cattle

To protect animals from bad weather

To protect animals from predators

To protect animals from thieves

Importance of houses on a cattle farm

Houses protect animals from bad weather

Houses protect animals from thieves

Houses protect animals from predators
Houses are used to keep farm produce
Houses are used to keep farm records.
Houses are used to keep animal feeds
Houses are used to keep farm tools (farm equipment)
Houses are used as milking places.
Houses are used as treating places for animals.

Qualities of a good house for cattle

It should be well ventilated
To allow free circulation of air
To allow in fresh air
It should have a waterproof roof
To prevent leaking of rain
It should have a cemented floor
To make cleaning easy
To prevent accumulation of mud
It should have a slanting floor
For easy drainage of urine

Dangers of sharing a house with animals

It leads to bad smell in the house
Animals may spread parasites to people
Animals may destroy household property
It leads to competition for oxygen
Animals may spread diseases to people

Zoonosis (zoonotic disease)

This is a disease that can spread from infected animal to humans

Examples of Zoonoses

Tuberculosis (TB)

Rabies

Anthrax

Brucellosis

Anaplasmosis

FENCING

Fencing is the putting of a barrier of live or dead materials around the farm or home

A fence is a barrier of live or dead materials around the farm or home.

Types of fences

Natural fences (live Fences)

Artificial fences (dead fences)

NATURAL FENCES

These are fences planted by man.

Examples of plants used to make natural fences

Bamboo

Sisal

Pine

Cedar

Thorny plants

Acacia

ARTIFICIAL FENCES

These are fences made out of non living materials

Examples of artificial fences

Chain-link fence

Barbed wire fence

Concrete block fence

Electric fence

Stone fence

Wooden fence

Plain wire fence

Brick fence

Importance of fencing

It allows proper use of pasture.

It protects animals from thieves.

It controls the spread of cattle diseases

It prevents animals from destroying crops

Natural fences act as wind breaks.
It controls boundary disputes
Natural fences promote practice of agroforestry
It facilitates rotational grazing
It makes culling easy.
Some fences add humus to the soil.
It enables a farmer to easily separate animals according to age, sex and health.

Disadvantages of fencing

Thorny plants can cause injury to animals
Fences can hide snakes and ticks
Some fences are expensive to maintain

PASTURE

This is the grass for feeding farm animals.

PASTURE LAND

This is an open grassland on which animals graze.

TYPES OF PASTURE

Natural pasture
Prepared pasture

Natural pasture

This is pasture that grows by itself.

Examples of natural pasture

Kikuyu grass
Guinea grass
Nandi grass
Goat weed
Star grass
Elephant grass
Guatemala grass
Alfalfa

Prepared pasture

This is pasture made out of fodder crops.

What are fodder crops?

These are crops grown for feeding animals

Examples of fodder crops

Maize

Sorghum

Rice

Millet

Sweet potatoes

Oats

Cloves

Elephant grass

Kinds of prepared pasture.

Silage

This is undried green grass cut and stored to be used as food for animals

Hay

This is the grass cut and dried to be used as food for animals.

Importance of pasture

It is food for farm animals

It adds humus to the soil after decaying.

It is used as animal bedding.

It controls soil erosion.

It is used for thatching houses

Leguminous pastures fix nitrogen in the soil.

PASTURE WEEDS

These are unwanted plants in the pasture land.

Examples of pasture weeds.

Thorn apple

Sodom apple

Lemon grass

Tick berry

Catstail grass (timothy grass)

Dangers of pasture weeds.

They are poisonous to farm animals.

They compete with pasture for nutrients.

They add a strange smell in milk.

TANNING

This is the process of making leather from hides

Methods of tanning (methods of preserving hides and skins)

Wet salting

Salt absorbs moisture from hides.

Suspension drying

This is the act of stretching a hide on flat surface to dry under shade.

FEEDING HABITS IN CATTLE.

Cattle are herbivores (they feed on vegetation)

Cattle are ruminant (ungulate)s hoofed mammals.

RUMINATION

This is the ability of some mammals to chew cud

RUMINANTS

These are mammals that chew cud.

Characteristics of ruminants

They chew cud

They have four stomach chambers.

How do most ruminants protect themselves?

By using their horns.

Examples of ruminant animals

Cattle

Sheep

Goats

Horse

Giraffe

Camel
Antelope
Elephant

THE DIGESTIVE SYSTEM OF RUMINANTS

Uses of each part

Mouth

It chews food by the help of teeth

Gullet (oesophagus)

It is the passage of food mouth to rumen

Food (roughage) moves from gullet to rumen by a process called **peristalsis**.

Rumen (paunch)

It is the first and largest stomach chamber of a ruminant.

It stores food for a short time before chewing cud.

It breaks down cellulose and vitamin B

It is where food is fermented and softened.

Reticulum (honeycomb stomach)

It is the second stomach chamber of a ruminant.

It retains foreign bodies.

It maintains supply of digestive fluids.

It separates well chewed food from unchewed food

Omasum

It is the third stomach chamber of a ruminant.

It grinds food.

It absorbs water.

Abomasum (true stomach)

It is the fourth stomach chamber of a ruminant.

It is where digestion of proteins starts.

It mixes food with enzymes

Small intestines (ileum)

It absorbs digested food.

Caecum and appendix

It is where cellulose is digested by the action of bacteria

Rectum

It stores undigested food as dung

Anus

It is where dung is passed out of the body

TYPES OF CATTLE FEEDS.

Forages

Concentrates

Production rations

Maintenance rations

Additives

Forages:

These are plants given to cattle as food

Hay (dried grass)

Maize stalks

Vegetables

Legumes

Silages

Green grass

Roughages

Concentrates

These are commercial cattle feeds prepared in factories

Maize bran

Crushed oil seeds

Bone meal

Blood meal

Fish meal

Supplements

These are proteins and vitamins added to cattle feeds.

Production rations

These are extra feeds given to cattle to produce more beef or milk.

Maintenance rations

These are feeds given to cattle to sustain their usual feeds.

Additives

These are drugs and flavour added to cattle feeds (such as; salt)

IMPORTANCE OF SALT TO CATTLE

Why are cattle given salt to lick?

It stimulates milk production
It controls milk fever disease.
It provides mineral salts to the body
It fattens the cows

Grazing

This is the proper use of grassland by livestock

SYSTEMS (METHODS) OF GRAZING

Herding
Paddock grazing
Strip grazing
Tethering
Zero grazing

Mention three methods of rotational grazing:

Paddock grazing
Strip grazing
Tethering

HERDING

This is when a herdsman looks after animals as they graze.

Herdsmanship is sometimes called **free range grazing or open range grazing**

Advantages of herding

Animals eat a variety of feed
Animals make enough body exercise
Less attention is needed
It is cheap

Disadvantages of herding

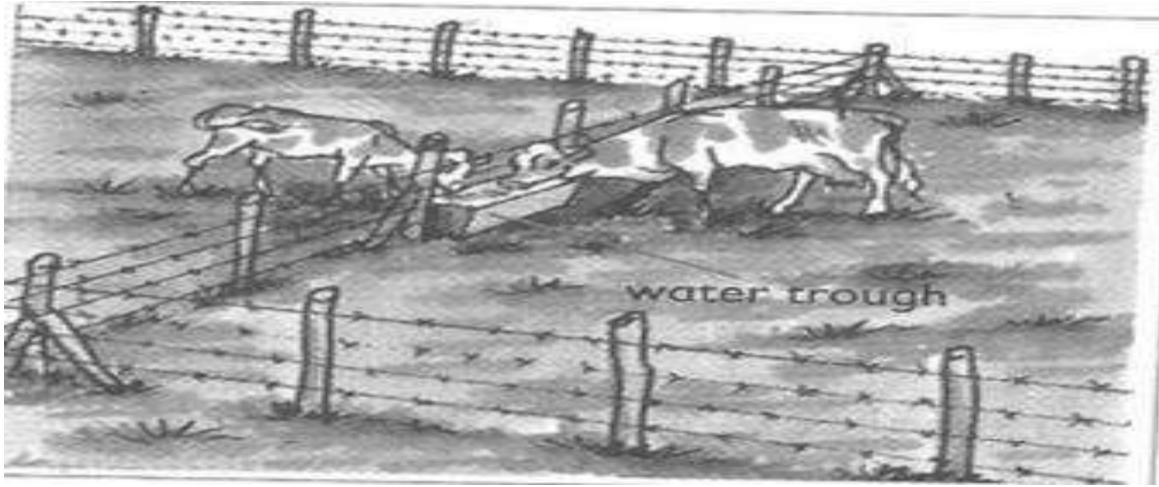
There is easy spread of cattle diseases and parasites
Animals can destroy crops.
Animals can get lost
It needs a big piece of land.
It can lead to overgrazing.

PADDOCK GRAZING

Paddock grazing is the grazing of animals on a pastureland divided into small fenced plots.

Paddocks are small fenced plots on pastureland.

Illustration of paddock grazing



When the pasture is fully grazed by animals, the animals are moved to another paddock.

Advantages of paddock grazing

- It allows proper use of pasture.
- It gives pasture time to grow.
- It controls over grazing.
- Animals do not destroy crops.
- Manure is evenly distributed on the farm.
- It prevents easy spread of tickborne diseases
- It controls ticks

How?

By starving ticks to death (it breaks the life cycle of ticks).

Disadvantages of paddock grazing

- It is expensive to fence the paddocks
- It needs a big piece of land.
- Animals do not make enough body exercises

STRIP GRAZING

This is the grazing of animals on a pastureland divided into strips using electric wires.

How do electric wires used in strip grazing limit animals from going escaping?

They shock animals to keep them in the strip.

Illustration of strip grazing

When the pasture is fully grazed by animals, the wire is moved to a different area.

Advantages of strip grazing

There is proper use of pasture.

It controls cattle diseases and parasites

It prevents over grazing

Animals do not destroy crops

Disadvantages

It is expensive to maintain

Few animals are kept

Animals do not make enough body exercises

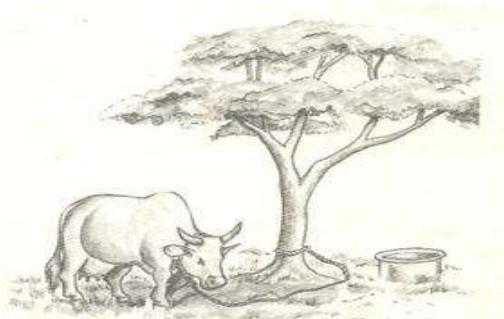
It can only be used in places with electricity

TETHERING

This is the grazing of animals in which a farmer ties the animal on a peg or tree using a rope.

The animals tethered is moved to a new place when necessary.

An illustration showing tethering



Advantages of tethering

No fence is needed.

It is easy to start

It is cheap to manage

It needs a small piece of land

Animals may not destroy crops

The farmer gets time to do other work

Disadvantages of tethering

Animals do not make enough body exercises

Animals do not get balanced diet.

The rope can easily strangle the animal

Few animals are kept.

Animals can easily be stolen

Animals can easily be killed by predators.

ZERO GRAZING

This is the keeping of animals in stalls where water and food are provided.

Zero grazing can also be called **stall grazing**

Advantages of zero grazing

Feeds are not wasted.

It needs a small piece of land

Animals are protected from bad weather

It is easy to collect manure

It is easy to cull sick animals

It is easy to control cattle diseases and parasites

It is easy to carry out selective breeding

Many animals are kept in a small area.

Animals produce a lot of milk. (since there is no wastage of energy)

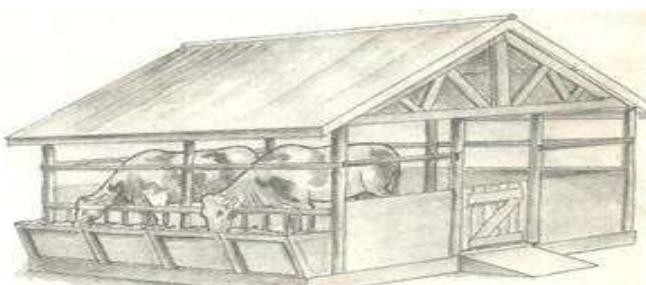
Disadvantages of zero grazing

It is expensive

Animals lack body exercises

It needs a lot of labour (to clean the stalls and to provide food

ILLUSTRATION SHOWING ZERO GRAZING



REQUIREMENTS FOR ZERO GRAZING

Cattleshed (byre)

It is where the animal is kept.

A store

It is used to keep farm tools and animal feeds

Feeding trough

It is where animal feeds are put.

Water trough

It is where animals drink water from.

Workers

To clean the shed

Garden

It is where fodder crops are grown

Chaff cutter

It is used to cut animal fodder into fine pieces (maize stalks, hay and elephant grass)

PRACTICES THAT HARM DOMESTIC ANIMALS

Making animals to over work

Dehorning

Castration

Branding

Piercing them to get blood

Over beating the animals

Neglecting the animals when they are sick

Over loading of animals on small vehicles

Brutal ways of killing animals (in abattoir)

PRACTICES THAT HARM CATTLE.

Write down the practices that harm cattle in the field.

Over beating cattle.

Making animals to over work.

Improper disposal of polythene bags.

Piercing them to get blood.

Giving animals less food.

Write down the practices that harm animals at home.

Castration

Dehorning (disbudding)

Ear tagging

Branding

Ear notching

Neglecting animals when they are sick

Giving animals less food.

Write down the practices that harm animals in transit.

Overloading cattle on small trucks.

Making cattle to walk long distances.

Write down the practices that harm cattle in abattoirs.

Brutal killing of animals

Slaughtering them with blunt objects

What is an abattoir?

This is a public house where domestic animals are slaughtered.

Handling structures on the livestock farm

Milking parlour

For handling the animal when milking

Cattle crush

For restraining the farm animal during some farm practices (dehorning, branding, drenching and castration)

Spray race

For handling the animals during spraying

SPRAY RACE.

This is a confined space in which cattle are sprayed.

Advantages of a spray race

It is quick

Many animals can be sprayed in short time

There is no wastage of acaricides

Less labour is needed

Disadvantage of a spray race

It is expensive

CATTLE PARASITES

These are parasites that attack cattle

A parasite is an organism that depends on another organism for survival

A host is an organism on which a parasite depends for food.

How do parasites benefit from their host for survival?

Parasites get food from their host

Parasites get shelter from their host

GROUPS (TYPES OR CLASSES) OF PARASITES

External parasites (ectoparasites)

Internal parasites (endoparasites)

External parasites (ectoparasites)

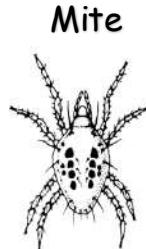
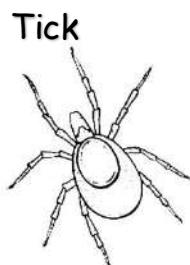
These are parasites that live outside the body of host.

Ticks

Tsetse flies

Mites

ILLUSTRATIONS OF EXTERNAL PARASITES IN CATTLE.



Ways of controlling ectoparasites (external parasites) in cattle

Spraying animals using acaricides

Dipping animals in acaricides

By paddock grazing

Using a spray race

By dusting animals with acaricides

By deticking (hand picking the ticks)

Clearing bushes around the farm (to control tsetse flies)

Trapping tsetse flies using tsetse fly traps.

Reasons why ticks are very difficult to control.

Due to host movement

Due to high cost of acaricides

INTERNAL PARASITES (ENDOPARASITES)

These are parasites that live inside the body of the host.

They live in the intestines and liver.

Give examples of internal parasites (endoparasites)

Tape worms

Thread worms

Hookworms

Liver flukes

Ways of controlling endoparasites (external parasites) in cattle.

By deworming (drenching and dosing)

Regular vaccination

Grazing in well drained areas (to control liver flukes) / Avoid grazing in high risk pastures

Giving animals clean feeds

Always clean the feeding equipment

Effects of parasites of cattle

Pests suck blood from animals.

Some pests spread diseases.

Pests damage the skin of animals.

Some pests cause discomfort to the host

CATTLE DISEASES

These are diseases that attack cattle.

Signs of sickness in farm animals (cattle)

Dullness

Sneezing

Runny eyes

Rough hair

Diarrhoea

Dry muzzles

Coughing

Blood stained dung

Loss of appetite

Symptoms of diseases (sickness) in farm animals

Fever

Body weakness

Constipation

Conditions that can lead to diseases in farm animals

Poor feeding

Poor sanitation in their houses

Dirty food and water

Physical injuries like dirty wounds

Infected bites from vectors

Routes of disease infection in animals

Direct body contact with sick animals

Through dirty food and water.

Mention three groups of causative organisms for cattle diseases

Bacteria

Viruses

Protozoa

GROUPS OF CATTLE DISEASES.

Bacterial diseases

Viral diseases

Protozoan diseases

EXAMPLES OF CATTLE DISEASES

Bacterial diseases

Anthrax

Brucellosis/bang disease/contagious abortion

Mastitis

Tuberculosis

Foot rot

Black Quarter

Red water

Heart water

Calf scour

Viral diseases:

Rinderpest

Foot and mouth disease

Viral and bacterial disease

Pneumonia

Protozoan diseases

Nagana (trypanosomiasis)

East coast fever (ECF)

Coccidiosis

Mention four tick-borne disease in cattle

Heart water

East coast fever

Anaplasmosis

Red water

Name of disease	How its spread	Signs and symptoms	Prevention control and treatment
Bacterial diseases			
<p>Anthrax</p> <p>It is caused by a bacterium called <u>bacillus anthracis</u></p>	<p>Through body contacts and contaminated feeds</p> <p>Feeding animals on dirty feeds</p> <p>Feeding animals on dirty water</p> <p>Through open wounds</p>	<p>High fever</p> <p>Loss of appetite for pasture.</p> <p>Sudden death</p> <p>Blood stained dung</p> <p>Watery blood from body openings</p>	<p>Bury the dead animal in deep pits.</p> <p>Burn the carcass.</p> <p>Regular vaccination annually.</p> <p>Isolate and sick animals</p>
<p>Mastitis</p> <p>It affects the mammary glands (teats and udder).</p>	<p>Through body contact with an infected animal</p> <p>Through sores on the teats</p>	<p>Milk with blood stains and pus</p> <p>Swollen udder and teats</p> <p>A cow refuses to be milked and suckled</p> <p>The udder gets dead and gives no milk.</p>	<p>Treat with antibiotics</p> <p>Use a strip cup to detect mastitis in cattle</p> <p>Regular vaccination</p> <p>Ensure proper hygiene when milking</p> <p>Use disinfectants during milking</p> <p>Use the right milking techniques</p>

Foot rot	<p>It attacks hooves of all hoofed animals.</p> <p>It is always common during wet weather.</p>	<p>Swollen hooves</p> <p>Rotten hooves</p> <p>Smelly hooves</p> <p>Lameness</p> <p>High fever</p> <p>Reduced milk production</p>	<p>Treat with antibiotics.</p> <p>Trim affected hooves.</p> <p>Always provide foot bath to animals.</p> <p>Regular foot trimming.</p>
<p>Tuberculosis</p> <p>It is caused by a bacterium called <i>mycobacterium tuberculosis</i></p>	<p>Through inhaling contaminated air</p> <p>Through milk of infected cows</p>	<p>Coughing</p> <p>Loss of weight (emaciation)</p> <p>Loss of appetite to</p>	<p>Isolate and treat sick animals</p> <p>Ensure proper sanitation</p> <p>Kill infected animals</p> <p>Early treatment using antibiotics</p>
<p>Brucellosis (contagious abortion or bang's disease)</p> <p>It is caused by a bacterium called <i>Brucella</i></p>	<p>Through mating with infected animals</p> <p>Through body contact with infected animals</p>	<p>Miscarriage (abortion in cows)</p> <p>Brownish discharge from vulva</p> <p>Swollen testicles</p> <p>Still births in cows</p> <p>The placenta remains inside the uterus</p>	<p>Isolate and treat the sick animals</p> <p>Regular vaccination</p> <p>Use gloves to hold aborted fetus.</p> <p>Use artificial insemination to avoid mating infection</p> <p>Always drink well boiled milk.</p>

Anaplasmosis It destroys the red blood cells	Through bites of infected ticks (blue ticks). Through surgical and dehorning instruments with infected blood	Constipation Blood in urine and dung Loss of weight High fever Rapid reduced milk production Loss of appetite for food Rapid loss of weight Pale skin around the eyes and muzzle Abortion	Dip cattle in acaricides Spray animals with acaricides
Heart water	Through bites of infected ticks (brown ear tick)	Animals walk in circles. Animals become restless Animals place their heads on objects When the animal falls, legs keep paddling in air	Dip animals in acaricides Spray animals with acaricides
Red water It damages the liver	Through bites of infected ticks (red tick)	High fever Red urine Loss of appetite Constipation Infected animal stays away from the herd	Dip animals in acaricides Spray animals with the acaricides.

Viral diseases

Foot and mouth disease It attacks the muzzle and coronet.	Through sharing feeding containers with infected animals	Swollen teats and lameness Salivation in the mouth	Regular vaccination (every six months)
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	<p>Through sharing grazing land with infected animals</p> <p>Through body contact with infected animals</p>	<p>Lameness (due to wounds on the cornet).</p> <p>Blisters on top of hooves, tongue and muzzle</p> <p>Loss of appetite for pasture</p> <p>High fever</p> <p>Reduced milk production</p>	<p>Applying quarantine.</p> <p>Slaughter the infected animals</p> <p>It has no treatment</p>
Rinderpest	<p>Through body contact with infected animals</p>	<p>Soars in the mouth</p> <p>Sunken eyes</p> <p>Nasal discharge</p> <p>Rapid breathing</p> <p>Discharge from eyes</p> <p>High fever</p> <p>Profuse diarrhoea</p>	<p>Regular vaccination</p> <p>Applying quarantine</p> <p>Slaughter the infected animals</p> <p>It has no treatment</p>

Bacterial and viral disease

Pneumonia	<p>Spreads through inhaling contaminated air</p> <p>Through living in dirty places</p>	<p>Difficulty in breathing</p> <p>Coughing,</p> <p>Nasal discharge</p> <p>Loss of appetite for pasture</p> <p>High fever</p>	<p>Use well ventilated dry and clean pens.</p> <p>Treat the animal at the early stage of the disease</p>
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Protozoan disease

<p>Nagana (trypanosomiasis)</p> <p>It is caused by protozoan parasite called Trypanosoma.</p>	<p>Through the bites of infected tsetse flies</p>	<p>Loss of weight</p> <p>Anemia</p> <p>Loss of appetite</p> <p>High fever</p> <p>Dullness</p>	<p>Clear all bushes around the farm</p> <p>Spray with insecticides</p> <p>Use tsetse fly traps</p>
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		Licking of soil by Animals Swollen lymph nodes Runny eyes	Treat using drugs
East coast fever (ECF) It is caused by a protozoan parasite called Theileria parva	Through bites of infected ticks (brown ear tick)	Nasal discharge Diarrhoea Loss of appetite High fever Difficulty in breathing Body weakness Swollen lymph nodes	Dip animals in acaricides Spray animals with acaricides
Coccidiosis	Through infected dung in the kraal	Blood stained dung Diarrhoea Rapid dehydration Loss of weight Loss of appetite	Isolate and treat the sick animals Use coccidiostat drugs in food and water

Deficiency disease

Milk fever It is common in pregnant and lactating cows	Lack of calcium in the diet	Loss of appetite Body weakness Dry muzzle Dullness Stillbirths	Provide feeds rich in calcium after calving Provide calcium salts in an oral gel Feed animals on forages
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FACTORS TO CONSIDER BEFORE STARTING A LIVESTOCK FARM

Land

Capital

Labour

Market

Management

LAND

This is the place on which the farm is started.

Ways of getting land

- By buying the land
- By inheriting the land
- By hiring the land
- From donations

The reward to land is **rent**

CAPITAL

This is the money used to buy things needed to start a farm.

Ways of getting capital

- Through donation
- Through savings
- Through loans

The reward to capital is **interest**

LABOUR

These are all people who do activities on the farm.

Groups of labour (classes of workers) on the farm

- Skilled labour
- Unskilled labour

SKILLED LABOUR

These are people who are trained to do specialized work

Examples of specialized work on the farm

- | | |
|-------------------------|-----------|
| Vaccination | Deworming |
| Artificial insemination | Dehorning |
| Castration | Dipping |

UNSKILLED LABOUR

These are people who do casual work on the farm

Examples of activities done by unskilled labour.

- | | |
|---------------------|-------------------|
| Feeding the animals | Cleaning the farm |
| Weeding the farm | Milking |

The reward to labour is **wage or salary**

MARKET.

This is the demand for cattle and cattle products.

MANAGEMENT.

These are skills applied on the farm to have work done in a profitable way.

FARM RECORDS

These are written information about different activities done on a farm.

TYPES OF FARM RECORDS

Breeding records	Sales and expenses records
Production records	Inventory records
Health records	Feeding records
Labour records	

Production records

These show yields of various farm produce.

They involve how many animals have been produced and how many have died.

Health records

These show the type of disease and parasites affecting the cattle.

These also show treatment that has been given to cattle.

Field records

These show the number of animals kept on the farm.

They show different farm activities carried out on the farm.

Sales and expenses records (marketing records)

These show the amount of money collected after selling the products and how much is spent.

They show the products sold on the farm.

Labour records

These show number of workers on the farm

They also show their work.

Inventory records

These show the list of farm equipment with their respective value.

REASONS FOR KEEPING FARM RECORDS

To know the profits or losses.

To be taxed fairly.

To enable the farmer to make decision.

- To get loans easily.
- To plan for the farm.
- To know the farm history.

PROBLEMS FACING CATTLE FARMERS IN UGANDA

- | | |
|----------------------|--------------------------------|
| Cattle diseases. | Prolonged drought. |
| Cattle parasites. | Shortage of labour. |
| Lack of enough land. | Shortage of water and pasture. |
| Lack of capital. | Lack of ready market. |

FREEDOM OF DOMESTIC ANIMALS

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

RESOURCES IN THE ENVIRONMENT

A resource is anything that people use to meet their needs.
Resources can either be living or non-living components of environment.

TYPES OF RESOURCES

- Renewable resources
- Non-renewable resources

RENEWABLE RESOURCES

These are resources that can be replaced naturally.
They are sometimes called **exhaustible resources**

Examples of renewable resources (inexhaustible resources)

Soil (land)	Water	Fungi
Plants	Sun	
Animals	Air or wind	

NON-RENEWABLE RESOURCES

These are resources that cannot be replaced naturally.
They are sometimes called **exhaustible resources**.

Examples of non-renewable resources (exhaustible resources)

Rocks
Minerals
Fossil fuels

IMPORTANCE OF PLANTS AS RESOURCES

Some plants are used as herbal medicine.
Some plants provide food to animals.
Plants provide shades and shelter to animals
Some plants provide wood for making furniture
Some plants provide wood fuel
Some plants provide electric poles
Some tree barks are used to make bark cloth
Some plants provide plant fibres e.g cotton, sisal, jute, flax, hemp, raffia, ramie and banana fibre
Some plants are used as live fences.

Ways of conserving plants as resources

By afforestation
By reforestation
By agroforestry
Use of energy saving stoves (clay stoves)
Use of electricity and biogas for cooking
Avoid deforestation
Avoid bush burning
Use of better methods to harvest wood

BETTER METHODS OF HARVESTING WOOD

Coppicing
Lopping
Pollarding

POLLARDING

This is the cutting of the top part of a tree.

AN ILLUSTRATION SHOWING POLLARDING

Importance of harvesting trees by pollarding

- It enables fruit trees to produce more and better fruits e.g. mangoes
- It keeps fruit trees short for easy harvesting of fruits.

LOPPING

This is the cutting of side branches of a tree.

Mature side branches are harvested as the tree continues to grow

AN ILLUSTRATION SHOWING LOPPING

Importance of lopping

It enables the tree to grow taller

It enables the tree to continue growing after harvesting firewood

COPPICING

This is the cutting of the whole tree leaving a short stump.

AN ILLUSTRATION SHOWING COPPICING (E.G. EUCALYPTUS)

Importance of coppicing

It allows growth of new shoots

It provides good wood for timber

Note:

Sprouting means to develop new shoots

Why is pollarding or coppicing not done on some trees (e.g pine, podo and cypress)?

Some trees cannot grow new branches

NOTE:

Selective felling: This is when only mature trees are harvested leaving young trees to grow

Carpet felling: This is when all mature and young trees are harvested at once.

How does covering of wood with banana leaves conserve plants?

It prevents heat loss hence using less wood fuel

IMPORTANCE OF ANIMALS AS RESOURCES

Some animals provide animal fibres

Some animals provide hides and skins

Some animals are sources of food (eggs, meat, milk and honey)

Some animals are used for transport (donkeys, horses and camels)

Some animals are used to plough land (oxen and donkeys)

Some animals are used to guard people's homes (dogs and parrots).

Some animals are used for hunting (dogs)

Animal wastes are used to make biogas

Animal dung and urine are used as manure.

EXAMPLES OF ANIMAL FIBRES

Mohair: from Angora goats

Wool: from Sheep and Llama

Rabbit fur: Angora rabbits

Silk: from Silkworms

Chiengora: from dogs

BEASTS OF BURDEN (DRAUGHT ANIMALS)

These are animals that are used to provide labour.

Forms of animal labour.

Pulling carts

Ploughing

Transport

Turning machines

Examples of beasts of burden.

Donkeys

Horses

Mule

Camels

Oxen

WAYS OF CONSERVING ANIMALS AS RESOURCES.

Gazetting game parks

Putting strict laws against poaching

Treating sick animals

Vaccinating animals

Use of legal fishing methods

Examples of poor (illegal) fishing methods

Overfishing

Use of under sized nets

Use of poison

By what process are plants and animals replaced naturally?

By reproduction

FUNGI

These are organisms which lack chlorophyll and unable to make their own food

How do fungi feed?

Most fungi feed saprophytically

Some fungi feed parasitically

Examples of fungi

Yeast

Moulds (penicillium, rhizopus and mucor)

Mushrooms

Toadstools

Puffballs

Bracket fungi

IMPORTANCE OF FUNGI AS RESOURCES

Penicillium moulds are used to make penicillin drug (antibiotics)

Mushrooms are sources of food

Mushrooms are sold for income

Yeast helps in making of alcohol (fermentation of alcohol)

Yeast helps in baking of breads (it is used to leaven bread)

Yeast extracts are sources of vitamin B when eaten

Fungi help in decomposition of organic matter to form soil

Penicillium is used in making of cheese

SOIL

Soil is the top layer of the earth's surface.

IMPORTANCE OF SOIL AS A RESOURCE

For growing crops

For building houses

For making glasses

For making ceramics

For making sand papers

For making bricks

For putting out fire.

For washing cooking utensils

For filtering water

How soil can be conserved as a resource.

By mulching

By manuring

By intercropping

By agroforestry

By bush fallowing

By cover cropping

By strip cropping

By contour ploughing

By terracing

By crop rotation

How can soil be replaced naturally?

By decomposition

By weathering

SUN

It is the main natural source of heat and light energy.

IMPORTANCE OF SUN AS A RESOURCE

Sunlight helps crops to make starch.

How?

By splitting water into hydrogen and oxygen

Sunlight is used to produce solar electricity.

Sunlight helps our skin to make vitamin D

Sun's heat dries wet clothes

How?

By evaporating water from wet clothes

Sun's heat helps to preserve food (dries harvested crops)

How?

By evaporating moisture from food

Sun helps in the water cycle

How?

It heats plants and water bodies to cause transpiration and evaporation

What do we call energy from the sun?

Solar energy

Why the sun is called an energy resource

It provides people with useful energy

IMPORTANCE OF WATER AS A RESOURCE

For cooking

For bathing

For drinking

For washing

For mopping

For irrigation

Water is used as a raw material in beverages industries

Water is used to cool machines

Water helps in seed germination

Water helps crops to make starch

Water is used for keeping aquatic animals like fish
Fast flowing water is used to generate hydro electricity

How is water replaced naturally?

Through rain cycle (water cycle)

Sources of water

Rain (it is the main natural source of water)
Lakes
Rivers
Swamps
Wells
Hot springs

Games played on water bodies

Swimming
Boat racing
Water surfing
Water relay

AIR AND WIND AS RESOURCES

AIR

This is the mixture of gases

Components of air

Nitrogen 78%
Oxygen 21%
Rare gases 0.97%
Carbon dioxide 0.03%

IMPORTANCE OF AIR A RESOURCE

Oxygen

Oxygen is used for respiration
Oxygen supports burning (combustion)
Oxygen helps in seed germination

Carbon dioxide

Carbon dioxide is used to put out fire.

Why?

It does not support burning

Carbon dioxide is used by plants to make starch

Carbon dioxide helps to preserve bottled soft drinks

Why?

It does not allow germs to multiply

Nitrogen

Nitrogen is used to preserve vaccines and semen

Nitrogen is very cool

Nitrogen is used in aeroplane tyres

Rare gases

Rare gases are used in electric bulbs

Rare gases such as helium are used in gas balloons

Mention two gases used in gas balloons

Helium

Hydrogen

Why does a gas balloon fly up in air when released?

Air inside the balloon is lighter than air outside

Why is a balloon tied with a thread?

To prevent it from flying up in air

Why a balloon is always tied with long threads

To prevent the gas inside the balloon from escaping

WIND

This is air in motion (moving air)

What causes wind?

Difference in atmospheric pressure between places

IMPORTANCE OF WIND AS A RESOURCE

It is used for winnowing

It turns windmills to produce electricity

It is used to fly kites

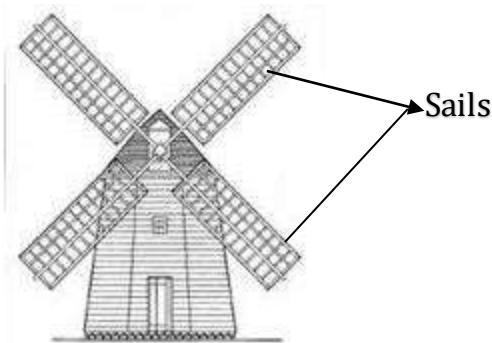
It sails boats and dhows

It helps in seed dispersal

It helps in pollination

It increases the rate of evaporation to enable the clothes to dry faster

STRUCTURE OF A WINDMILL



Uses of a windmill

It is used to draw water from underground tanks

It is used to grind grains and seeds

It is used to generate wind electricity

Why are windmills not commonly used in Uganda to produce electricity?

Uganda does not have regular windy seasons

Dangers of wind to people

It is an agent of soil erosion

It spreads airborne diseases

It destroys houses

It capsizes (overturns) boats on water bodies

It breaks trees and crops

MINERALS AS RESOURCES

A mineral is anything that occurs naturally in the earth's crust.

OR

A mineral is a useful solid or liquid material obtained from underground.

Minerals are non-renewable resources.

Examples of minerals and their uses

Chalk

Clay

Copper; making telephone wires, bullets, coins and refrigerators.

Gold; coating trophies and making coins

Tin; making food cans and tins for carrying water

Silver; coating metals and trophies

Gold; coating metals, rings and trophies

Cobalt

Wolfram: provides tungsten for making filaments of electric bulb

Asbestos; making roofing sheets and fire suits for fire service men

Uranium; producing nuclear electricity

Diamond; cutting of glass and drilling of rocks.(It is the hardest metal)

Lead; making accumulators, batteries and water pipes

Phosphates: used to make phosphate fertilizers

Limestone; for making cement

Bronze; coating rings, trophies and medals

Aluminium; making aircrafts and cooking utensils

Mercury; used as a thermometric liquid, to make insecticides and to fill dental caries

General uses of minerals

They are source of income when sold

They are used as raw materials in industries

They earn foreign exchange for the government

Ways of conserving minerals

Making alloys

Painting metals to avoid rusting

Recycling scrap metals

ALLOYS

An alloy is the mixture of two or more metals.

Reasons for making alloys (importance of making alloys)

To make the metals harder

To lower the melting point of metals

To reduce wear and tear of metals

To increase electrical resistance of metals

EXAMPLES OF ALLOYS AND THEIR USES

ALNICO: This is a mixture of aluminum, nickel and cobalt

For making magnets

CUPRONICKEL: This is a mixture of copper and nickel.

For making coins

SOLDER: it is a mixture of lead and tin

For joining metals

DENTIST AMALGAM: it is a mixture of copper and mercury

For filling dental cavity in tooth.

BRONZE: it is a mixture of copper and tin

For decorating metals

For making coins and medals

BRASS: it is a mixture of copper and zinc

For decorating ornaments

For making wires

For making brass musical instruments

ALNICO: it is a mixture of aluminium, nickel and cobalt.

For making permanent magnets

STEEL: is a mixture of iron and carbon

For making cars

Examples of steel

Cobalt steel

For making permanent magnets

Stainless steel (chromium steel)

For making cooking utensils that do not rust.

Manganese steel

For reducing wear and tear on railway lines

Nickel steel

ROCKS AS RESOURCES

A rock is a solid substance made up of tightly packed minerals.

A boulder is a large detached rock

Why are rocks regarded as non - renewable resources?

Rocks cannot be replaced naturally.

Importance of rocks as resources

They form soil by weathering.

They provide precious metals (minerals).

They provide building materials.

They act as habitat for some wild animals

They describe earth's history.

TYPES OF ROCKS

Igneous rocks

Metamorphic rocks

Sedimentary rocks

Igneous rocks

These are rocks formed when magma cools and hardens.

They are hard and impervious (waterproof).

Basalt

Quartz

Pumice: for scrubbing human feet during bathing

Obsidian: it was used by early man to make tools

Feldspar

Granite

Sedimentary Rocks

These are rocks formed by accumulation of sediments (sand, clay and mud).

They are soft and porous.

Limestone

Sandstone

Ironstone

Shale (clay-rock)

Flint

Metamorphic rocks

These are rocks which change from one form to another.

They are also called **changed rocks**

Marble

Slate

Graphite

Schist

Quartzite

Ores

An ore is a rock that contains metals

Examples of metal ores

Bauxite: an ore of aluminium

Galena: an ore of lead

Calamite: an ore of zinc

Malachite: an ore of copper

Haematite and magnetite: are ores of iron

Magnetite is a natural magnet

WEATHERING.

This is the breakdown of rocks into small particles to form soil.

How is weathering important in the environment?

It helps in soil formation.

TYPES OF WEATHERING.

Chemical weathering

Physical weathering

Biological weathering

What is chemical weathering?

This is the breakdown of rocks as a result of chemical reactions.

What is physical weathering?

This is the breakdown of rocks by use of force.

What is biological weathering?

This is the breakdown of rocks by plants and animals.

AGENTS OF WEATHERING.

Type of weathering	Agents of weathering
Biological weathering	Action of plant roots Animal burrowing
Physical weathering	Temperature changes Frost action Ice wedging Human activities e.g road construction, mining and quarrying Flowing water Animal movements

FOSSILS

These are remains of plants and animals which lived and died long time ago.
They are found in sedimentary rocks and stone quarries

Examples of fossils

Plant fossils

Animal fossils

Uses of fossils

Fossils help geologists to determine the age of a place or rock.

Fossils help geologists to determine the plants and animals which lived in a given place.

Fossils help to tell how the land looked before.

Fossils show us how sedimentary rocks were formed.

Fossils help to tell what the animal or plant looked like.

Fossils help in formation of fossil fuels.

FOSSIL FUELS AS RESOURCES

These are fuels formed from remains of plants and animals which lived and died long time ago.

Fossil fuels are sometimes called fossil minerals

What made fossils to turn into fossil fuels?

Heat and pressure from underground

Examples of fossil fuels (fossil minerals)

Crude oil (petroleum)

Coal

Natural gas

Coal and petroleum are not got from ores.

How are fossil fuels are obtained from underground?

By mining

PETROLEUM (CRUDE OIL)

This is a liquid fossil fuel got from remains of animals

Fuels got from crude oil (petroleum)

Petrol

Diesel

Kerosene (paraffin)

Jet fuel

Fuels are got from petroleum by a refinery process called **fractional distillation**

Other petroleum products

Plastics

Lubricating oil

Grease

Petroleum jelly

LPG (Liquefied petroleum gas)

Paints

Antiseptics

Detergents

Importance of petroleum products

They are used to produce thermal electricity in generators (petrol and diesel)

They are used to run engines (petrol, diesel and jet fuel)

It provides kerosene for cooking and lighting.

They are used to prevent rusting of metals (grease, lubricating oil and paint)

They are used to reduce friction (grease and lubricating oil)

Antiseptics and detergents are used to kill germs

LPG which provides a hot flames to cut metals

COAL

This is a solid fossil fuel got from remains of plants

Coal is a hard black material found below the ground.

Products from coal

Coal tar

Coal gas

Importance of coal

- It is burnt to produce thermal electricity
- It is used to supply heat at power stations
- It is used as a fuel in steam engines
- It provides coal gas is used for lighting and cooking
- It provides coal tar for surfacing roads

NATURAL GAS

This is a gaseous fossil fuel mined from areas where petroleum is found.

Gases which make up natural gas

- Methane
- Ethane
- Propane
- Butane

Uses of natural gas

- It is used for lighting
- It is used for heating
- It is used as a fuel at powerstations

Write LNG and LPG in full

- Liquefied Natural Gas
- Liquefied Petroleum Gas

Disadvantages of using fossil fuels

- They pollute the environment
- They can lead to fire outbreak
- They are expensive

How to conserve fossil fuels and minerals

- Using petroleum products sparingly
- Avoid over mining
- Using alternative energy resources
- Using bicycles instead of driving vehicles
- Walking short distances instead of driving vehicles
- Repairing vehicles in dangerous mechanical conditions to conserve fuel

FUELS

This is anything that burns to produce energy.

Forms of energy produced by fuels

Heat energy

Light energy

Electric energy

TYPES OF FUELS

Liquid fuels

Kerosene

Petrol

Diesel

Jet fuel

Solid fuels

Firewood

Charcoal

Sawdust

Coal

Wood shavings

Gas fuels

Biogas

Natural gas

FIBRES.

These are thin long threadlike structures used to make certain materials (fabrics).

Write down the types of fibres.

Natural fibres.

Synthetic fibres.

NATURAL FIBRES

These are threadlike materials got from plants and animals.

Examples of plant fibres (natural fibres got from plants) and their importance.

Plant fibres	Importance
Sisal	For making ropes, sacks and doormats (carpets)
Cotton	For making cotton cloths and cotton wool

Flax	For making linen cloths, papers and ropes
Hemp	For making ropes, cloths (jeans), bags, papers and shoes
Jute	For making ropes, jute bags (gunny bags), curtains and doormats (carpets)
Raffia	For weaving baskets, making bags, hats and mats
Ramie	For making threads, fishing nets and filter cloths
Banana fibre	For making bags, dolls, balls, ropes and mats,

Examples of animal fibres (natural fibres got from animals) and their importance.

Animal fibres	Animal from which it is obtained	Importance
Wool	Sheep and Llama	For making woollen jackets, blankets, carpets and wax
Silk	Silkworm	For making silk suits, jackets and sleeping bags
Mohair	Angora goat	For making mohair blankets, carpets, socks, duvets, wigs and scarves.
Rabbit fur (Angora fibre)	Angora rabbit	For making sweaters, scarves and blankets
Chiengora	Dog	For making cloths and pillows

ARTIFICIAL FIBRES (SYNTHETIC FIBRES)

These are man-made thread like chemical substances joined together.

Examples of artificial fibres (synthetic fibres) and their importance

Synthetic fibres	Importance
Nylon	For making ropes, tarpaulin, sleeping bags, car seat belts and dental floss

Rayon	For making blankets, carpets and curtains
Polyester	For making clothing, tarpaulin, filters and bottles
Acrylic	For making sweaters, blankets, hats, socks, shawls and carpets
Polythene (polyethylene)	For making waterproof papers, ropes and shopping bags

Advantages of synthetic fibres over natural fibres.

Synthetic fibres are stronger than natural fibres

Synthetic fibres are more durable than natural fibres

Synthetic fibres are cheaper than natural fibres

Disadvantages of synthetic fibres over natural fibres.

They can be affected if washed with hot water unlike natural fibres

They can catch fire easily as compared to natural fibres

Synthetic fibres are cheaper than natural fibres

HARVESTING RESOURCES

This is the collection of materials from the environment for the purpose of using them

a) Harvesting non - living resources

Obtaining sand from dry river beds: scooping it with spades and machinery

Mining sand from the ground

Harvesting minerals

By mining

Fossil fuels like oil

By drilling

Harvesting energy from the sun (solar energy)

It can be harvested in the following ways

Uses of solar panels

Use of solar cookers

Use of solar driers

Use of solar heater

Harvesting water

- Using water tanks
- Using big drums
- Using basins
- Using jerrycans
- Using buckets
- Using windlass to draw water from deep wells
- Using electric water pumps.

Harvesting energy from air

- Wind can be trapped and used to drive wind will
- It can be tapped using sail to drive sail boat + dhows

Harvesting living resources

- Plants resource
- Hand picking ripe coffee berries , cotton balls
- Plucking tea leaves from tea plants
- Ready maize cobs are harvested by hands
- By cutting sisal leaves

Harvesting animal resources

a) Meat

Animals are slaughtered, skinned and meat cut off from the carcass.

b) Skins and hides

Animals are slaughtered and skins carefully removed from the carcass.

c) Horns

The horns are cut or sawn off with the saw from the head of the slaughtered animals

d) Milk

It is obtained by milking using either hands or machines

d) Honey:

It is extracted from honey combs.

THE ENVIRONMENT

Environment refers to an organism and its surrounding.

COMPONENTS OF ENVIRONMENT

The environment is composed of the following

- Water
- Soil
- Air (wind)
- Plants
- Animals
- Sun
- Fungi
- Bacteria
- Protista

TYPES OF ENVIRONMENT

Environment is divided into two types:-

Biological environment (Biotic / non physical environment)

This is the type of environment which consists of living things eg plants and animals

Physical environment (a biotic environment)

This is the type of environment which consists of non - living things eg mountains , lakes , rivers , temperature , wind (air) vapour.

FOOD CHAIN

A food chain is the way how organisms in an environment get their food. In the environment, plants make their own food and are called producers.

The organisms which depend on food made by plants (producers) are called consumers

Consumers are divided into the following groups

Primary consumers

These are organisms which feed directly on producers eg goats, cattle, rabbits, sheep etc

Secondary consumers

These are organism which feed on primary consumers eg foxes, dogs, lions

Tertiary consumers

Tertiary consumers which feed on secondary consumers eg. Leopards, man, birds of prey etc.

NB: In a food chain , organism like fungi and bacteria help in reducing food to its component parts (decay / rot) are called decomposers

The sun is the main source of energy in a food chain from which energy flows other organism in the environment

Illustration of a food chain

Producer - primary consumer - secondary consumers - Tertiary consumers.
plants -grasshoppers - lizard - Hawks.

A FOOD WEB

A food web is a more complicated interrelationship of how organism in an environment obtain their food.

A food web involves many organism in an ecosystem how they get food from many other living things

Illustration of a food web

Ecosystem

An ecosystem is the community of living things (organisms) in a habitat and non-living things.

A habitat

This is a home of an organism in the environment

Degradation

Degradation is the way of lowering (spoiling) the quality, stability and usefulness of something.

Environment degradation

Is the lowering the quality, stability and usefulness of the environment

Types of environment degradation

Soil / land degradation

Deforestation / devegetation

Wetland drainage

Pollution

Wild life destruction (degradation)

- silting

Causes of environmental degradation

There are two main causes of environmental degradation

- a) Human activities
- b) Natural causes

HUMAN ACTIVITIES THAT CAUSES ENVIRONMENTAL DEGRADATION

- a) Mining / quarrying
- b) Construction and road work
- c) Poor waste disposal
- d) Bad agricultural practices e.g bush burning, over grazing etc.

NATURAL CAUSES OF ENVIRONMENTAL DEGRADATION

Soil erosion / leaching

Silting

Hurricanes

Tornados

Whirl wind / whirl pools

Earth quakes

Hailstones

Land slides

Flood

Tsunamis

Volcanic eruptions

Global warming

- a) Soil / land degradation

This is the destruction / lowering the quality or usefulness of land by human activities or natural causes.

Leaching

Is a process through which mineral salts or nutrients sink deeper into the soil layers where they cannot be reached by plant roots

It is caused by too much rain.

Soil erosion: Is the washing / blowing away of top soil by agents of erosion.

SILTING

This is the deposition of eroded materials into water bodies

Causes of silting

Soil erosion

Cultivation near water sources

Allowing animals to drink from water bodies

Swamp drainage

Burning / destroying vegetation in the swamp

Dangers of silting

It leads to water pollution

It reduces the depth of water bodies

It leads to flooding of water bodies

It destroys homes of some marine (aquatic) animals

It leads to death of some marine animals

Effect of silting

It destroys habitat for animals that live in water

Lower water level and it dries out

Destroys source of food for fish and other aquatic animals

Kills fish of other animals and plants in water

Destroys eggs of fish and other aquatic animals.

Deforestation

Deforestation is also called devegetation ie cutting down large number of trees / plant without replacing them.

Causes of deforestation

Population growth leading to need for land for settlement , farming and recreation

Industrialization (development of industries in an area)

Wild fires / bush burning

Clearing forests for fire wood , charcoal , building poles timber etc

Effects of deforestation

It leads to reduction of rain fall causing to drought / desertification

Loss of habitat for different plants and animal species

Soil erosion leaving poor soils

Silting of water bodies.

Wet land degradation

A wet land is any area which has water and growing vegetation throughout the year

Examples of wet lands

Swamps

Marshes

Bogs

Lakes and rivers

Importance of wet lands

They are habitats to many plant and animals species

They control floods by sucking the water

They filter muddy water by trapping the impurities

They regulate the climate by influencing the temperature and humidity

They provide water

They provide water for domestic and industrial use.

They are source if food eg fish

They provide raw materials for art and crafts eg clay papyrus etc

They are source of building materials

POLLUTION

Pollution is the contamination of the natural environment caused by natural or human activities

CAUSES OF POLLUTION

Waste gases from industries
Industrial waste / chemical
Exhaust fumes from vehicles
Oil spills from ships in the ocean
Chemical sprays
Non degradable wastes eg polythene , glass plastics etc
Smoke from burning tyres , oil or bushes
Dust

TYPES OF POLLUTION

- a) Air pollution - caused by smoke and fumes / poisonous gases.
- b) Soil pollution - caused by agricultural sprays, industrial waste, refuse etc
- c) Water pollution - By silt, oil spills, refuse, human waste and industrial waste washed into it.
- d) Noise pollution - Due to too many vehicles or industries in the environment, loud music etc

EFFECTS POLLUTION

Poisoning of soil and water by chemical waste dumped on them.

Death and disappearance of biodiversity (variety of plants and animals living things)

Outbreak of disease in the environment

Loss of soil fertility leading to poor yields

Formation of acidic rains due to gases from industries and vehicles as they dissolve in rain.

Destruction of habitats for many plants and animals

Less production of plants such as fibers , timbers fruits and other construction materials

CONTROL AND PREVENTION OF POLLUTION IN THE ENVIRONMENT

Uses of alternative energy source eg. bio gas , natural gas , solar energy , wind m power , hydro electricity

Ensure proper disposal of domestics and industrial wastes

Educating people about the danger of pollution

Using good method of farming

Advantages (importance) of conserving wildlife

Some mammals, plants and birds are a source of food for man.

Some animals and birds are valued as cultural heritage by some countries and clans.

Plants are homes of many animals, birds and insects.

Trees or forests help in the formation of rainfall.

Mammals, birds and trees species earn foreign exchange for the government through tourists.

Plants improve the atmosphere by balancing the amount of carbon dioxide and nitrogen.

Plants provide shade to man and other animals.

How to conserve and protect wild life.

Animals are protected by law in their habitant through the Uganda Wildlife Authority (UWA).

A habitant is a natural environment or home of a plant or animal.

Uganda wildlife Authority is a department which is responsible for wildlife in Uganda.

The animals are being taken care of in national game parks and game reserves.

Banning the selling and buying of wildlife trophies helps to reduce their being killed.

Fishes can be conserved by controlled fishing.

Some rare animals should be caught and let to breed in wildlife educational centre.

Conserving non renewable resources

Soil erosion should be controlled.

Soil should be kept fertile by using manure and fertilizers.

Plastic wastes like broken Jerrycans, polythene papers should be recycled.

Vehicles in dangerous mechanical conditions should be repaired to conserve fuel.

Petroleum products should be used wisely to prevent further exploitation of oil.

Conserving the natural vegetation

Over grazing should be discouraged because it causes soil erosion.

Bush burning should be restricted to certain areas.

Over stocking is dangerous because it leads to over grazing.

The government should limit population growth because more people means more land to be destroyed for housing and agriculture.

Cattle farmers should practice rotational grazing.

Afforestation should be practiced.

Swamps and wetlands should be declared restricted areas.

RESPIRATION

Respiration is the oxidation of food in the living cells to produce energy

It occurs in the living cells.

Respiration is a **chemical change**

Oxidation is the process by which oxygen combines with a substance

Importance of respiration to the human body.

It provides energy to the body

EQUATION FOR RESPIRATION

Food + Oxygen \longrightarrow Heat energy + Carbon dioxide + Water vapour

Raw materials for respiration

Food (glucose or carbohydrates)

Oxygen

Main (useful) product of respiration

Energy

By-products (waste products) of respiration

Carbon dioxide

Water vapour

TYPES OF RESPIRATION

Aerobic respiration

This is the type of respiration that uses oxygen

Anaerobic respiration

This is the type of respiration that does not use oxygen

Note

In animals, it produces lactic acid in muscles during vigorous exercises

In plants and yeast, it produces alcohol and carbon dioxide

Why does a person breathe heavily after a vigorous exercise?

To pay the oxygen debt.

THE RESPIRATORY SYSTEM (BREATHING SYSTEM)

This is the group of organs that deal with breathing and respiration

Importance of the respiratory system

It supplies the body with oxygen.

It gets carbon dioxide out of the body.

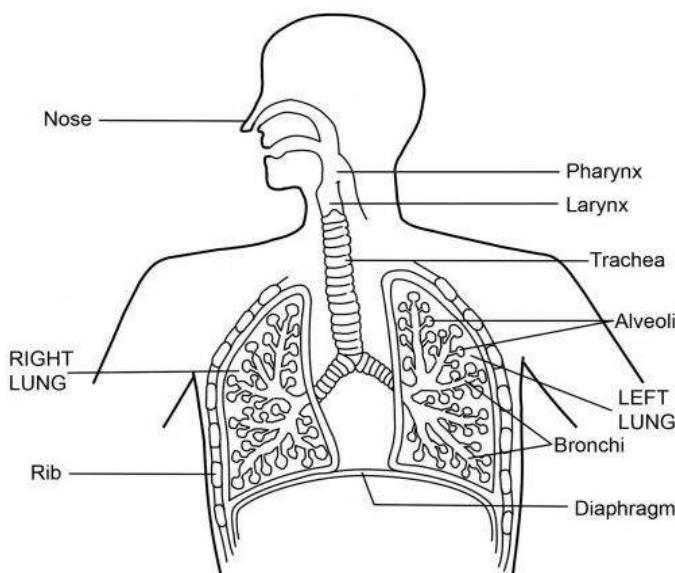
ORGANS OF RESPIRATORY SYSTEM

Nose

Trachea (wind pipe)

Lungs (the main respiratory organs)

THE STRUCTURE OF THE RESPIRATORY SYSTEM



NOSE

It is an olfactory organ (sense organ for smell)

It contains cilia and mucus that trap dust and germs

Importance of the nose

For smelling

It is the passage of inhaled air to the trachea

It cleans, warms and moistens inhaled air

Why is the temperature in the nose slightly higher than the rest of the body parts?

To warm the inhaled air before it reaches the lungs

Contents of the nose and their importance

Nasal mucus (snot)

It traps germs and dust

It moistens inhaled air

It prevents the nose from drying up

Cilia

Cilia filter inhaled air (trap dust and germs)

What happens to inhaled air in the nose?

Air is cleaned (filtered)

Air is warmed

Air is moistened.

Why do people sometimes breathe through the mouth?

Due to nasal congestion

Due to deviated nasal septum

Why is it not advisable to breathe through the mouth?

The mouth has no cilia to clean the inhaled air

It can chill the lungs since air is not warmed

Disorders of the nose

Nose bleeding

Nasal congestion

What warms the inhaled air in the nose?

Blood in the vascular membrane

Why should we cover the nose while sneezing?

To prevent spread of droplet infections (airborne diseases)

Care for the nose

Wash the nose with clean water and soap.

Do not share handkerchiefs

Use a clean piece of cloth to clean the nose

Avoid rough games that can harm the nose

Do not allow mucus to flow and reach the lips

THROAT (PHARYNX)

This is a common passage for food and air

It carries air to the respiratory tract and food to the digestive tract.

EPIGLOTTIS

It prevents food from entering the trachea.

It prevents choking.

LARYNX (VOICE BOX)

It contains vocal cords

Vocal cords vibrate to produce sound when air flows over them

THE TRACHEA (WIND PIPE)

It is the passage of air to the lungs.

Trachea is made up of rings of cartilage

Why?

To keep it open all the time.

The trachea contains cilia that trap dust and germs.

The trachea divides into **bronchi** (left bronchus and right bronchus)

The bronchi subdivide into **bronchioles**

The bronchioles end into tiny air sacs called **alveoli**

Gaseous exchange takes place in the **alveoli**

DIAPHRAGM

This is a dome-shaped muscle that separates the chest cavity and abdominal cavity

It helps in breathing

INTERCOSTAL MUSCLES

They hold the ribs in position.

THE LUNGS

These are spongy air filled organs on either sides of the chest cavity.

Lungs are the breathing organs

The **rib cage** protects the lungs and heart.

A person has **two lungs** (left lung and the right lung)

Lungs are covered by **pleural membrane**

The pleural membrane produces **pleural fluid**

Pleural fluid reduces friction between the lungs and ribs.

The space between the two layers of pleural membrane is called **pleural cavity**

Pleural cavity holds the pleural fluid

Why are lungs regarded as respiratory organs?

They supply oxygen for respiration

Why are lungs regarded as excretory organs?

They remove metabolic wastes from the body

Importance of the lungs in the human body

They supply oxygen to blood (they oxygenate blood)

They remove carbon dioxide and water vapour from the body

Why are lungs elastic?

To easily expand and contract during breathing

How are lungs adapted to their functions?

They are spongy and elastic

They have very many alveoli

They have a dense network of blood capillaries.

They have a moist surface

They are covered in thin membranes

GASEOUS EXCHANGE IN HUMAN BEINGS

This is the transfer of respiratory gases between the cells and the environment

In which human body organ does gaseous exchange take place?

In the lungs

Where in the lungs does gaseous exchange take place?

In the alveoli (air sacs)

By what process does oxygen in the alveoli enter red blood cells?

By diffusion

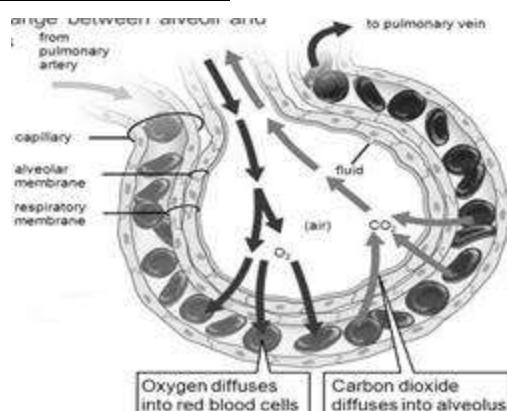
What is diffusion?

Diffusion is the movement of molecules from an area of high concentration to an area of low concentration

ALVEOLI (AIR SACS)

This is where the exchange of gases takes place by diffusion.

The structure of the alveolus



Adaptations of alveoli (air sacs) to their function

They have thin walls.

They have a moist surface.

They are covered by a dense network of blood capillaries.

They are numerous (very many in number).

COMPOSITION OF AIR BREATHED IN AND OUT

Type of air	Inspired air	Expired air
Oxygen O ₂	21%	16%
Carbon dioxide CO ₂	0.03%	4%
Nitrogen N ₂	78%	78%
Water vapour	Low (less)	High (more)
Rare gases	0.97%	0.97%

Explanation:

Inhaled air has more oxygen than exhaled air

Oxygen is used during respiration

Exhaled air has more carbon dioxide than inhaled

More carbon dioxide is produced during respiration.

Exhaled air has more water vapour than inhaled air

More water vapour is produced during respiration

Nitrogen and rare gases in exhaled air and inhaled air remain the same

They are not used in the human body

BREATHING (VENTILATION OF THE LUNGS)

This is the movement of air in and out of the lungs

IMPORTANCE OF BREATHING

It provides oxygen to the lungs

It removes carbon dioxide from the lungs

What is tidal air?

This is the amount air that passes in and out of the lungs during a normal breath

TYPES (PHASES) OF BREATHING

Breathing in (inhalation or inspiration)

Breathing out (exhalation or expiration)

Breathing in (inhalation or inspiration)

This is the intake of air into the lungs.

Things that occur during inhalation (inspiration)

Intercostal muscles contract

Ribs move upwards and outwards.
Diaphragm contracts and flattens
Volume of the chest cavity increases
The lungs expand.

In four steps, explain the mechanism of inhalation

Diaphragm and intercostal muscles contract
Volume of the chest cavity increases
Air pressure inside decreases
Air rushes into the lungs

Why is inhalation said to be an active process?

It involves muscle contraction that requires energy

Breathing out (exhalation or expiration)

This is the expelling of air from the lungs.

Things that occur during exhalation (expiration)

Intercostal muscles relax.
Ribs go downwards and inwards.
Diaphragm relaxes and becomes dome-shaped (move upwards)
Volume of the chest decreases
The lungs contract
The lungs and the stomach go to their original size.

In four steps, explain the mechanism of exhalation

Diaphragm and intercostal muscles relax
Volume of the chest cavity decreases
Air pressure inside increases
Air moves out of the lungs

Why is exhalation regarded as a passive process?

It does not involve muscle contraction

MODEL TO SHOW THE MECHANISM OF BREATHING

Cut off the bottom of a plastic bottle.
Cover and tie the open end with a rubber sheet.
Tie two empty balloons to a Y - shaped (straw) glass tube.
Insert the straw into the bottle through its cork.



When the rubber sheet is pulled outwards, the balloons expand.
When the rubber sheet is pushed inwards, the balloons contract

DISORDERS OF THE RESPIRATORY SYSTEM

Nasal congestion

Yawning

Hiccups

Coughing: it is caused by irritation
of the windpipe by dust

Sneezing

Choking: It is caused by blockage of
air passage to the lungs by a
foreign object (food)

DISEASES OF THE RESPIRATORY SYSTEM (RESPIRATORY DISEASES)

Communicable (infectious) respiratory diseases

Tuberculosis (TB)

Pneumonia

Diphtheria

Influenza (Flu)

Whooping cough (Pertussis)

Common colds

Non communicable (non-infectious) respiratory diseases

Lung cancer

Emphysema

They are caused by tobacco smoking

Chronic bronchitis

Asthma: it is a hereditary disease

Asbestosis: it is caused by too much exposure to asbestos

RESPIRATORY DISEASES WORSENERED BY TOBACCO SMOKING

Asthma

Tuberculosis

ASTHMA

It is a hereditary disease of the respiratory system
It blocks the bronchioles hence making breathing difficult.

Sign of asthma

Difficulty in breathing (especially during cold days)

Wheezing

Why is asthma called a hereditary disease?

It is passed on from the parents to the offsprings through blood.

TUBERCULOSIS

It is a bacterial airborne disease (droplet infection)

It attacks the respiratory and skeletal system

It mainly affects the lungs and the backbone (spine)

Name the germ (bacterium) which causes tuberculosis

Mycobacterium tuberculosis

How does tuberculosis spread?

Through inhaling contaminated air

Through drinking unboiled milk from tubercular cows

Signs and symptoms of tuberculosis

Chronic cough

A lot of sweating at night

Loss of body weight

Ways of preventing and controlling tuberculosis

Immunize babies using BCG vaccine

Isolate and treat the infected person

Drink boiled or pasteurized milk

CARE FOR THE RESPIRATORY SYSTEM

Perform regular body exercise

Avoid tobacco smoking

Take infants for immunisation

Do not play in dusty places

Always keep the nose away from dust

Always breathe through the nose but not the mouth

Sleeping in a well-ventilated house

Feed on a balanced diet

TERM THREE

TOPIC: SCIENCE AT HOME AND COMMUNITY

WATER

This is a colourless liquid made up of hydrogen and oxygen.

The ratio of hydrogen to oxygen in water (H_2O) is 2:1

Water supports life.

SOURCES OF WATER

Natural sources of water

Rain	Lakes
Springs	Rivers
Streams	Swamps
Oases	Oceans

Seas

Ponds

Rain is the main natural source of water

Artificial sources of water

Wells	Dams
Boreholes	Water tank

PROPERTIES OF PURE WATER

It has no colour (colourless)

It has no taste (tasteless)

It has no smell (odourless)

It boils at 100°C and freezes at 0°C

Importance of water in the human body

It forms blood plasma

It forms body fluids (tears and saliva)

It helps in food digestion

It maintains the shape of body cells

It cools the body

It prevents hiccups

USES OF WATER IN THE ENVIRONMENT

For cooking

For building houses

For washing

For mixing drugs and agrochemicals

For bathing

For making beverages

For drinking

For irrigation

For mopping

For cooling machines in factories

For generating electricity

It is used by plants to make starch

GROUPS (TYPES) OF WATER

Hard water

Soft water

SOFT WATER

This is the water that lathers quickly

Examples of soft water

Distilled water (pure water)

Spring water

Rainwater

Sources of soft water

Rain

Springs

Advantages of soft water

Distilled water is used for mixing drugs in hospitals

Distilled water is used in car radiators

HARD WATER

This is the water that does not lather quickly

What causes hardness in water?

Presence of much mineral salts in water

High concentration of dissolved mineral salts in water

Mineral salts found in hard water

Calcium

Magnesium

Sources of hard water

Lakes

Rivers

Seas

Oceans

Oases

Advantages of hard water

It strengthens teeth and bones

It is used for making beer

It helps in formation of shells in molluscs

It is used in science experiments to conduct electricity

Disadvantages of hard water

It wastes soap

It damages hot water pipes

It stains on clothes

It causes furring of kettles

Types of hardness in water

Permanent hardness

Temporary hardness

Ways of making hard water soft (removing temporary hardness in water)

By boiling the water
By distilling the water
Use of detergents

Adding washing soda (sodium carbonate)

WATER CONTAMINATION

This is the way of making water dirty

WATER POLLUTION

This is the releasing of harmful materials in water

Water impurities (water pollutants)

These are things that make water dirty and unsafe to use

Examples of water impurities (water pollutants/water contaminants or foreign objects in water)

Human wastes	Soil
Animal wastes (animal dung, droppings and urine)	Garbage
Herbicides	Rotting fruits
Insecticides	Waste engine oil
	Industrial wastes

Ways of contaminating (polluting) water sources

- Urinating in water sources
- Defecating in water sources
- Dumping rubbish (or garbage) in water sources
- Using dirty containers to harvest water
- Constructing a pit latrine very near a water source
- Allowing animals to drink in water sources

Control of water contamination/water pollution

- Fencing open wells
- Avoid defecating in water sources
- Avoid urinating in open water sources
- Avoid washing in water sources
- Rubbish heaps should far from water sources
- Repairing damaged wells
- Clearing all bushes around a water source
- Avoid bathing from water sources
- Do not allow animals to drink from water sources
- Pit latrines should be constructed far from water sources

SILTING

This is the deposition of eroded materials into a water sources

Agents of silting

Flowing water

Strong wind

Moving animals

SILT

These are eroded materials deposited into a water source

Examples of silt

Soil/mud

Grass

Cow dung

Rubbish

Causes of silting

Soil erosion

Cultivating along riverbanks and lake shores

Allowing animals to drink from water sources

Clearing vegetation around riverbanks and lake shores

Effects (dangers) of silting

It leads to water pollution

It reduces the depth of a water body (it makes a water body shallow)

It leads to death of some marine animals

It destroys the habitats for marine animals

How does silting lead to floods?

By reducing the capacity/depth of water sources

How does silting lead to death of aquatic (marine) animals?

Silt suffocates marine animals

Control of silting

Avoid cultivating along river banks and lake shores

Planting short grass around water sources

Putting silt traps around water bodies

Using a dredging machine to remove silt from water bodies

DREDGING

This is the removal of silt from a water body.

Importance of dredging

It maintains the depth of water bodies

It prevents flooding of water bodies

Of what importance is a dredging machine?

For removing silt from water bodies

DISEASES ASSOCIATED WITH WATER

These are diseases that are spread by unprotected water

Groups (classes) of diseases associated with water.

Water borne diseases

Water cleaned diseases

Water contact diseases

Water habitat vector diseases

WATER BORNE DISEASES

These are diseases spread through drinking contaminated water

Examples of waterborne diseases

Cholera

Dysentery

Hepatitis B

Typhoid

Poliomyelitis

Guinea worm disease

Bilharziasis

Diarrhoea

Cholera

It attacks the digestive system

It is caused by bacteria called vibrio cholerae

Typhoid

It attacks the digestive system

It is caused by bacteria germs called salmonella typhi

Bilharziasis (schistosomiasis)

It attacks the kidneys

It is caused by blood flukes or schistosomes

It is spread by fresh water snails

Poliomyelitis

It attacks the skeletal system (bones)

It also attacks the nerves (nervous system)

It is caused by poliovirus

It is spread by cockroaches

Dysentery

It attacks the digestive system

Bacillary dysentery is caused by bacilli bacteria called shigella

Amoebic dysentery is also caused by an amoeba called entamoeba histolytica

Hepatitis A

It attacks the liver

It is caused by hepatitis A virus

Diarrhoea

It attacks the digestive system

It is caused by rotavirus

Guinea worm disease (GWD)

It is caused by guinea worms

CONTROL OF WATERBORNE DISEASES

Always drink clean boiled water (always drink safe water)

Proper disposal of human wastes

What does "WASH" stand for?

Water, Sanitation and Hygiene

Of what importance is WASH programme to the community?

It reduces the spread of waterborne diseases

It promotes clean water supply

WATER CONTACT DISEASES

These are diseases spread through bathing or swimming in contaminated water

Examples of water contact diseases

Bilharziasis

Swimmer's itch

Swimmer's ears (otitis externa)

CONTROL OF WATER CONTACT DISEASES

Avoid swimming in contaminated water

Avoid bathing with dirty water

Treating water in swimming pools

WATER CLEANED DISEASES

These are diseases spread when we do not use enough water to clean our body
(to promote personal hygiene)

Examples of water cleaned diseases

Trachoma

Athlete's foot

Scabies

Ringworm

Impetigo

Conjunctivitis

Scabies

It is caused by itch mites

It attacks the skin

Impetigo

It is caused by bacteria

It attacks the skin

Trachoma

- It is caused by bacteria germs called chlamydia trachomatis
- It is spread by houseflies
- It attacks the eyes

Ringworm

- It is caused by fungi
- It attacks the skin

Athlete's foot

- It is caused by fungi
- It attacks the skin, mainly the feet

Conjunctivitis

- It is caused by virus or bacteria
- It attacks the eyes

CONTROL OF WATER CLEANED DISEASES

- Bathing with enough clean water and soap
- Washing clothes with enough clean water and soap

WATER HABITAT VECTOR DISEASES

These are diseases spread by vectors that develop, live or get food from water.

Examples of water habitat vector diseases

Bilharziasis	Yellow fever
River blindness	Dengue fever
Malaria	Zika fever
Elephantiasis	Chikungunya fever

Bilharziasis (schistosomiasis)

- It is caused by blood flukes or schistosomes
- It is spread by a fresh water snail

River blindness (onchocerciasis)

- It is caused by onchocerca volvulus worms
- It is spread by a black fly
- It attacks the eyes

Malaria

- It is caused by protozoa called plasmodia
- It is spread by female anopheles mosquitoes

It attacks the red blood cells (circulatory system)

Elephantiasis (filariasis)

It is caused by filarial worms

It is spread by culex mosquitoes

Dengue fever

It is caused by dengue virus

It is spread by aedes (tiger) mosquito

Yellow fever

It is caused by flavivirus

It is spread by Aedes (tiger) mosquito

Zika fever

It is caused by zika virus

It is spread by Aedes (tiger) mosquito

Chikungunya fever

It is caused by Chikungunya virus (CHIKV)

It is spread by Aedes (tiger) mosquito

EXAMPLES OF VECTORS THAT SPREAD WATER HABITAT VECTOR DISEASES

DISEASES

Fresh water snail

Culex mosquito

Black fly (Jinja fly or Simulium fly)

Aedes (tiger) mosquito

Female anopheles mosquito

CONTROL OF WATER HABITAT VECTOR DISEASES

Draining still water

Treating water to kill water snails

Oiling still water

Avoid sleeping near river banks

Spraying with insecticides to kill adult mosquitoes

Keeping fish in ponds to eat mosquito larvae

SAFE WATER

This is the water that does not contain germs

WAYS OF MAKING WATER SAFE FOR DRINKING

By boiling

Use of ultra Violet light

By treating water with chemicals (chlorination or fluoridation)

BOILING

This is the heating of water to its boiling point (100°C)

It is the cheapest and safest method to prepare safe water for drinking

How does boiling make water safe for drinking?

It kills germs in water

Why should boiled water be put in clean containers and covered?

To prevent water contamination

Why should clean cups be used to draw water from storage containers?

To prevent water contamination

Common containers used to store boiled water

Pots

Water bottles

Vacuum flasks

Jerrycans

Saucepans

Buckets

Why are water storage containers in modern homes always kept in a refrigerator or freezer?

To keep water cold and free from germs

How does a refrigerator keep water safe (free from germs)?

It has cold conditions that prevent multiplication of germs

Why do most rural homes use pots instead of refrigerators to keep their boiled drinking water cool?

Lack of electricity in most rural areas

Pots are cheaper than refrigerators to buy

Why are pots used to keep boiled water first smoked with dry grass or dry bean husks before use?

To kill germs in the pot

To give water a good taste

Why is boiled water sometimes filtered before storage?

To remove solid impurities

Why does water boil faster in an old aluminium saucepan with soot than in a new aluminium saucepan?

An old aluminium saucepan with soot absorbs heat faster than a new aluminium saucepan

USE OF ULTRA VIOLET LIGHT (USE OF UV LIGHT)

This is the use of strong electric current to kill germs in water

CHEMICAL TREATMENT OF WATER

This is the killing of germs in water using chemicals.

Methods of treating water with chemicals

By chlorination

By fluoridation

By adding iodine crystals

Chlorination

This is the adding of chlorine in water to kill germs.

Fluoridation

This is the adding of fluoride in water to kill germs

Examples of chemicals used to treat water

Chlorine

Fluoride

Iodine

How do chemicals make water safe for drinking? (Importance of chemicals used in water treatment)

They kill germs in water

Disadvantages of using chemicals

They are expensive to buy

They add colour to the water

They add some smell to water

Excess chemicals are poisonous

They add bad taste to water

STEPS (STAGES) OF WATER TREATMENT FOR PUBLIC WATER SUPPLY

Screening

Filtration

Coagulation

Chlorination

Sedimentation

Screening

This is removal of floating impurities at the water intake from the source to prevent damaging the pipes.

Coagulation

This is the adding of a substance to make wastes turn into a semi solid that can be removed from water easily

Sedimentation

This is the use of gravity to remove suspended impurities from water

Filtration

This is separating of solid impurities from water using a filter

Chlorination

This is the adding of chlorine to water to kill germs

After chlorination, treated water is distributed to different areas through water pipes.

Write Nwsc in full

National water and sewerage corporation

Duties of Nwsc

To supply of treated piped water in urban areas

To supply sewerage services in urban areas

How is boiling different from evaporation?

Boiling occurs at a specific temperature while evaporation occurs at any temperature

Boiling occurs in the entire liquid while evaporation occurs on the surface of the liquid

Boiling occurs rapidly while evaporation occurs slowly

Bubbles are formed during boiling while bubbles are not formed during evaporation

CLEAN WATER

This is water that does not contain impurities

METHODS OF MAKING DIRTY WATER CLEAN

Decantation

Filtration

Distillation

DECANTATION (THREE POT METHOD)

This is the separating of a liquid from solid impurities or non-mixing liquids by gently pouring the liquid on top into another container

Application (importance) decantation at home

For collecting clean water from dirty water

For removing unwanted liquid from a mixture of immiscible liquids

Uses of water collected by decantation

For washing

For mixing herbicides and

For cooking

acaricides

For irrigation

Why is water collected by decantation not safe for drinking?

Decantation does not kill germs

Experiment of the three pot system (decantation)

Get three containers (pots)

Put dirty water in the first pot

Allow dirt to settle at bottom and gently pour the clear water on top into another pot.

After some time, gently pour the clean water on top into the last pot

FILTRATION

This is separating of solid impurities from a liquid using a filter

Materials used as a filter (equipment used for filtration)

Clean cloth

Sieve (strainer)

Filter paper

Cotton wool

Which human body organ acts as a biological filter?

Kidney

Examples of residue (solid impurities or suspended materials) filtered from water.

Dirt (soil)

Grass

Small stones

Leaves

Animals dung

Diagram showing filtration

Filtrate is the clear liquid that passes through the filter

Residue (filtrate) is the solid substance that remains on the filter

Why is the filtrate (filtered water) not safe for drinking?

Filtration does not kill germs

Uses of filtered water at home

For washing

For cooking

For washing

For mopping

For irrigation

Application (uses) of filtration in our homes

For removing tea leaves from tea

For removing husks from local beer

For removing seeds from fruit juice

For collecting clean water from dirty water

Local materials used in water filtration at home

Sand

Banana leaves

Pebbles (small stones)

Charcoal

Clean grass

Cotton wool

HOW TO MAKE A HOMEMADE WATER FILTER

Cut off the bottom of a plastic bottle and turn it upside down

Fix cotton wool in the neck or mouth of the bottle

Put a layer of charcoal powder followed by clean sand and then gravel (small stones)

Pour dirty water on top

A DIAGRAM SHOWING A HOMEMADE WATER FILTER (FILTRATION AT HOME)

IMPORTANCE OF EACH COMPONENT OF HOMEMADE WATER FILTER

Pebbles

To remove bigger solid impurities

Clean sand (coarse sand and fine sand)

To remove smaller solid impurities

Charcoal

To remove smell and taste from water

To remove toxin (poison) from water

To adsorb pollutants

Cotton wool

To allow out clean water (filtrate)

Beaker

To collect the filtrate

Plastic bottle

To hold the filtering materials

Why is the bottom of the plastic bottle cut off?

To allow the dirty water to be poured into the filtration system

What force enables water to move down through the components?

Gravity

Why is it advisable to always use two layers of sand in homemade water filter?

To make water cleaner

DISTILLATION

This is a method of collecting a pure liquid from impure liquid by evaporation and condensation

Distillate is the pure liquid collected after distillation

Why is the distillate (distilled water) not good for drinking?

It lacks mineral salts

Why does the distillate lack mineral salts?

They are lost during evaporation

Use of distilled water

For mixing drugs in drips and injections

For drip hydration

For cleaning the human body before taking an injection

Diagram showing distillation

Application (importance) of distillation

It helps in making of alcohol

It helps in water purification

It helps in separation of petroleum into different products

Disadvantages of distillation

It can lead to burns and scalds

It can lead to fire outbreaks

It needs much attention

CLEANING CLOTHES AT HOME

How do clothes keep our bodies warm?

By preventing heat loss

LAUNDRY

These are dirty clothes that need to be washed

This is a business that washes clothes for customers

STEP USED IN CLEANING CLOTHES AT HOME

Sorting

Wringing

Soaking

Drying

Washing

Ironing

Rinsing

SORTING

This is the grouping of clothes according to colour, thickness or dirtiness.

It prevents mixing of colours

It prevents very dirty clothes from making white clothes dirty

It enables the clothes that need special care to be washed separately

Factors considered when sorting clothes

Colour of clothes

Dirtiness (intensity of dirt)

Thickness of clothes

SOAKING

This is the putting clothes in soapy water (water with detergents) for some time.

It dissolves dirt and stains

It softens thick clothes.

It reduces wear and tear of clothes during washing.

It makes washing easy

WASHING

This is the removal of dirt from clothes using clean water and soap

Reasons for washing clothes

To remove dirt and stains

To remove bad smell from clothes

To prevent skin infections

To remove parasites like lice

Why do we wash clothes with soap?

To kill germs and parasites in clothes

To prevent skin infections

To remove bad smell easily

To remove dirt and stains easily

Common detergents used during washing

Omo Washing Powder

Jik Bleach

Nomi Washing Powder

Lotus Liquid Soap

Magic Washing Powder

Chamuka Liquid Soap

Reasons for using detergents when washing clothes

To remove tough stains

To whiten clothes

To kill germs and parasites

To remove bad smell easily

To make hard water soft

RINSING

This is the putting of clothes in clean water to remove soapy water

It removes soapy water from the clothes

WRINGING

This is the squeezing of clothes to remove excess water before they are dried

It makes drying faster (speeds up drying)

Reasons why woollen clothes should be dried without wringing

It prevents the clothes from losing their shape

DRYING

This is the hanging of wet clothes on a clothesline to dry

How does sun's heat reaches our wet clothes on earth?

By radiation

How does sun's heat dry wet clothes?

By evaporating water from clothes

How do wet clothes dry when hung in shady places?

By the help of wind

How does wind speed up drying of clothes?

By blowing away water from clothes

Which property of air enables wind to dry wet clothes in a shade/at night?

Air exerts pressure

State one danger of keeping damp or wet clothes for so long.

It leads to growth of mosses which cause stains

IRONING

This is the pressing of clothes with a hot flat iron or charcoal iron box

To kill germs and parasites

To remove creases

Why should clothes be ironed when they have some little moisture?

For easy removal of creases when ironing

To save charcoal/electricity when ironing

ACCIDENTS AND FIRST AID

AN ACCIDENT

This is a sudden happening that causes harm to the body

COMMON ACCIDENTS (INJURIES) AT HOME AND SCHOOL

Burns	Poisoning	Dislocation
Scalds	Bruises	Insect stings
Fractures	Sprains	Animal bites (snake bites)
Nose bleeding	Strains	
Cuts	Fever	Near drowning
Strains	Convulsions	Electric shocks

EFFECTS OF ACCIDENTS TO AN INDIVIDUAL

Lameness	Loss of some body parts
Death	Loss of property
Discomfort	Dehydration
Brain damage	

WAYS OF MANAGING ACCIDENTS AT HOME, SCHOOL AND ON THE ROADS

Avoid playing with hot objects

Avoid playing with cutting objects

Avoid careless running

Avoid unnecessary climbing of trees

Avoid fighting

Avoid playing rough games

Avoid playing in bushes

Avoid speeding the vehicles

Avoid playing on the roads
Always cross busy roads at zebra crossings
Avoid putting metallic objects in electric sockets
Avoid touching electric wires that have fallen off the poles

FIRST AID

This is the immediate help given to a casualty before being taken to the hospital

Casualty

This is a person who has been injured in an accident

Reasons (importance or advantages) of giving first aid

It saves life (it is the main reason)	It prevents further injuries
It reduces pain	It stops external bleeding
It promotes quick recovery	

FIRST AIDER

This is a person who gives first aid

Qualities of a good first aider

A first aider should be observant	A first aider should be knowledgeable
A first aider should be skilful	A first aider should be quick in action
A first aider should have common sense	A first aider should not panic
A first aider should be careful	
A first aider should be tactful	

RESPONSIBILITIES OF A FIRST AIDER

A first aider should take the casualty to the health centre
A first aider should make use of the bystanders
A first aider should chase away the crowd
A first aider should improvise shelter
A first aider should not make the situation worse
A first aider should deal calmly with the injury
A first aider should make a report about the casualty at the health centre
A first aider should study the situation and find out what has happened

STEPS FOR GIVING FIRST AID

Check whether the victim is breathing

Check the blood circulation by feeling the heart beat

The above steps can be summarized as below:

ABC - Airway, Breathing, Circulation

OR:

3Bs - Breathing, Bleeding, Broken bone

FIRST AID BOX

This is a small container used to keep first aid kit

Places where a first-aid box is found

Schools

Petrol stations

Football stadium

Homes

Airports

Groups of people found in the school sick bay

Health workers (nurses)

Sick people (sick children)

FIRST AID KIT

This is the set of tools used to give first aid

THE FIRST AID KIT (COMPONENTS OF A FIRST AID BOX)

Bandage	Scissors	A pair of tongs
Plaster (adhesive bandage)	Safety pin	Small first aid book
Methylated spirit	Surgical gloves	Tourniquet
Cotton wool	Tweezers	Arm sling
Razorblade	Pain killer	
	Liniment	

FIRST AID KIT	IMPORTANCE
Bandage	To dress big cuts
Plaster (adhesive bandage)	To dress small cuts
Methylated spirit	To kill germs on cuts and wounds
Cotton wool	To clean cuts and wounds
Razorblade	To cut bandage To shave hair on the injured part

Scissors	To cut the bandage
Safety pin	To fasten bandage
	To remove thorns from the skin
Surgical gloves	To prevent direct contact with blood
Tweezers	To remove insect stingers from the skin
Pain killer	To reduce (relieve) pain
Liniment	To reduce pain on sprains and strains
	To reduce swelling on sprains and strains
A pair of tongs	To hold cotton wool when cleaning cuts and wounds
Tourniquet	It is used to stop bleeding on cuts
Small first aid book	To guide a first aider on how give first aid
Armsling	To hold the broken arm in one position

How does a tourniquet stop bleeding?

By stopping the flow of blood in the blood vessels

OTHER THINGS USED TO HELP CASUALTIES

Splints

To keep the broken bone of the limb in one position

Ambulance

To transport the casualty to the hospital

Plaster of Paris

To hold the broken limb in one position as it heals

Crutch

To support the casualty to walk

How do crutches support the casualty to walk?

By reducing the body weight put on the leg

Stretcher

It is used to carry a casualty who cannot walk

Why is a stretcher not kept in a first aid box?

It is too big to fit in a first aid box

Mention four accidents (injuries) that require the use of a stretcher

Fractures

Sprains

Dislocation

Strains

Fainting

How is a wheel chair important to a crippled person?

It helps a crippled person to move

COMMON ACCIDENTS AND THEIR FIRST AID

SCALDS

A scald is a skin injury caused by wet heat

Causes of scalds

Skin contact with steam

Skin contact with hot tea

Skin contact with hot water

Skin contact with hot milk

Skin contact with hot porridge

Skin contact with hot soup

Objects (things) that may cause scalds

Hot milk

Hot sauce

Hot tea

Hot cooking oil

Hot porridge

Steam

First aid for scalds

Put the injured part in clean cold water

BURNS

A burn is a skin injury caused by dry heat

How is a burn similar to a scald?

Both are caused by heat

How does a burn differ from a scald?

A burn is caused by dry heat while a scald is caused by wet heat

CAUSES OF BURNS

Skin contact with hot charcoal

Skin contact with hot flat iron

Skin contact with hot plates and cookers

Skin contact with acids

Skin contact with fire

Skin contact with burning cigarette

Skin contact with high voltage electricity wires

Too much exposure of the skin to sun rays

Skin contact with friction from revolving wheels

Objects (things) that may cause burns

Hot charcoal

Hot saucepan

Cookers

Hot flat iron

Fire

Hot nails

Hot plates

Hot charcoal stove

Acids

EXAMPLES OF BURNS

Dry burns: are caused by fire flames and cigarettes

Chemical burns: are caused by acids

Radiation burns: are caused by too much exposure to sun rays or x-rays

Electrical burns: are caused by high voltage electricity or lightning

Dry friction burns: caused by the skin rubbing against objects such as ropes

DEGREE OR TYPES OF BURNS (CLASSIFICATION OF BURNS)

First degree burns

Second degree burns

Third degree burns

FIRST DEGREE BURNS

These are minor burns which do not form blisters

Why are first degree burns also called superficial burns?

They affect the outermost layer of the skin

Signs of first degree burns

No blister is formed

Skin becomes red

Dry peeling skin as the burn heals

Minor swelling

Symptom of first degree burns

Tender skin (painful skin when touched)

First aid for first degree burns

Put the burnt part in clean cold water

Why?

To reduce pain

To cool down the temperature

Note

First degree burns need no dressing

SECOND DEGREE BURNS

These are burns which form blisters

Blister

This is a raised skin with a liquid inside it.

Signs of second degree burns

Blisters are formed

Swelling of the skin

Symptom of second degree burns

Much pain on the injured part

First aid for second degree burns

Put the injured part in clean cold water; if the blister is not broken

Cover the injured part with a bandage or clean cloth; if the blister is broken

Why it is not advisable to break (burst) blisters?

It exposes the wound to germs

It causes more pain

Why should a second degree burn be dressed in a clean bandage?

To prevent infections

THIRD DEGREE BURNS

These are very serious burns that damage all the layers of the skin

They are the most severe burns

Signs of third degree burns

Skin may turn white

Skin is burnt deeply

Skin may turn black/may be
charred

Raised and leathery skin

Signs of third degree burns

Shock

Numbness

First aid for third degree burns

Put the burnt part in clean cold water

Cover the wound with a clean cloth

To protect it from houseflies and dust

Give the casualty a lot of fruit juice

To prevent dehydration

To replace the lost water and mineral salts

Why is a third degree burn not painful at all though it is very serious?

It damages the nerves

How is skin grafting important in treatment of burns?

It helps to fill the burnt part with skin cut from another body part

When is a burn said to be a fourth degree burns?

When a burn affects muscles and bones

EFFECTS (DANGERS) OF BURNS AND SCALDS

They lead to loss of some body parts

They damage the skin

They lead to loss of feeling

They lead to death

They can lead to dehydration

They lead to lameness

PREVENTION OF BURNS AND SCALDS

Use heat insulators to lift hot objects

Cooking from raised places

Keep hot objects and acids out of children's reach

Do not keep petrol in a living house.

Avoid cooking in open places

Do not allow young children to cook

Refill lanterns or lamps after putting them off

Teach children the dangers of fire

Do not play near hot things and acids

Put smoke detectors in buildings

Measure bath water temperature before use

Lock up kitchens when not in use

Handle home distillation tools with care when in use

Do not put a burning candle near beddings and curtains at night

THINGS WE SHOULD NEVER DO TO BURNS AND SCALDS (DON'TS WITH BURNS AND SCALDS)

Never apply cooking oil, rabbit fur and cow dung

They contaminate the wound and cause infections

Never apply salt

It absorbs water and causes dehydration

Never apply sugar

It attracts bacteria that cause infections

Never burst the blisters

It exposes the wound to germs (it may lead to infections)

Never apply cotton balls on a burn

They can stick in the injury and lead to infections

FEVER AND CONVULSIONS

FEVER

This is the condition when the body temperature rises beyond the normal one

This is the abnormal rise in body temperature

Note

The normal body temperature is **37°C or 98.6°F.**

Fever is not an illness but a symptom of many illnesses.

Signs of fever

Excessive sweating

Frequent urination

Causes of fever

Reactions to vaccines

Body injuries

Some sicknesses (diseases)

High temperatures in the environment

Diseases that has a symptom of fever

Malaria

Typhoid

Measles

Meningitis

FIRST AID FOR FEVER

Apply tepid sponging

To reduce body temperature

Give the victim plenty of fruit juice

Remove most of the victim's clothes

Tepid sponging

This is the act of putting a cloth soaked in lukewarm water on the forehead or chest of a victim

Why is it not advisable to leave a cold wet cloth on the patient's body for a long time?

It can lead to convulsions(to prevent convulsions)

EFFECT OF FEVER

High fever leads to convulsions

CONVULSIONS

These are sudden uncontrolled body movements

OR

This is the condition when the body shakes (jerks) involuntarily

CAUSES OF CONVULSIONS

Epilepsy (fits)

Brain tumour

Alcohol withdrawal

High fever

Cerebral malaria

SIGNS OF CONVULSIONS

Violet shaking of the body

Foaming mouth (saliva bubbles in the Mouth)

FIRST AID FOR CONVULSIONS

Apply tepid sponging

To cool down body temperature

Remove all tight clothes on the victim

To cool down body temperature

Put a clean object in the victim's mouth

To prevent the victim from biting the tongue.

Control the bystanders

To enable the victim get enough fresh air

Do not give any food or drink to the victim

To prevent choking

Do not force the jaws to open in case they have closed

To prevent breaking the victim's jaws

Why are patients taken to hospitals after convulsions have stopped?

For medical checkup and treatment

Causes of fits/epilepsy

Brain damage during birth

Epilepsy can be inherited

Give any one cause of baby's brain damage during birth

Difficulty in delivery

FAINTING

This is the loss of consciousness for a short time.

Fainting is sometimes called nervous shock

Main cause of fainting

Lack of oxygenated blood supply to the brain

Conditions that can lead to fainting

Doing very heavy exercises

Excessive bleeding

Extreme anger

Excessive coldness

Extreme excitement

Being frightened

Dehydration

Excessive hunger(starvation)

Severe pain

Sudden shocking news

Standing under sunshine for a long time (excessive heat)

Overcrowding in poorly ventilated houses

Why does a person faint after receiving shocking news?

Due to shortage of oxygen supply to the brain

Signs and symptoms of fainting

Loss of body balance (dizziness)

Loss of senses for a short time

Symptom of fainting

General body weakness (fatigue)

FIRST AID FOR FAINTING

Raise the legs of the victim slightly above the head

To allow blood flow faster to the brain

Loosen up all tight clothing and fan the victim

Put the victim in a shade and fan him or her

Avoid bystanders around the victim

To enable the victim have enough fresh air

State what should be done to a fainted victim after regaining consciousness

Give the victim glucose (sweet warm water) to get energy

Get the victim some soft food to eat

Let the victim rest for some time

DROWNING

This is the condition when a person dies in water

Why is there no first aid for drowning?

The victim is already dead

NEAR DROWNING

This is the condition when a person stops breathing due to having the lungs filled with water but not yet dead

A person who has near drowned has **4 minutes** only to stay alive.

Common places for drowning and near drowning

Swimming pool

Basins full of water

Ponds

Streams

Lakes

Irrigation trenches

Wells

Pits dug by builders to trap rain
water

Bathtubs

Rivers

Main cause of near drowning

Having lungs filled with water

Factors that can lead to near drowning

- Lack of swimming skills
- Leaving babies in basins full of water
- Heart attack and seizures while in water
- Panic in water
- Alcoholism while in water

First aid for near drowning

- Apply the kiss of life (mouth to mouth resuscitation)
- Shout out for help
- Remove the casualty from water as quickly as possible

How to apply the kiss of life (mouth to mouth resuscitation/artificial respiration)

- Lie the casualty on his or her back
- Remove any foreign objects stuck in the mouth
- Press the casualty's nostrils with your fingers
- Blow into the casualty's mouth several times to restore breathing

How is the kiss of life an important first aid for near drowned person?

- It restores breathing

How can a first aider force water out of the lungs of a near drowned person?

- By making upward push on the belly using the hands

How to prevent drowning and near drowning

- Learn swimming skills
- Always empty bathtubs
- Cover all septic tanks
- Fence swimming pools
- Do not use leaking boats while fishing
- Do not store big open water containers in children's reach
- Wear life jackets when using water transport
- Pits to trap water for building should be fenced
- Do not allow children to go near open water sources without adults
- Do not allow babies to play in basins full of water

NOSE BLEEDING

This is the sudden flow of blood from the nose

Main cause of nose bleeding

Breaking of the blood vessels in the nose

Conditions that lead to nose bleeding

Headache

Over blowing of the nose

Over inhaling of dry air

Being hit on the nose or head

FIRST AID FOR NOSE BLEEDING

Make casualty sit and bend forward

To prevent dizziness and swallowing blood which can cause vomiting

Pinch the nose just below the bridge

To make the bleeding blood vessel stop bleeding

Encourage the casualty to breathe through the mouth

To prevent over straining the blood vessels in the nose

Put the ice pack on the nose

To moisten the lining of blood vessels in the nose

NOTE

Do not make the casualty to bend backwards

To swallowing blood which can cause vomiting

Do not blow the nose very soon after nose bleeding

To prevent rebleeding

Why are casualties with excessive nose bleeding sometimes advised to bend backwards though it is not recommendable?

To prevent excessive loss of blood

To reduce the amount of blood that comes out

PREVENTION OF NOSE BLEEDING

Avoid inhaling dry air

Keep the nostrils moist

Eat citrus fruits to make blood vessels strong

Avoid rough games that can harm the nose

ELECTRIC SHOCK

This is a sudden painful contraction of muscles when electricity flows through them

Causes of electric shocks

Short circuits

Touching electric wires that have fallen off the poles

Pushing metallic objects in electric sockets

Touching electric appliances with wet hands
Repairing electric appliances when you are not an expert

First aid for electric shock

Switch off current the source of electricity
Use an insulator to put away the victim

Prevention of electric shocks

Cover electric wires using insulators
Do not put metallic objects in electric sockets
Do not touch plugged electric appliances with your wet hands
Electricians should wear rubber gloves during electric repairs
Electric repairs should be done by experts

SNAKE BITES

This is an injury when a venomous snake injects venom into the victim

Signs of snake bites

Two puncture wounds (fang marks) on the injured part	Swelling of injured part
Bleeding from the injured part	Difficulty in breathing
	Excessive sweating

Symptoms of a snake bite

Pain	Necrosis on the injured part
Fever	Blurred vision

FIRST AID FOR SNAKE BITES

Tie the bandage slightly above the bitten part
To prevent venom from flowing to the heart
Apply a black stone
To suck venom from the injured part
Keep the casualty calm and at rest
To prevent venom from spreading

Why is it not advisable to wash a bitten part in case of a snake bite?

Any venom left on the skin can help to identify the type of snake

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

To be given the right antivenin

HOW TO PREVENT SNAKE BITES

Stay away from bushes

Wear boots and gloves when working in a bush

Do not try to capture a snake

Give a snake room to move away if it appears

DON'TS WITH SNAKE BITES

Don't apply ice on the snake bite

It blocks blood circulation (it causes frostbite)

Don't suck blood with your mouth

To prevent swallowing the venom

Don't cut across the wound

Venom may not be where you expect it to be since snake fangs are curved

Don't apply a tourniquet

Concentrated venom destroys the cells rapidly since blood does not flow

Don't try to capture the snake

It may bite you again

SPRAINS

This is an injury on a ligament

OR

This is a stretched/torn/twisted ligament

What is a ligament?

This is a tissue that joins a bone to a bone

CAUSES OF SPRAINS

Twisting of the ligament

Tearing of the ligament

Stretching of the ligament

SIGNS OF SPRAINS

Swelling

Difficulty in moving the injured

Bruising

part

Symptom of sprains

Pain at the injured part

Mention three body parts where sprains occur

Ankles

Thumbs

Knees

Wrists

STRAIN

This is an injury on a muscle or tendon

OR

This is a stretched/torn or twisted/muscle or tendon

What is a tendon?

This is a tissue that connects a muscle to a bone.

Causes of strains.

Twisting of the muscle/tendon

Tearing of the muscle/tendon

Stretching of the muscle/tendon

SIGNS OF STRAINS

Swelling

Difficulty in moving the injured

Bruising

part

Symptoms of strains

Pain at the injured part

Muscle spasms

Muscle weakness

Mention three body parts where strains occur

Back

Calf

Thigh

First aid for sprains and strains

Rest the injured part

To prevent further injuries

Apply ice pack on the injured part

To reduce pain

Wrap a clean bandage around the injured part

To prevent swelling

Elevate the injured part

To reduce pain

Write RICE in full as used in first aid

Rest, Ice pack, Compress, Elevate

HOW TO PREVENT STRAINS AND SPRAINS

Perform regular body exercises

Warm up before any sports activity

Wear proper fitting sports shoes

Wear protective equipment for

Feed on a balanced diet

every sport

DISLOCATION

This is the condition when a bone is displaced from a joint

Signs of dislocation

Swelling of the injured part

Difficulty in moving the injured part

Symptom of dislocation

Pain at the injured part

First aid for dislocation

Rest the injured part

Apply ice pack on the injured part

Provide a crutch to let the casualty walk

Use a stretcher to carry the casualty who cannot walk

FRACTURE

This is a broken or cracked bone in the body

Causes of fractures

Falls

Unnecessary jumping

Fighting

Heavy blows

Car knocks

What disorder of the skeletal system occurs due to excessive stress on bones?

Fracture

General signs of fractures

A snap of the bone is felt

Difficulty in moving the fractured limb

Swelling of the fractured part

Symptom of fractures

Pain on the fractured part

TYPES OF FRACTURES

Compound fracture (open fracture)

Greenstick fracture

Simple fracture (closed fracture)

Depressed fracture

Comminuted fracture

Complicated fracture

COMPOUND FRACTURE

This is the type of fracture where a broken bone breaks and comes out of the skin (flesh)

Signs of compound fracture

The broken bone is seen outside the skin

Bleeding on fractured part

SIMPLE FRACTURE

This is the type of fracture where a bone breaks and remains inside the skin (flesh)

Signs of simple fracture

The broken bone may be seen near the skin

Swelling of the fractured part

Bruise at the injured part

Symptom of simple fracture

Pain on the fractured part

GREENSTICK FRACTURE

This is the type of fracture where a bone is bent but broken on one side

It is common in babies

Why is green stick fracture common in babies (young children)?

They have weak bones

COMMINUTED FRACTURE

This is when a bone breaks into many pieces

A broken bone is crushed

DEPRESSED FRACTURE

This is when a bone of the skull is pushed inside

COMPLICATED FRACTURE

This is the type of fracture where a bone breaks and damages an internal body organ e.g lungs, heart or intestines

It can occur when a rib is broken

FIRST AID FOR FRACTURES

Tie splints around the fractured part

To keep the broken bone in one position

Use arm sling to hold the broken arm in one position

Use a stretcher to carry a casualty who cannot walk

Provide a crutch (walking stick) to help the casualty in walking (for stability when walking)

Why are antibiotics applied on a compound fracture?

To prevent bacterial infections

Why is it dangerous for the first aider to attempt putting broken/displaced bone in its position?

It can lead to further injuries

EQUIPMENT USED TO GIVE FIRST AID TO FRACTURES

Arm sling

Stretcher

Crutches/walking stick

Wheelchair

Splints

To keep the broken bone in one position

Stretcher

It is used to carry a casualty who cannot walk

Why is a stretcher not kept in a first aid box?

It is too big to fit in a first aid box

Crutch/walking stick

It helps a casualty with a broken leg to walk

How do crutches help a casualty with a broken leg in walking?

By reducing the body weight put on the broken leg

Arm sling

To keep the broken arm in one position

BRUISE

This is a swelling on the skin with blood inside it

Causes of Bruises

Falls

Boxing

Sports injuries

Being hit by a hard object

Car accidents

Signs of bruises

Swelling

Skin becomes tender

Skin discoloration

Symptom of bruise

Pain

FIRST AID FOR BRUISE

Wrap a clean wet bandage around the injured part

Raise the injured part above the chest

To reduce pain

Rest the injured part

To prevent further injuries

POISONING

This is the condition when a harmful substance is taken into the body

Poison

This is a substance that can cause harm or death when taken into the body

Examples of corrosive poisons

Paraffin (kerosene)	Insecticides
herbicides	Acaricides
Rat poison	Expired drugs
Jik Bleach (liquid cleaners)	Carbon monoxide gas
Petrol	

Why is kerosene called a corrosive poison?

It is a highly reactive chemical and can cause death when taken into the body

Ways through which poison can be introduced into the body

- Through inhaling contaminated air
- Through taking overdose of drugs
- Through taking expired drugs
- Through drinking harmful chemicals
- Through infected animal bites and stings
- Through skin contact with harmful chemicals
- Through eating poisoned food

SIGNS OF POISONING

Rapid breathing	Vomiting
Sweating	Loss of body balance
Mental confusion	The victim may smell poison
Coma	

SYMPTOMS OF POISONING

Feeling thirsty	Low blood pressure (hypotension)
Blurred vision	Dizziness

CAUSES OF POISONING

- Keeping poisonous drugs in unlabelled containers
- Taking overdose of drugs
- Taking expired drugs
- Keeping harmful liquids in bottles of soft drinks
- Keeping poisonous substances children's reach
- Taking essential drugs got from local shops
- Breathing in poisonous gases

FIRST AID FOR POISONING

Poisoning with liquid poison/corrosive poison (kerosene, petrol and liquid cleaners)

Give the casualty a lot of drinks (milk, juice or safe water)

To dilute the poison

Why is it not advisable to induce vomiting in case a person takes a corrosive poison?

It causes double damage to the gullet

Poisoning with rat poison and expired solid drugs

Give the victim soapy water to induce (cause) vomiting

Push your finger into the victim's mouth (throat) to cause vomiting

PREVENTION OF POISONING

Keep drugs out of children's reach

Label the containers of poisonous drugs

Follow the drug prescription

Teach children the dangers of poisonous drugs.

Do not keep poisonous liquids in bottles of soft drinks

Do not buy drugs from local shops

Dispose expired drugs

Avoid drug misuse

What is food poisoning?

This is a group of diseases caused by eating contaminated food

OR

This is any food borne disease

Examples of food borne diseases

Diarrhoea

Dysentery

Cholera

Poliomyelitis

Typhoid

CUTS AND WOUNDS

TYPES OF CUTS

Minor cuts

Deep cuts

Minor cuts

These are cuts near the skin surface

Deep cuts

These are cuts which go deep in the skin

Signs of cuts

Bleeding from injured part

EFFECTS OF CUTS

They cause wounds

They cause bleeding

WOUNDS

A wound is a tear on the skin that allows blood to escape

Types of wounds

Lacerated wounds

Incised wounds

Puncture wounds

Abrasion wound

Contused wounds

Lacerated wounds

These are deep wounds caused by sharp objects like knives and razorblades.

Puncture wounds

These are deep wounds with a small hole caused by long pointed objects like needle, nail or spear

Contused wounds

These are wounds caused by direct blows by some objects

Incised wounds

These are wounds caused by sharp objects that can lead to open bleeding e.g razorblade and knife

Abrasion wounds

These are wounds caused by friction when a body scrapes across a rough surface

FIRST AID FOR CUTS AND WOUNDS

Apply a bandage

Apply a tourniquet to stop blood flow

First aid for cuts and wounds

Apply direct pressure with a clean cloth

To stop bleeding

Raise the injured leg or arm above the heart

To reduce (slow) bleeding

Cover the cut with a clean cloth or bandage

To prevent infections

To prevent exposing the wound or cut to germs

Apply a plaster on the minor cut

Apply a clean bandage/tourniquet on the deep cut

To stop bleeding

How does a tourniquet stop bleeding in case of a deep cut?

By stopping the flow of blood

INSECT STING

This is when insects put their stingers into the human skin

Examples of insects which sting

Wasps

Bees

Fire ants

First aid for insect stings

Apply ice pack on the injured part

To reduce pain

To reduce swelling

Use tweezers to remove the sting if present

Apply baking soda paste to reduce pain

FOREIGN BODIES

These are objects that enter the human body through a natural opening

Examples of natural openings on the human body

Nose

Ears

Mouth

Vagina

Anus

Throat

Eyes

Rectum

How do foreign bodies enter our bodies?

Some foreign objects enter by their own

Some foreign objects are pushed by people into the body

Effects of foreign bodies

They cause pain

They cause discomfort

FOREIGN BODIES IN THE MOUTH

Food remains

Chewing gum

Bone fragments

First aid for a foreign body in the mouth

By rinsing the mouth with clean water

By dental flossing
By brushing the teeth

Why is it not advisable to remove food particles stuck between teeth using a tooth pick?

A tooth pick can damage the gum

FOREIGN BODY IN THE EYE

Dust
Small insects
Small stones

Iron bits
Splinters

First aid for a foreign body in the eyes

Wash the eye with plenty of clean water

Use a clean soft cloth to remove the foreign body

How do ophthalmologists/oculists remove iron bits in the victim's eyes?

By using a magnet

Why is it not advisable to use a rough (sharp) object to remove a foreign object from the eye?

The object can harm the eye

FOREIGN BODIES IN THE EAR

Small insects
Small seeds

Small stones
Dust

FIRST AID FOR A FOREIGN BODY IN THE EAR

Pour clean cool water in the ear to make the insect come out

Why is it not advisable to try removing a foreign object besides an insect from the ear?

It can damage the ear drum

How can you help a person who has got a small stone inside the ear?

By taking the casualty to the hospital

FOREIGN BODIES IN THE NOSE

Small insects
Small seeds
Small stones

Dust
Beads

First aid for a foreign object in the nose

Blow the nose
To force out the insect
Breathe through the nose
To prevent sucking the object into the wind pipe

Why is it not always advisable to try removing a foreign object besides an insect from the nose?

It can go deeper and block the nose

FOREIGN BODIES IN THE ANUS

These are common in children who don't put on underwear or knickers

Sand	Leaves	Small seeds
Small stones	Grass	Dust

First aid for a foreign object in the anus

Wash the anus with plenty of clean water

FOREIGN BODIES IN THE VAGINA

These are common in young girls who climb trees and adolescent girls

Tampons (e.g cotton wool)	Grass
Sand	Small seeds
Small sticks	Small stones

Tampons

These are materials put in vagina to absorb menstrual blood e.g cotton wool

Why are adolescent girls at a risk of getting foreign bodies in their vaginas?

Some tampons (cotton wool) can stick in their vaginas during menstruation

First aid for a foreign object in the vagina

Wash the vagina with plenty of clean water
Use clean fingers to remove the object from the vagina

Why should a foreign body in the vagina be removed as quickly as possible?

To prevent infection of the vagina

Why do casualties sometimes fear to get first aid for foreign bodies in the anus or vagina?

Due to shyness (fear for ridicule)

FOREIGN BODY IN THE THROAT

Food

Beads

Coins

Food is the commonest foreign body in the throat

Effect of foreign bodies in the throat

They cause choking

CHOKING

This is the condition when a foreign body in throat blocks the airway to lungs

Conditions that can lead to choking

Eating hurriedly

Improper chewing of food

Swallowing big food particles

Eating while talking (talking with food in the mouth)

Signs of choking

Hand signals pointing to the throat

Clutching the throat (victim grabs the throat with hands)

Sudden inability to talk

Coughing

Difficulty in breathing

Wheezing

FIRST AID FOR CHOKING (FOREIGN BODY IN THE THROAT)

Give the victim sharp blows on the back

To force out the choking object

Apply abdominal thrusts

To force out the choking object

If the victim is a baby (smaller than you),

Hold the baby upside down and give sharp blows at the back

State any two effects of choking

Death

Asphyxia

This is the loss of consciousness due to interrupted breathing

Why is it not advisable to give the person anything to drink during choking?

To prevent fluids from covering the remaining space for passage of air

HOW TO PREVENT ACCIDENTS CAUSED BY FOREIGN BODIES

Avoid eating hurriedly

Do not talk with food in the mouth

Swallow small pieces of food

Do not put coins and beads in the mouth

Wear eye glasses and helmets when moving on motorcycles and bicycles

Teach children the dangers of putting foreign objects in their natural openings

SANITATION

SANITATION

This is the general cleanliness of a place where we stay

Which element of P.H.C promotes public cleanliness and clean water supply?

Water and sanitation

Tools used to promote sanitation

Hoe

Panga

Slasher

Wheel barrow

Brooms

Mop or rag

Rake

Mop bucket

Dust bin (trash bin/litter bin)

COMPONENTS OR REQUIREMENTS OF A CLEAN HOME (ELEMENTS OF SANITATION)

Rubbish pit or dustbin

Rack (plate stand)

Latrine

Bathroom

Kitchen

Urinal place

Of what importance is a plate rack at home?

It is where washed utensils are put to dry without contamination

How is a tippy tap important at home?

For washing dirty hands

IMPORTANCE OF GOOD SANITATION

It prevents bad smell in a place

It prevents diarrhoeal diseases

It prevents mosquito borne diseases

It destroys breeding places for insect vectors

It destroys hiding places for insect vectors

POOR SANITATION

This is the general dirtiness of a place where we stay

Signs (indicators) of poor sanitation

Tall grass in the compound

Many insect vectors in a place

Poor ventilation of a house

Still water near our homes

Bushes around homes

Rubbish in the compound

Sharing houses with domestic animals

Faeces in the compound

Bad smell in a place

Dirty water sources

Diseases associated with poor sanitation

Dysentery

Trachoma

Malaria

Poliomyelitis

Cholera

Diarrhoea

Typhoid

Leprosy

Bilharziasis

Causes of poor sanitation

Poor disposal of human wastes

Poor drainage in a home

Poor disposal of rubbish

Bursting of sewage pipes

Lack of clean water supply

Overcrowding in a home

Ignorance of good sanitation

Why is it unhealthy practice to defecate in bushes near our homes?

It leads to outbreak of faecal/diarrhoeal diseases

Dangers (effects) of poor sanitation

It leads to bad smell in a place

It leads to outbreak of diarrhoeal diseases

It leads to outbreak of mosquito borne diseases

It leads to contamination of water sources

It leads to multiplication of vectors and germs

HOW TO CONTROL POOR SANITATION (WAYS OF PROMOTING PROPER SANITATION)

Mention four activities done to promote good sanitation.

Constructing rubbish pits:

For proper disposal of rubbish

Constructing pit latrines:

For proper disposal of faeces and urine.

Picking rubbish around homes:

To keep away vectors like houseflies

Burning rubbish at home:

To destroy breeding places for houseflies

Providing dust bins:

For proper disposal of rubbish

Sweeping away rubbish in the compound:

To keep away dust and insect vectors

Draining still water:

To destroy breeding places of mosquitoes

Smoking ordinary pit latrines:

To kill houseflies

To prevent bad smell

Slashing tall grass in the compound:

To destroy hiding places for mosquitoes

Cutting bushes around our homes

To destroy hiding places for mosquitoes and tsetse flies

Treating sewage before it is disposed off

Fencing and sweeping around water sources

To prevent water contamination

Spraying insect vectors using insecticides

Avoid sharing a house with domestic animals

Scrubbing the floor of latrines

Mopping the floor of the house

Incinerator

It is where rubbish is burnt under high temperature

HOUSING

This is the providing of a proper house/shelter to an animal

Importance of proper housing to people

It protects people from wild animals

It protects people from bad weather

It protects people from thieves

Factors to consider before selecting a site for a house

Well drained soil

Nearness to the market/shop

Size of a house

Distance from the main road

Nearness to the water source

Security of the place

Nearness to the health centre

SITE OF A HOUSE

This is a place where a house is located

Qualities of a good site for a dwellinghouse (residential house)

It should have well drained soil

It should be near a water source

To easily get water for domestic use

It should be near a health centre

To easily get proper medical care in time

It should be near shops and markets

To easily buy the domestic needs

It should be at a reasonable distance from main road

To prevent motor accidents

It should not be near a wetland or forest

They are hiding places for vectors and wild animals

QUALITIES OF A GOOD HOUSE

It should be well ventilated

It should have a veranda

It should be well roofed

It should be big enough to accommodate all family members

COMPONENTS OF A WELL-VENTILATED HOUSE

Windows

Ventilators

Doors

Louvres (louvers)

VENTILATORS

To let out warm stale air

Why are ventilators always put (above windows and doors) near the roof/ceiling of a house?

To easily allow out warm stale air which is lighter than fresh air

WINDOWS AND DOORS

To allow in fresh air

To allow in light

Why are doors and windows are put at a lower level than ventilators?

To easily allow in fresh air which is denser than stale air

How does light help in control of insect vectors in a dwellinghouse?

It chases away vectors like cockroaches

How is an egress window or door useful on a residential house?

It acts as emergency exit

Besides allowing in light and fresh air, state other importance of a door on the house.

It acts as entrance and exit

LOUVRES (LOUVERS)

To allow in fresh air and light while keeping out rain

IMPORTANCE OF PROPER VENTILATION ON A HOUSE (REASONS WHY A GOOD HOUSE SHOULD BE WELL VENTILATED)

To allow free air circulation (To allow in fresh air)

To prevent easy spread of airborne diseases

To reduce temperature inside the house

How does air move through the ventilation components of a house?

By means convection currents/by convection

WAYS OF IMPROVING AIR CIRCULATION IN A WELL-VENTILATED HOUSE

By opening windows

By using electric

By using air purifiers

fans

DANGERS OF LIVING IN A POORLY VENTILATED HOUSE

It leads to easy spread of air borne diseases

It leads to suffocation

WAYS OF KEEPING THE DWELLING HOUSE CLEAN

By sweeping the floor

By mopping the floor

By scrubbing the floor

By removing cobwebs from the walls

Avoid sharing same house with domestic animals

Dangers of sharing a house with domestic animals

It leads to bad smell in the house

It leads to competition for oxygen

It leads to parasites in the house e.g ticks
Sick animals may spread diseases to people
Animal wastes make the house dirty
Animals may destroy household property

Zoonoses (zoonotic diseases)

These are diseases that can spread from sick animals to people

Examples of Zoonoses

Tuberculosis	Brucellosis	Bubonic plague
Rabies	Anthrax	

TYPES OF HOUSES

Temporary houses	Permanent houses
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TEMPORARY HOUSES

These are houses that last for a short time

Examples of temporary houses

Huts	Caravans
Tents	Houseboats

Materials used to build temporary houses

Mud	Small sticks
Dry grass	Papyri
Reeds	Bamboo
Cow dung	Dry leaves
Banana fibres	Tarpaulin
Sisal	

Advantages of temporary houses

They are cheap to make	They need a small space
They need less labour to make	

Disadvantages of temporary houses

They last for a short time (they are not durable)	They are vulnerable to bad weather
	They are small in size

PERMANENT HOUSES

These are houses that last for a long time

Examples of permanent houses

Flats	Bungalow	Mansion
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Materials used to build houses

Iron bars	Glass	Iron sheets
Concrete	Bricks	Steel nails
Cement	Wood	Metallic poles
Mortar	Stones	Polythene sheets

Advantages of permanent houses

They are durable (last longer)

It is easy to build a big house

They are resistant to bad weather

Disadvantages of modern houses

They are expensive to make

They require skilled labour to make

IMPORTANCE OF A VERANDA ON A HOUSE

It prevents dampness

It prevents flowing water from entering the house

DAMP-PROOF COURSE (D.P.C)

This a layer of polythene paper in the walls of a house

Importance of damp-proof course (D.P.C)

It prevents water from rising through the walls

It prevents dampness of the walls and floor

By what process does water rise through the walls of a house?

By capillarity/capillary action

MORTAR

This is the mixture of water, cement and sand

Of what importance is mortar during building construction?

It is used to bind/join bricks
together

It is used to plastering walls

CONCRETE

This is the mixture of water, sand, cement and small stones

Importance (uses) of concrete

It is used to make buildings

It is used to make concrete dams

It is used to make roads and
bridges

It is used to make pavements

It is used to make culverts

Advantages of using concrete

It is strong

It is fire resistant (it does not

It is durable

burn)

It does not rust

It can be cast in different shapes

It is a sound insulating material

Disadvantages of using concrete

It is heavy

It is expensive to make formwork
to hold concrete

It is less ductile

WAYS OF INCREASING THE STRENGTH OF CONCRETE

Adding iron bars and wire mesh

Concrete curing

Reducing water to cement ratio

CONCRETE CURING

This is the maintaining of enough moisture and temperature for hydration of concrete

Ways of curing concrete?

By pouring water on concrete surface

By putting polythene sheet on concrete surface

By putting sand on concrete surface

Why do builders always pour water on concrete after construction?

(Importance of concrete curing)

To harden (strengthen) concrete

To make concrete durable

To prevent cracks

What do we call the process by which water hardens concrete after placement?

Hydration

LATRINES

These are places where human wastes are disposed

Importance of latrines

For proper disposal of human wastes

Why should human wastes be disposed in a latrine? (importance of proper disposal of faeces)

To prevent easy spread of faecal/diarrhoeal diseases

To prevent water contamination

To prevent bad smell in a place

To prevent multiplication of vectors

To limit exposure of human wastes to vectors

TYPES OF LATRINES

Pit latrine

Toilets (flush
toilets)

Potties

How is a lavatory useful in an aircraft?

It helps in proper disposal of human wastes

PIT LATRINES

These are latrines made by digging a hole in the ground

Factors to consider when siting a pit latrine (qualities of a good site for a pit latrine)

It should be 10 metres from a dwellinghouse, school, hotel or kitchen

To prevent food contamination

To prevent bad smell

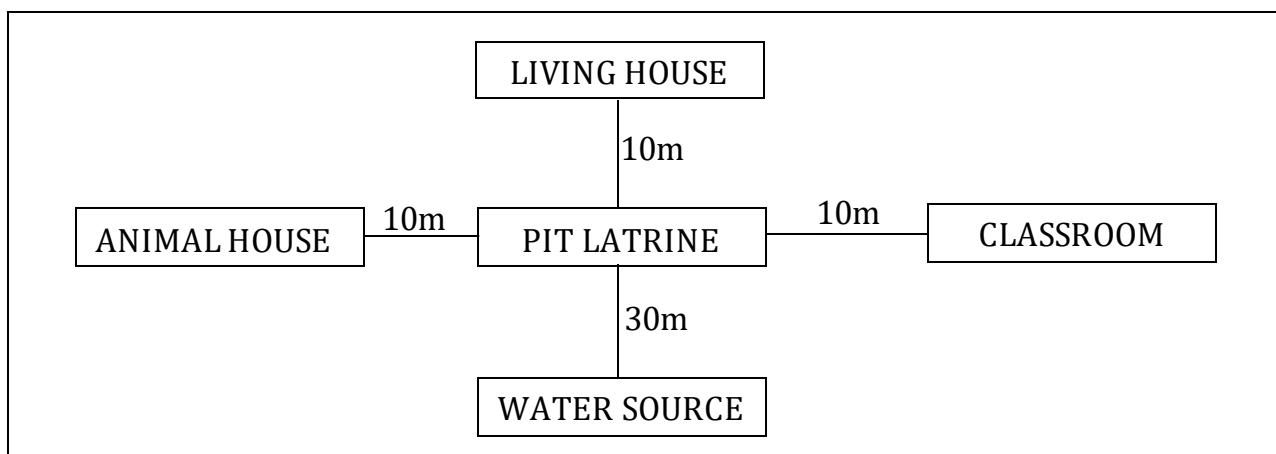
It should be 30 metres from water source

To prevent water contamination

It should be constructed downhill from a water source

To prevent water contamination

A diagram showing a good site for a pit latrine.



Qualities of a good pit latrine

It should have a deep pit

To keep faeces for long time

It should have a strong floor

To allow the user stand on

It should have a smooth floor
For easy cleaning
It should be well roofed
To prevent leaking of rain (to protect the floor and user from rain)
It should have a hole that is big enough for the human wastes to pass but small enough to prevent children from falling inside
It should have stances and walls
For privacy
The pit should be 2 metres above the water table
To prevent contamination of ground water

DISADVANTAGES OF PIT LATRINES

They can pollute ground water if not placed clearly
They are not friendly to babies

WAYS OF MAKING PIT LATRINES DIRTY

Defecating on the floor	Spitting on the floor
Urinating on the floor	Rubbing faeces on the floor
Dumping dirty toilet tissue on the floor	

MATERIALS USED TO MAKE THE FLOOR OF PIT LATRINES

Strong wood	Wire mesh	Sand
Iron bars	Concrete	Mud

THINGS USED TO CLEAN THE FLOOR OF PIT LATRINES

Soapy water	Broom
Scrubbing brush	Disinfectants

Why should disinfectants be used when cleaning the floor of an ordinary pit latrine?

To kill germs	To reduce the bad smell
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TYPES OF PIT LATRINE

Ordinary/conventional pit latrine	Ecosan latrine
VIP latrines	Pour-flush latrine

ORDINARY (CONVENTIONAL) PIT LATRINES

This is a local pit latrine without a vent pipe and screen (flyscreen)
It is made from local materials
Ordinary pit latrines are common in rural areas

Characteristics of an ordinary pit latrine

It does not have a vent pipe

It has a lid on the squat hole

It does not have a screen

(flyscreen)

A diagram showing an ordinary pit latrine

Importance of a lid on the squat hole of an ordinary pit latrine

To prevent bad smell from escaping

To keep out houseflies

Local materials used to make ordinary pit latrines

Reeds

Small sticks

Sisal

Banana fibres

Cow dung

Strong wood

Papyri

Mud

Dry grass

Clay

Ways of keeping an ordinary latrine clean (how to maintain an ordinary pit latrine)

Sweeping the floor

Scrubbing the floor

Smoking an ordinary pit latrine

Removing cobwebs from the walls

Repairing any damage on the latrine

Cutting tall grass around the latrine

Disposing human wastes directly into the squat hole

Importance of smoking an ordinary pit latrine

To kill houseflies

To reduce bad smell

CORRECT USE OF AN ORDINARY PIT LATRINE

Remove the lid from the squat hole
Squat and pass the wastes into the squat hole
Clean yourself, dress up and cover the squat hole
Wash your hands with clean water and soap

VIP LATRINE

This is a modern pit latrine with a vent pipe and a screen (flyscreen)

VIP stands for Ventilated improved pit latrine

Why is VIP latrine said to be ventilated?

It has a vent pipe that takes out bad smell

Why is VIP latrine said to be improved?

It does not smell badly and it kills flies

CHARACTERISTICS (FEATURES) OF A VIP LATRINE

It has a vent pipe

It has spiral walls

It has a screen (fly screen)

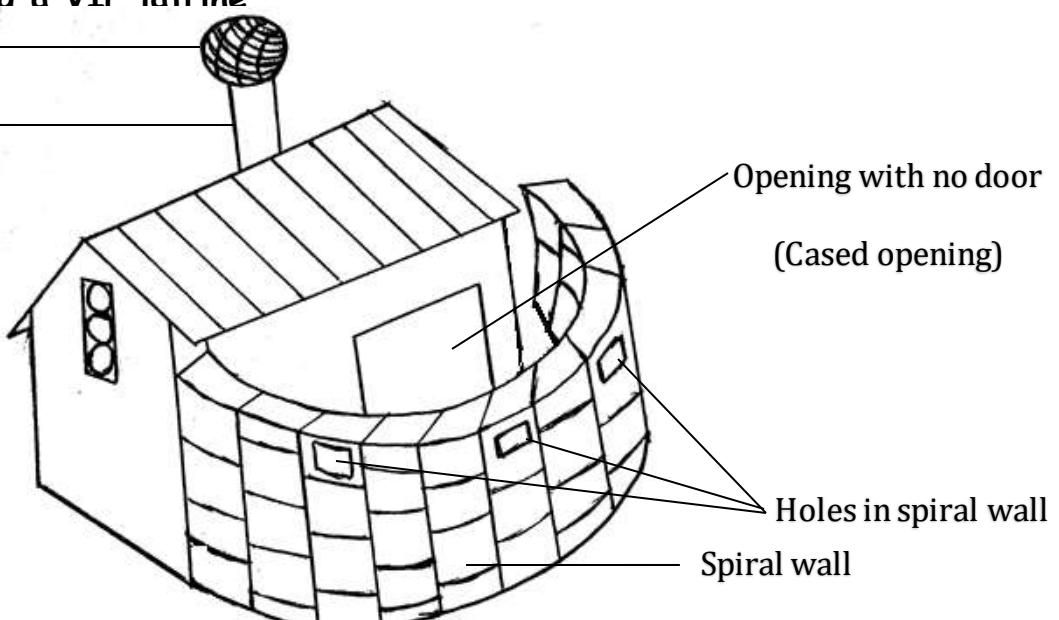
It has no door on its opening

It has no lid for the squat hole

A diagram showing a VIP latrine

Flyscreen (Screen) _____

Vent pipe _____



IMPORTANCE OF EACH PART OF A VIP LATRINE

Vent pipe

To let out bad smell

Screen (flyscreen)

To trap and kill flies

How does the screen kill houseflies?

It suffocates them without escaping

What attracts flies to pass through the vent pipe towards the screen?

Light entering through the screen

Spiral walls

For privacy

To direct fresh air into the door of the VIP latrine

Why are the some holes put in the spiral walls of a VIP latrine?

To allow free circulation of air

Why is a VIP latrine made with no door on its opening?

To allow free circulation of air (to allow in fresh air)

Why does a VIP latrine has no lid for the squat hole?

To allow in fresh air (to allow free circulation of air)

By what process does air move (circulate) in a VIP latrine?

Convection

Ways of keeping A VIP latrine clean (How to maintain a VIP latrine)

Sweeping the floor

Scrubbing the floor

Repairing any damage on the latrine

Removing cobwebs from the walls

Cutting tall grass around the latrine

Disposing human wastes directly into the squat hole

Why is it not necessary to smoke a VIP latrine?

It has a vent pipe that lets out bad smell

It has a screen that kills flies

Why is a lid of no importance on the squat hole of a VIP latrine?

It blocks air circulation

ECOSAN LATRINE

This is a modern pit latrine in which urine does not mix with faeces

Ecosan stands for Ecological sanitation

Characteristic (feature) of an Ecosan latrine

It has a shallow pit

To allow ash reach faeces before spreading

Why is ash poured into the pit of Ecosan pit latrine after use?

To dry up faeces

A diagram showing Ecosan latrine

ADVANTAGES OF ECOSAN LATRINE

It does not produce any smell

Human wastes collected are used as manure

Give a reason why an Ecosan pit latrine does not produce any smell

There is no mixing of faeces and urine

The ash dries up faeces

Ways of keeping an Ecosan latrine clean (How to maintain Ecosan latrine)

Sweeping the floor

Avoid dirtying the floor with ash

Cover faeces with ash after use

Why are Ecosan pit latrines not cleaned with water?

To prevent mixing of faeces with water

TOILETS (FLUSH TOILETS/ WATERBORNE TOILETS /WATER CLOSETS)

These are latrines with a water flushed bowl connected to a sewer

WC stands for Water closet

Why are toilets sometimes called flush toilets?

They use water to carry away human wastes

PLACES WHERE TOILETS ARE FOUND

Hospitals

Modern houses

Urban schools

Banks

Hotels

Why are flush toilets found in towns and cities?

There is supply of piped water

Why are flush toilets not common in rural areas?

There is no supply of piped water

Why are toilets not smoked?

Heat can cause damage to the toilet equipment

A diagram showing a flush toilet

IMPORTANCE OF EACH COMPONENT OF A FLUSH TOILET

Seat

It is where the user sits when using the toilet

Toilet bowl

It is where human wastes are deposited

What is the importance of water that remain inside the toilet bowl after flushing?

To prevent bad smell

Handle

It is pulled or pushed or pressed to flush the toilet

Toilet water tank (cistern)

To keep water for flushing the toilet

Why is the cistern (water tank) always raised up the bowl?

To increase water pressure when flushing the toilet

Refill pipe

To supply water to the water tank (cistern)

Upper pipe (water pipe)

To carry water from the tank to the bowl

Lid (seat cover)

To cover the seat and bowl when not in use

Toilet bowl brush

For cleaning the toilet bowl

Sewage pipe (sewer)

To carry human wastes from to the septic tank

Septic tank (cesspit)

To store sewage (to store human wastes after flushing)

Why should a septic tank be cemented (made with concrete walls)?

To prevent contamination of ground water

To prevent drainage of sewage into the soil

Why should the septic tank not be put near a kitchen?

To prevent food contamination

Why should the septic tank be covered?

To prevent bad smell

To prevent exposure of human wastes to vectors

Roles of S-trap in the sewage pipe

To prevent bad smell

To prevent back flow of human wastes into the bowl

To trap objects that may block the flow of wastes through the pipes

CORRECT USE OF A FLUSH TOILET

Open the lid and sit on the seat

Pass wastes into the bowl

Clean yourself with toilet paper and dress up

Flush and cover the toilet bowl

Sewage

These are human wastes carried from toilets through sewers

CESSPOOL EMPTIER

This is a vehicle used to empty septic tanks and pit latrines

A diagram showing a cesspool emptier

Importance of a cesspool emptier

To empty septic tanks and pit latrine

ADVANTAGES OF A WATERBORNE TOILET

It can be put inside the house

It can be used by young children

It is easy to clean

Why are waterborne toilets said to be user friendly?

They can be used by young children

DISADVANTAGES OF WATERBORNE TOILET

It is very expensive to construct

It needs piped water to use

It gets blocked if hard objects are put in it

National water and sewerage corporation (NWSC)

It collects and treats sewage (it supplies sewerage services in towns)

It supplies treated piped water in urban areas

Ways of keeping a flush toilet clean (how to maintain flush toilets/urban toilet system)

Flush the toilet after use

To carry human wastes to the septic tank

Do not squat on the seat

To prevent making the seat dirty

To prevent injuries in case the seat breaks

Sweep the floor

Remove cobwebs from the walls

Dispose human wastes directly into the bowl

Mop the floor with long stick mop

Use a bowl brush to clean inside the toilet bowl

Use soapy water or detergents to clean the toilet

To kill germs

To prevent the bad smell

Do not use the toilet when it is blocked

To prevent spilling of human wastes

Repair any damage on the toilet equipment

Put disinfectants in the bowl

To kill germs

Put toilet papers in the toilet

To prevent blocking the sewage pipe

Put a dustbin in the toilet

For proper disposal of hard materials like sanitary pads and hard papers

Do not use hard papers in a toilet

To prevent blocking the sewage pipe (sewer)

Why should we wear gloves when cleaning the latrine?

To protect our hands from germs

Problems faced by urban toilet system/flush toilets

Lack of water for flushing makes the toilet fail to work

Use of hard materials blocks the sewage pipes

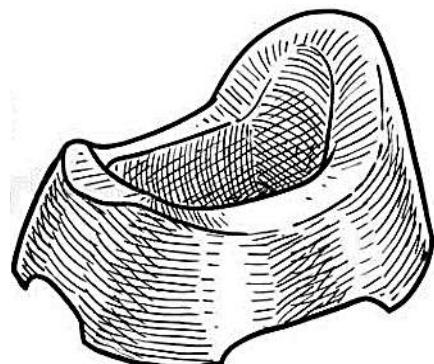
Blocking of sewage pipe spills human wastes that attracts vectors in the toilet

POTTY

This is a small portable latrine for small children

It is usually used by toddlers as they train them to use other latrines

A drawing showing a potty



Groups of people who use potties

Toddlers/Babies

Very sick people/invalids

Elderly

Why are potties not used by big children?

To prevent them from breaking the potties

State the importance of a potty at home

For proper disposal of human wastes by small children

It is where small children dispose their human wastes

Mention one disease that can make a toddler to be with a potty all the time

Diarrhoea

Why do crawling babies have a high risk of diarrhoea/food poisoning?

They eat contaminated food

GROWTH AND DEVELOPMENT

Growth

This is the increases in body size

It is a biological change

Growth is most rapid during infancy

Development

This is the increase in maturity

Note:

Growth and development occur at the same time

Factors that affect growth and development

Hormones

Genes

Environment

PUBERTY

This is the period when a person becomes sexually mature

ADOLESCENCE

This is the transitional stage between childhood and adulthood

Adolescent

This is a person developing from childhood to adulthood

At what age does adolescence usually begin and end in boys and girls?

10 to 19 years (10 to 24 years)

Note:

Girls experience early menstruation than boys because they have more fat tissues than boys

STAGES OF ADOLESCENCE (CHANGES THAT OCCUR DURING ADOLESCENCE)

Primary sex characteristics (basic sex characteristics or puberty changes)

Secondary sex characteristics (physical sex characteristics)

Emotional (psychological sex characteristics)

Out of step adolescent changes

PRIMARY (BASIC) SEX CHARACTERISTICS/PUBERTY CHANGES

These are changes which prepare sex organs for reproduction

Primary sex organs in females are the **ovaries** while in males are the **testes**

Examples of primary (basic) sex characteristics

In boys

Penis enlarges (enlargement of the penis)

Wet dreams begin

Production of sperms

In girls

Menstruation begins

Uterus develop (development of the uterus)

Ovulation begins

In both girls and boys

Production of gametes

Development of gonads

SECONDARY (PHYSICAL) SEX CHARACTERISTICS

These are changes on the body which distinguish a mature person from a young person

They give a person either male or female appearance

Oestrogen controls secondary sex characteristics in girls

Testosterone controls secondary sex characteristics in boys

Examples of secondary (physical) sex characteristics

In boys

Sweat glands become more active

Voice deepens

Growth of pubic hair and armpit
hair

Growth of pimples

Body grows more muscular

In girls

Sweat glands become more active

Growth of pubic hair and armpit hair

Voice becomes soft and attractive

Breasts enlarge (breasts grow bigger)

Hips enlarge (widening of hips)

In both boys and girls

Sweat glands become more active

Change in voices

Growth of pubic hair and armpit
hair

Growth of pimples

EMOTIONAL (PSYCHOLOGICAL) CHANGES OF ADOLESCENCE

These are changes which occur in minds of adolescents

Examples of emotional (psychological) changes in adolescents

They get sexual feelings (They become interested in members of opposite sex)

They want freedom

They reject rules of elders (they become disobedient)

They quickly react towards situation

They want to have their own identity

They want to be recognized as mature (they become ambitious)

They quickly become angry (mood swings)

They spend much time in peer groups

What causes mood swings in adolescent boys and girls?

Changes in levels of sex hormone

OUT OF STEP ADOLESCENT CHANGES

These are changes which occur to different individuals of the same age group

Examples of out of step adolescent changes

Some boys and girls suddenly becomes taller than the agemates

Some boys and girls suddenly become fatter than the agemates

Some boys and girls grow pubic hair faster than the agemates

Some girls develop breasts faster than the agemates

Some girls undergo menstruation before their agemates

COMMON PROBLEMS OF ADOLESCENCE

It leads to antisocial behaviour

It increases the risks of drug

It leads to sexual conflicts

abuse

It results into body odours

It leads to conflicts with elders

It leads to conflicts with culture and religion

It increases the risks of unwanted pregnancies

HOW TO HELP ADOLESCENTS (HOW TO OVERCOME THE CHALLENGES OF ADOLESCENCE)

Advise them to share their problems with elders

Advise them to join good social clubs

Advise them to have good role models

Teach them how to manage the body changes

Teach them the dangers of early sex

Regular counselling and guidance

REPRODUCTION IN ANIMALS

Reproduction is the process by which living things multiply in the environment

Reproduction is the process by which new organisms are produced from the parent organisms

It is a biological change

Importance of reproduction

It prevents extinction of living things
It promotes continuity of living things
It increases the population of living things

TYPES OF REPRODUCTION

Asexual reproduction

Sexual reproduction

ASEXUAL REPRODUCTION

This is the type of reproduction which does not involve the union of gametes

Examples/forms of asexual reproduction in animals

Binary fission

Fragmentation

Budding

Parthenogenesis

A table showing examples of animals that undergo asexual reproduction

FORMS OF ASEXUAL REPRODUCTION	ANIMALS
Budding	Coelenterates (Hydra, Corals, Jellyfish, Sea anemone)
Fragmentation	Starfish, Brittle star, Tapeworms, Blackworms, Hydra
Parthenogenesis	Some bees, Some ants, Some aphids, Some sharks

SEXUAL REPRODUCTION

This is the type of reproduction which involves the union of gametes

Gamete

This is a reproductive cell

Gonad

This is a sex organ that produces a gamete

A TABLE SHOWING GAMETES AND GONADS IN ANIMALS

Male gonad	Male gamete	Female gonad	Female gamete
Testes	Sperms	Ovary	Ova

Examples/forms of sexual reproduction

Giving birth to live young (calving, kidding, lambing, childbirth, kindling)

Laying eggs

HERMAPHRODITE

This is an organism with both male and female sex organs

Examples of hermaphrodites

Snails

Slugs

Earthworms

FERTILISATION

This is the union of male and female gametes to form a zygote

The immediate result of fertilization is a zygote

TYPES OF FERTILIZATION

External fertilization

Internal fertilization

EXTERNAL FERTILIZATION

This is the type of fertilization which occurs outside the body of the female

It takes place in water/moist areas/aquatic environment

Examples of animals which undergo external fertilisation

Tilapia

Shark

Salamander

Nile perch

Frog

Newt

Mudfish

Toad

Groups of vertebrates that undergo external fertilization

Fish

Amphibians

How are eggs of amphibians and fish fertilised?

They are fertilized externally

Why does external fertilization usually occur in water?

Water facilitates the movement of sperms to the eggs

INTERNAL FERTILIZATION

This is the type of fertilization which occurs inside the body of the female

It takes place in the oviducts (fallopian tubes)

Examples of animals that undergo internal fertilization

Human being

Duck

Crocodile

Monkey

Eagle

Tortoise

Gorilla

Cobra

Chicken

Chameleon

Groups of vertebrates that undergo internal fertilization

Mammals

Birds

Reptiles

How are birds, mammals and reptiles fertilized?

They are fertilized internally

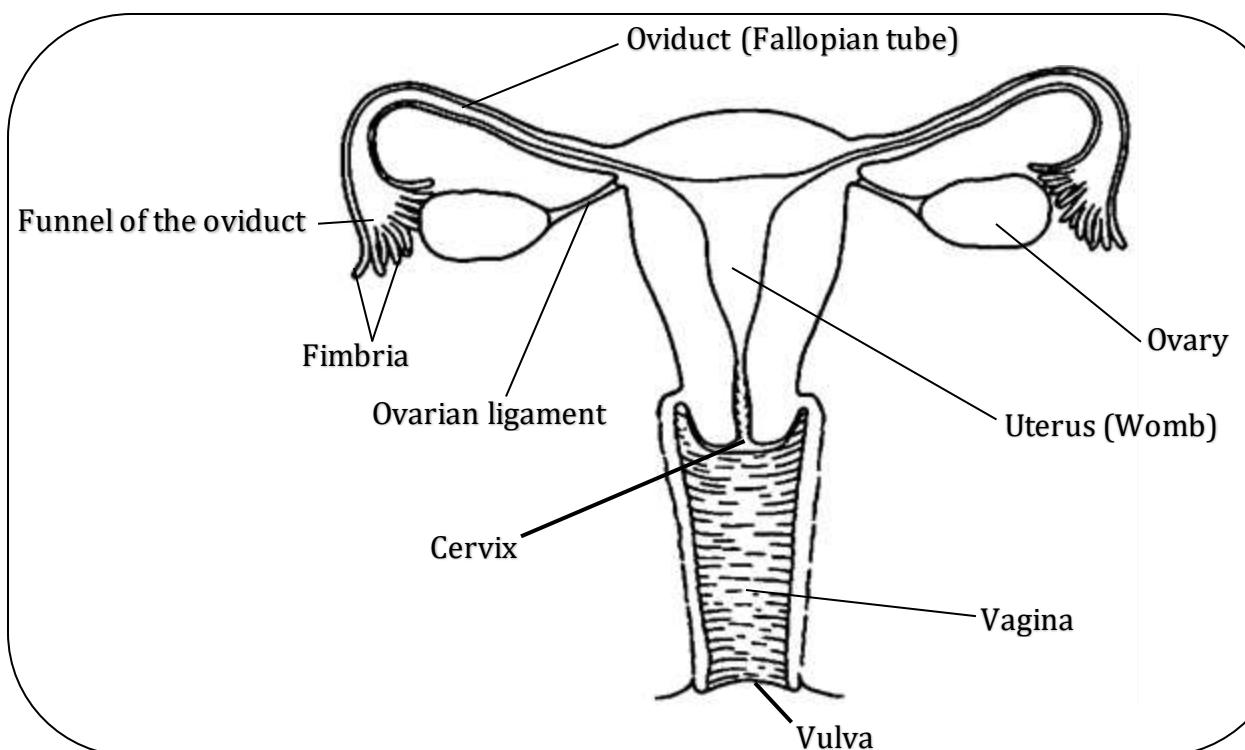
REPRODUCTION IN HUMANS

Humans undergo sexual reproduction

They undergo internal fertilization

Fertilization in humans occurs in the oviducts (fallopian tubes)

A DIAGRAM SHOWING THE FEMALE REPRODUCTIVE SYSTEM



FUNCTIONS OF THE FEMALE REPRODUCTIVE ORGANS

OVARIES

These are the female gonads

A woman has two ovaries

Ovulation occurs in the ovaries

They produce ova/eggs (they produce female gametes)

They produce female sex hormones (oestrogen and progesterone)

Besides producing eggs and female hormones, give other two functions of ovaries

They release eggs for fertilization

They protect the eggs

Ova (eggs)

These are the female gametes (female reproductive cells)

An ovum (egg) unites with a sperm to form a zygote

Functions of oestrogen

It regulates secondary sex characteristics in girls

It regulates menstrual cycle

It regulates vaginal lubrication (regulates sexual desires)

Functions of progesterone

It thickens the uterine walls for implantation

It maintains pregnancy

OVIDUCT (FALLOPIAN TUBE/UTERINE TUBES)

It is where fertilization takes place

It is the passage of the egg from the ovary to the uterus

It is where conception occurs

UTERUS (WOMB)

It is where the fetus grows from

It is where implantation takes place

CERVIX

It closes the lower end of the uterus during pregnancy

It prevents the fetus from coming out before it is time.

URETHRA

It passes out urine from the Urinary bladder

VULVA

It is the outer part of the female reproductive system

VAGINA

It is where sperms are deposited

It is a birth canal

How is the vagina adapted to its function as a birth canal?

It has elastic muscular walls

How is mucus important in the vagina?

It lubricates the vagina

It keeps the vagina moist (prevents the vagina from drying up)

It provides acidic medium to prevent growth of bacteria and fungi

FIMBRIAE AND FUNNEL OF THE OVIDUCT

It directs the ovum (egg) into the oviduct

HYMEN

It is the skin around the vaginal opening

CLITORIS

It is the most sensitive part of the female reproductive organs

OUTER LIPS (LABIA MAJORA)

It is the skin that protects the delicate organs inside

URINARY BLADDER

It stores urine for a short time before urination

DISORDERS OF THE FEMALE REPRODUCTIVE SYSTEM

Ectopic pregnancy
Female sterility (barrenness)
Fibroids
Ovarian tumour

Inflammation of oviducts
Vaginal fistula
Vaginitis (inflammation of vagina)

ECTOPIC PREGNANCY

This is the condition when a fertilized egg develops outside the womb (implants itself in the oviduct)

Causes of ectopic pregnancy

Inflammation of the oviduct
Cigarette smoking
Unsuccessful tubal ligation
Pelvic inflammatory disease

FEMALE STERILITY (BARRENNESS)

This is the condition when a woman fails to conceive

Causes of barrenness

Failure to ovulate
Blocked oviducts
Damaged uterus
Old age

FIBROIDS

These are swellings that develop on the uterine walls

OVARIAN TUMOUR

These are abnormal cells that grow on the ovaries

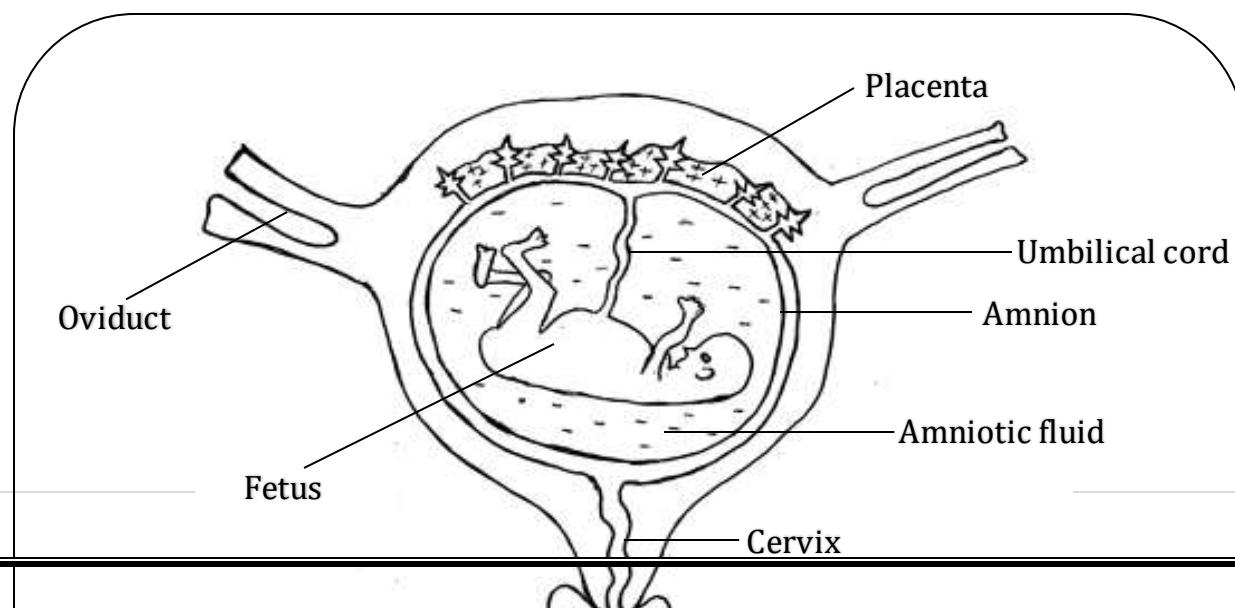
VAGINAL FISTULA

This is abnormal opening that connects the vagina with another organ (e.g urinary bladder, colon or rectum)

Causes of vaginal fistula

Injury during childbirth
Surgery of the vagina

THE HUMAN FETUS IN THE WOMB



PLACENTA

This is an organ that develops in the uterus/womb during pregnancy

It provides food and oxygen to the fetus

It removes waste products from the fetus (e.g carbon dioxide)

It prevents harmful substances from reaching the fetus

It prevents mixing of mother's blood and that of the fetus

Name any two harmful substances that can cross the placenta and harm the growing baby

Alcohol

Nicotine

What process allows exchanges between the mother and fetus in the placenta?

Diffusion

UMBILICAL CORD

This is the tube that connects the fetus to the placenta

It carries food and oxygen from the placenta to the fetus

It carries waste products from the fetus to the placenta

How is the umbilical cord adapted to its functions?

It has the umbilical vein and arteries

How is the function of umbilical artery different from that of umbilical vein?

Umbilical vein carries oxygenated blood from the placenta to the fetus while

umbilical artery carries deoxygenated blood from the fetus to the placenta

How is the umbilical artery similar pulmonary artery in terms of function?

Both carry deoxygenated blood

How is the umbilical vein similar pulmonary vein in terms of function?

Both carry oxygenated blood

AMNIOTIC SAC (AMNION)

It protects the fetus from injury

It keeps the amniotic fluid

AMNIOTIC FLUID

It protects the fetus from injury

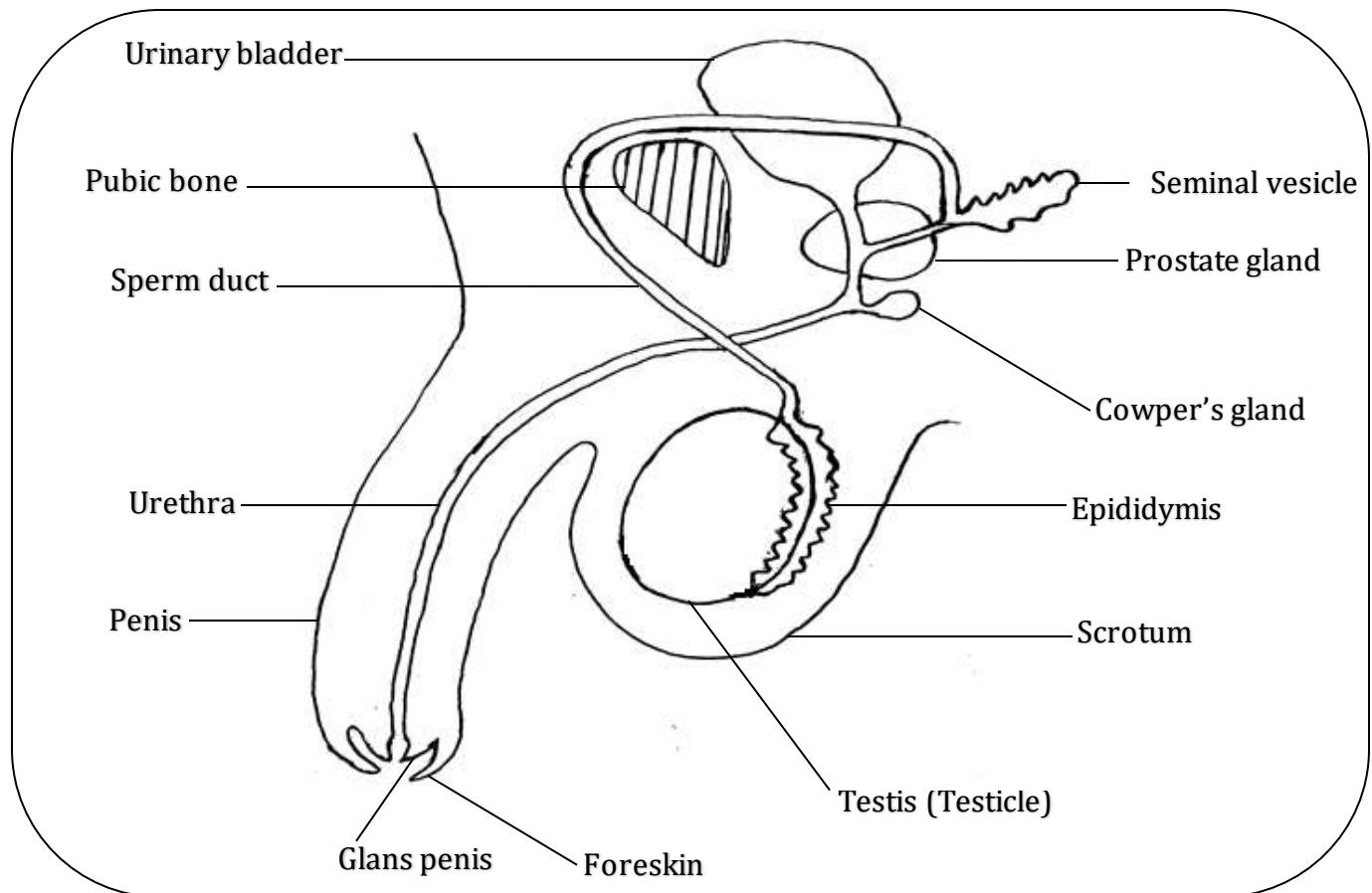
It prevents the fetus from drying up

It lubricates the fetus and prevents body parts from growing together

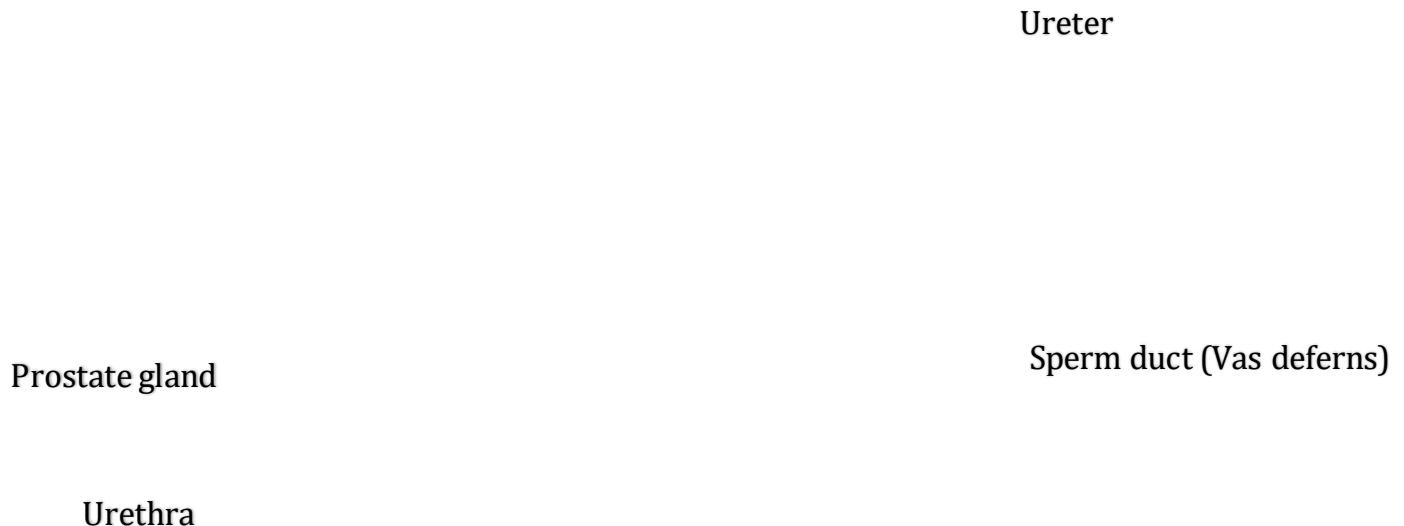
How does the amniotic fluid protect the fetus from physical damage?

By absorbing shock

THE STRUCTURE OF THE MALE REPRODUCTIVE ORGAN



FRONT VIEW OF THE MALE REPRODUCTIVE SYSTEM



Examples of male reproductive organs found outside the body

Penis

Scrotum

Testes

Examples of male reproductive organs found inside the body

Epididymis

Seminal vesicles

Vas deferens (sperm duct)

Prostate gland

Urethra

Cowper's gland

FUNCTIONS OF THE MALE REPRODUCTIVE ORGANS

PENIS

It deposits sperms into the vagina

Ejaculation is the depositing of sperms into the vagina by an erect penis

The penis has an **erectile tissue** to erect the penis during sex.

The most sensitive part at the tip of penis is called **glans penis**

Foreskin (prepuce)

It covers the glans (head of the penis)

TESTES (TESTICLES)

These are the male gonads

Most men have two testes

They produce the sperms (male gametes)

They produce testosterone (the main sex hormone in men)

Uses of testosterone

It controls secondary sex characteristics in boys

It controls sexual desires

SCROTUM

It protects the testes from harm.

It regulates temperature around the testes

How does the scrotum regulate temperature around the testes on the following days?

Cold days:

It contracts for the testes to move up and get warmth from the body

On hot days:

It relaxes for the testes to move away from the body to cool the temperature

Why is the scrotum hanging between the legs?

To keep the testes at cooler temperature than the body temperature

EPIDIDYMIS

This is a long coiled tube on the backside of the testes

It stores sperms

It helps sperms to survive and mature

Why is the epididymis coiled?

To allow sperms time to mature

To delay release of sperms

SPERM DUCT (VAS DEFERENS)

It carries mature sperms to the urethra

URETHRA

It carries sperms to the vagina

SEMINAL VESICLE

It helps in producing semen which helps sperms to swim

It produces an alkaline fluid that neutralizes acids in urethra

It produces a fluid that provides energy to sperms

PROSTATE GLAND

It produces prostate fluid

Give two functions of prostate fluid

To nourish sperms

To neutralize acids in the vagina

COWPER'S GLAND

It produces Cowper's fluid

Cowper's fluid is produced before ejaculation

Give two functions of Cowper's fluid

To neutralize acids in the urethra

To lubricate the urethra

DISORDERS OF THE MALE REPRODUCTIVE SYSTEM

Impotence

Enlargement/swelling of the

Low sperm count

prostate gland

Epididymitis

Swelling of the scrotum/hydrocele

Orchitis

Impotence

This is the inability of the penis to erect

It is caused by obesity, diabetes or high blood pressure

Low sperm count

This is the inability of the testes to produce enough sperms

It is caused by drinking too much alcohol and tobacco smoking

Swelling of the prostate glands

It occurs in men older than 50 years

Epididymitis

This is the inflammation of the epididymis

It is caused by bacterial STIs (gonorrhoea or chlamydia)

Orchitis

This is the inflammation of the testes

It is caused by mumps or bacterial STIs (gonorrhoea or chlamydia)

Hydrocele

This is the accumulation of fluids in the scrotum

It can be caused by an injury on the testes

REPRODUCTIVE HEALTH

This is the state of physical, mental and social well-being of the reproductive system

Importance of reproductive health

It prevents the spread of STIs (sexually transmitted infections)

It helps a mother to deliver a healthy baby

It creates awareness about safe sexual practices

CARE FOR REPRODUCTIVE SYSTEM (HOW TO PROMOTE REPRODUCTIVE HEALTH)

Washing genital parts with clean water

Shaving the long pubic hair

Always put on clean dry underwear

Abstain from premarital sex

Avoid tight underwear

Never spray perfumes on genital parts

- Observe good hygiene during menstrual periods
- Avoid sharing underwear and body towels
- Avoid cleaning the vagina with long fingernails and soap
- Always keep the flush toilets clean

FERTILIZATION IN HUMANS

Fertilization

This is the union of male and female gametes to form a zygote
It can follow sexual intercourse or artificial insemination
It occurs in the **oviducts (fallopian tubes)**
Its immediate result is the **zygote**

Conception

This is the formation of a zygote
It occurs in the oviducts (fallopian tubes)

Implantation

This is the attachment of a fertilized ovum onto the uterine wall
It occurs in the **uterus (womb)**

STAGES OF BABY DEVELOPMENT

Zygote Embryo Fetus

Zygote

This is a single cell formed after fertilization
It is the initial stage baby development

Embryo

This is the developing baby from two weeks after conception to eight weeks

Fetus

This is the developing baby from eight weeks after conception to birth
It is the final stage in baby development

GAMETES

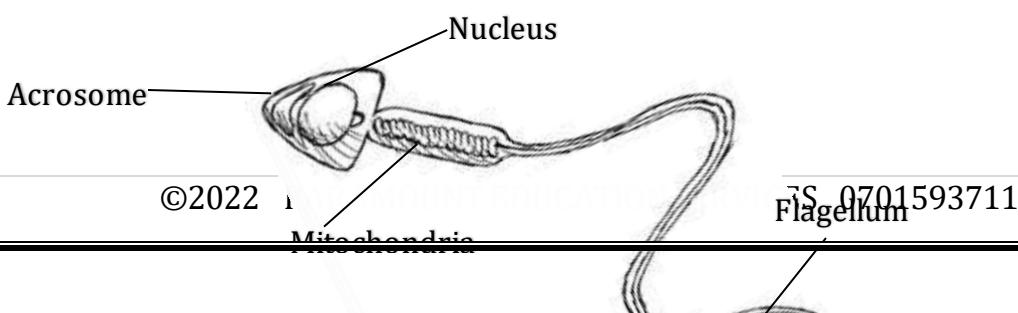
These are reproductive cells

Examples of gametes in humans

SPERM

This is a male gamete

The structure of a sperm cell



FUNCTIONS OF EACH PART OF A SPERM CELL

Acrosome

It has digestive enzymes

Nucleus

It contains chromosomes

Mitochondria

To supply energy to the cell

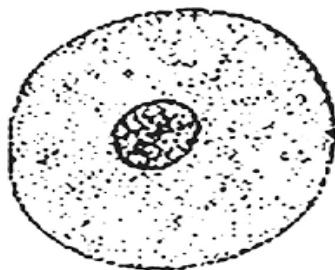
Flagellum (Tail)

For movement (for swimming)

OVUM

This is a female gamete

The structure of an ovum (human egg)



NOTE

An ovum spends 3 days moving from the oviduct to the uterus

A released mature ovum can survive for 24 hours

Sperms can stay in the female's body for about 3 days

OVULATION

This is the releasing of a mature ovum from the ovary

It occurs at about 14 days from the first day of the last menstrual cycle

An ovum is released every 4 weeks

MENSTRUATION

This is the monthly flow of blood from the uterus through the vagina

It recurs at about a month (4 weeks)

The average length of menstrual cycle is 28 to 32 days

Normal menstruation takes **3 to 4 days**.

The first menstruation occurs at the onset of puberty

Importance of menstruation

It prepares the uterus for implantation

It prepares the body for pregnancy

Problems that may occur during menstruation

Painful menstrual periods

No menstrual bleeding

Heavy menstrual bleeding

Conditions that cause missing menstrual periods (conditions that interrupt menstruation)

Pregnancy or Conception or Fertilisation

Breastfeeding

Use of contraceptive (birth control) pills and injections

Stress

Menopause

Strong fever

Tobacco smoking

Menopause

This is the time when menstruation stops permanently

It generally occurs between the ages of 45 and 55

It is confirmed when a woman misses her periods for 12 months

Care during menstruation

Regular bathing

Use tampons (sanitary pads to absorb blood)

Visit health workers incase abnormalities are noted

PROCESSES INVOLVED IN DEVELOPMENT OF A BABY INSIDE THE WOMB

Fertilization	Zygote formation	Implantation	Childbirth
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SEX DETERMINATION

The baby's sex is determined by **sex chromosomes** in sperms

Types of sex chromosomes

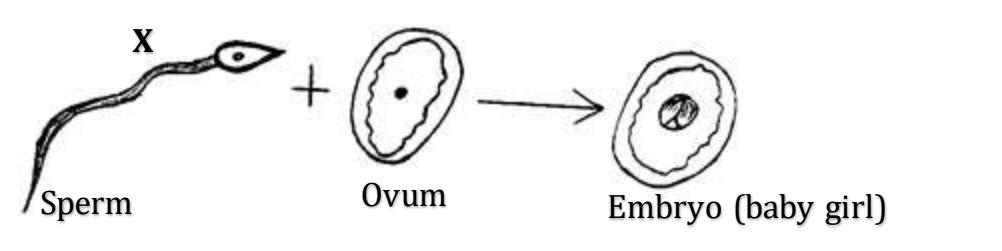
X chromosome

Y chromosome

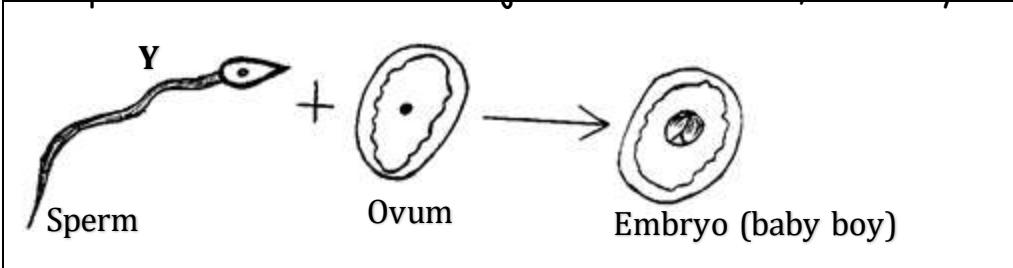
All females have XX chromosomes

All males have XY chromosome.

If a sperm with X chromosome joins with an ovum, the baby will be a girl



If a sperm with Y chromosome joins with an ovum, the baby will be a boy



PREGNANCY (GESTATION PERIOD IN HUMANS)

This is the time taken (period) from conception to birth

Pregnancy in humans lasts for **9 months**

Signs of pregnancy

Menstruation stops (missing the menstrual periods)

Breasts enlarge (grow bigger)

Frequent urination

Morning sickness

Belly enlarges

Danger signs of pregnancy

Swollen feet

Vaginal bleeding

Severe vomiting

Problems that may occur during pregnancy

Swollen feet

Severe abdominal pain

Backache

Vaginal bleeding

pain

Itchy breasts

Severe vomiting

Severe anaemia

Difficult in seeing

Severe tiredness

Constipation

Severe headache

Heartburn

Of what importance is the pregnancy test kit?

For detecting pregnancy

Why do women prefer blood pregnancy tests to urine pregnancy tests?

Blood tests detect pregnancy earlier than urine tests.

Why do pregnant women sometimes lick anthill soil?

Due to lack of iron (due to iron deficiency)

REQUIREMENTS OF PREGNANT WOMAN (EXPECTANT MOTHER)

Balanced diet (proper feeding)

Appropriate clothing

Antenatal care (prenatal care)

Regular body exercises

Enough rest and sleep

Good personal hygiene

WAYS OF CARING FOR A PREGNANT WOMAN

Feeding her on a balanced diet

Encouraging her to do body

Taking her for antenatal care

exercises

Helping her to do heavy work

FOOD FOR PREGNANT WOMEN

FOOD	FUNCTION
Proteins	To build up body tissues of the fetus To repair worn out body tissues of the mother
Carbohydrates	To provide energy to the mother's body
Vitamins	To keep their body healthy To boost the mother's immunity
Roughage	To prevent constipation
Iron	To form blood To prevent anaemia
Calcium	To strengthen bones

ANTENATAL CARE (PRE-NATAL CARE)

This is the treatment and education given to a pregnant woman at health centre

Ante means before

Natal means birth

Antenatal visit (prenatal visit)

This is a visit made by a pregnant woman to the health centre

Services provided during antenatal visits (examples of antenatal care)

Immunizing pregnant women with TT vaccine

Monitoring the foetal growth and position in the womb

Teaching pregnant women how to prepare for delivery (childbirth)

Teaching pregnant women how to keep themselves clean

Teaching pregnant women how to care for a newborn baby

Treating some STIs when detected

Why are pregnant women immunized with TT vaccine (Tetanus Toxoid vaccine)?

To protect the mother and her baby against tetanus during birth

POSTNATAL CARE (PNC)

This is care given to the mother and her newborn baby up to six weeks after birth

Postnatal visit

This is any visit made by a mother with her newborn baby to a clinic up to six weeks after birth

Services provided during postnatal visits (examples of post natal care)

Immunizing the baby

Checking the mother's recovery after birth

Reminding the mother to keep the baby warm

RESPONSIBILITIES OF FAMILY MEMBERS TO A PREGNANT MOTHER

Giving her medical care

Advising her to wear maternity clothes

Feeding her on a balanced diet

Helping her to do heavy work

Advising her to do body exercises

Giving her encouragement

WAYS OF PREPARING FOR CHILD BIRTH

Buying new clothing

Saving money for

Buying new beddings

emergency/transport

Buying mama kit

NEEDS FOR THE PREGNANT WOMAN DURING DELIVERY

Mama kit

Basin

Cotton cloth

Food and water

Money for transport (emergency)

Baby clothing

Soap

Clean towel

MAMA KIT

This is a set of things needed by a pregnant woman for clean and safe delivery

Examples of mama kit (Things needed by a mother for clean and safe delivery)

Cotton wool

Surgical gloves

Soap

Razor blade

Disinfectant
Plastic sheet (mackintosh)

Cord ligature
Sanitary pads

TEENAGE PREGNANCY

This is the pregnancy got by a girl aged between 13 and 19 years

This is the pregnancy in girls under the age of 20

It is also called **adolescent pregnancy**

Who is a teenager?

This is a person aged between 13 and 19 years

Causes of teenage pregnancy (adolescent pregnancy)

Peer pressure	Desire for luxury goods (greed for money)
Rape	Poverty at home
Premarital sex	Unfulfilled promises by parents
Drug abuse	Lack of sex education
Lack of parental care	
Forced marriage	

Effects (outcomes or consequences) of teenage pregnancy

Dropping out from school (loss of school education)

Rejection by parents

Lack of financial support

Obstructed labour

Due to contracted/small pelvis

Difficulty in delivery

Due to contracted/small pelvis

Attempt to have abortion

Isolation by friends

Prevention of teenage pregnancy

Avoid premarital sex	Avoid gifts for sex
Avoid bad peer groups	Avoid bad touches
Seek advice from elders	Attend sex education

YOUNG PARENTS

These are young girls and boys who give birth before the age of consent.

Young mother

This is the girl who gives birth before the age of consent

Young father

This is a boy who gives birth before the age of consent

Problems faced by young parents

Lack of skills to manage the family

Ignorance about caring for the

Lack of financial support

baby

Isolation by friends

Risks of abortion

Dropping out from schools

Risks of getting STDs

Obstructed labour

CHILDBIRTH AND LABOUR

CHILDBIRTH

This is the act of producing a baby in human beings

Methods of childbirth (delivery)

Vaginal delivery

Cesarean delivery

LABOUR

This is the process by which the fetus and placenta leave the uterus

What is the normal birth weight?

Between 2.5 kg and 4 kg

What is the average birth weight?

3.5 kg

Name the hormone which facilitates labour and childbirth

Oxytocin

Why does a baby cry directly after birth?

Due to cold air and the new environment

Why is it importance for a baby to cry after birth?

It cleans and opens the breathing system

Why are babies sometimes held upside down by the legs after birth?

To induce cry which cleans and opens the breathing system

MULTIPLE BIRTHS

This is when a mother delivers two or more babies in a single birth

Forms (examples) of human multiple births

Twins

Quintuplets

Triplets

Sextuplets

Quadruplets

TWINS

These are two babies born by the a mother in a single birth

It is the most common form of human multiple births

TYPES OF TWINS

Identical twins/monozygotic twins

Fraternal twins/dizygotic twins

Siamese twins/conjoined twins

IDENTICAL TWINS

These occur when a fertilized egg splits and develops into two babies

Features (characteristics) of identical twins

The babies share the same placenta

The babies look very alike

The babies are the same sex

The babies share the same DNA

FRATERNAL TWINS (DIZYGOTIC TWINS)

These occur when two eggs are fertilized by two separate sperms.

Features of fraternal twins

Each baby has its own placenta

The babies can be the same sex or different sexes

SIAMESE TWINS

These occur when a fertilised egg partially divides into two babies

Most siamese twins are still births or die shortly after birth

Features of siamese twins

The babies are born physically connected to each other

The babies may share some organs

Factors that increase the chances of having twins

Use of fertility drugs

High number of previous

Heredity

pregnancies

Old age of the mother

Problems faced by families with many children

Poor feeding (lack of balanced diet)

Poor education for children

Lack of parental care towards
children

Lack of proper medical care

Lack of clothes for children

Reasons why some families have many children (causes of frequent births)

Desire for a certain sex of a child

For prestige

To provide labour in the family

For security

Ignorance about family planning methods

High death rate of infants (high infant mortality rate)

Problems faced by the mother due to frequent births

Maternal anaemia

Underweight babies

Miscarriage

Rupture of the uterus during birth

Premature births

INFANT MORTALITY

This is the death of a child under one year of age

Causes of high infant mortality rate

Childhood immunisable diseases

Birth defects

Malnutrition

Premature births

Malaria

Ways of reducing infant mortality rate

Immunize infants

Practise exclusive breastfeeding

Get antenatal and postnatal care

Participate in health education

Practise family planning

Provide ORS to prevent dehydration in infants

CHILD SPACING

This is the giving of enough time between the births of children in a family.

Advantages of child spacing

It helps a child to get enough parental care and love

It enables the child to get enough basic needs

It allows the mother's uterus to rest and recover after birth

It helps the mother to keep healthy

FAMILY PLANNING

This is the use of birth control methods to decide when to have or not to have a child in a family

It depends on birth control (contraceptive) methods

Birth control (contraception)

This is the way of preventing pregnancy or conception

ADVANTAGES OF FAMILY PLANNING (REASONS WHY PEOPLE PRACTISE FAMILY PLANNING)

To the family

It enables a family to have a limited number of children

It promotes saving in the family

It promotes child spacing

To the mother

It prevents frequent births

It reduces risks of maternal death

It allows the mother's uterus to rest and recover after birth

It reduces the risks of miscarriages and abortion

To the baby/child

It enables the child to get enough parental care and love

It enables the child to get enough basic needs

To the country

It controls rapid population growth

CHALLENGES FACED BY FAMILY PLANNING IN UGANDA

Poverty

Myths and misconceptions about family planning

Ignorance about family planning methods

Religious teachings against family planning

Write "FPAU" in full

Family Planning Association of Uganda

Functions of FPAU

It educates people about family planning

It distributes contraceptives/birth control devices

It performs legal abortions at free of charge (incase a woman has Rubella)

FAMILY PLANNING METHODS (METHODS OF BIRTH CONTROL)

Natural Methods

Artificial methods

NATURAL BIRTH CONTROL METHODS (NATURAL METHODS OF FAMILY PLANNING)

Withdrawal method (coitus interruptus)

Exclusive (prolonged) breast feeding/Lactational Amenorrhoea Method(LAM)

Rhythm method (calendar method)

Cervical mucus method

Basal body temperature method

} Periodic abstinence methods

Advantages of natural family planning methods

They are cheap to use

They have no side effects

Disadvantages of natural family planning methods

They are unreliable (they are less effective)
They need complete cooperation of the husband and wife
They are difficult for women with irregular menstrual cycle
Only skilled women can use some of the natural methods

How does breastfeeding prevent pregnancy?

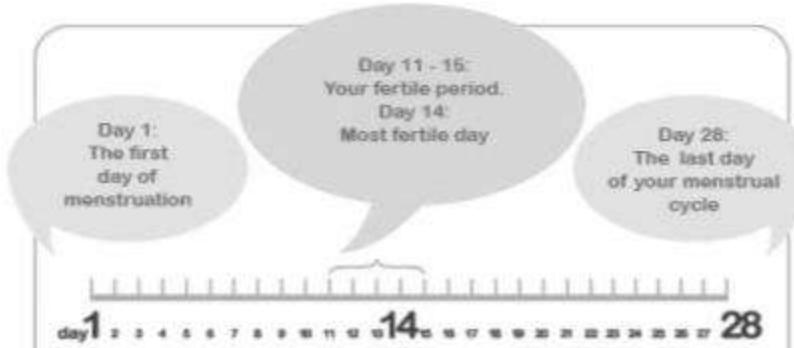
By delaying ovulation

Rhythm method (calendar method)

This is the use of ovulation calendar to predict the fertile days of a woman

Ovulation occurs at about 14 days from the first day of the last menstrual cycle

A diagram showing ovulation calendar



Of what importance is an ovulation calendar to a married woman?

It helps a woman to predict her fertile days

ARTIFICIAL BIRTH CONTROL METHODS (ARTIFICIAL METHODS OF FAMILY PLANNING)

ARTIFICIAL BIRTH CONTROL METHODS	HOW IT PREVENTS PREGNANCY
Use of condom (male and female condoms)	It traps sperms from reaching the vagina
Use of birth control/contraceptive pills	They prevent ovulation
Use of birth control/contraceptive injections	
Use of IUD or IUCD or loop or coil IUDs are often T-shaped	It prevents implantation It prevents fertilization
Use of diaphragm	It prevents sperms from entering the uterus

Use of cervical cap	It prevents sperms from entering the uterus
Use of implant	It produces a hormone which prevents sperms from reaching the egg
Use of spermicides (foams, gels and creams)	They kill sperms
Use of vaginal ring	It produces hormones which prevents ovulation It thickens cervical mucus to prevent sperms from reaching an egg
Permanent birth control methods	
Vasectomy This is when the sperm ducts are cut and tied	It blocks the passage of sperms through the sperm ducts
Tubal ligation This is when the oviducts are cut and tied	It blocks the passage of sperms and eggs through the oviducts

Which artificial family planning method prevents both pregnancy and STDs when used correctly?

Use of condoms

Why should the male and female condoms not be used at the same time?

They can break due to friction

ADVANTAGES OF ARTIFICIAL FAMILY PLANNING METHODS

They are very effective

They are easy to use

They are commonly available

DISADVANTAGES OF ARTIFICIAL PLANNING METHODS

They have side effects e.g amenorrhoea (absence of periods)

They are expensive to use

Some of them need supervision of health worker

Permanent birth control methods are irreversible (cannot be reversed)

Permanent birth control methods are painful

DIAGRAMS SHOWING TUBAL LIGATION AND VESECTOMY

How do the above methods prevent pregnancy?

Vasectomy

It blocks the sperm ducts and keeps sperms out of semen

Tubal ligation

It prevents the egg from traveling through the oviducts to reach the sperm

It prevents sperms from traveling up the oviducts to reach the egg

EXAMPLES OF CONTRACEPTIVE/BIRTH CONTROL DEVICES

Condom

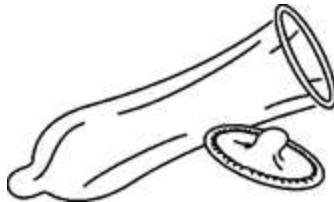
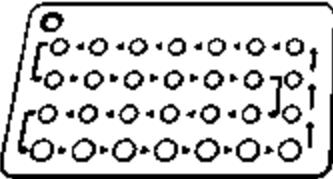
Implant

Contraceptive injection (birth control injection)

Intrauterine device (IUD)/Intra uterine contraceptive device (IUCD)

Contraceptive pill (birth control pill)

Diagrams showing contraceptive devices

Male condom	Female condom	Birth control pills
		
Vaginal ring	Diaphragm	Cervical cap
	 Diaphragm	 Cervical cap
Birth control injections	Intrauterine device (IUD)	Spermicides
		

State the importance of Emergency contraception pill

It is used to prevent pregnancy after sex

Factors that can lead to use of Emergency contraception pill

Playing sex without any contraception

Breaking of the condom when playing sex

MYTHS AND MISCONCEPTION ON CONTRACEPTIVES AND FAMILY PLANNING

Misconception is a wrong idea

Myth is a commonly held false belief

MYTH: Birth control is 100% effective

Fact: IUDs are the most effective with 99.8%

MYTH: A woman cannot get pregnant when breastfeeding

Fact: Breastfeeding is between 75% - 88% effective and so you can get pregnant

MYTH: Birth control pills increase the risk of cancer

Fact: They reduce the risk of ovarian cancer

MYTH: Birth control pills cause infertility

Fact: They don't cause infertility but preserve fertility by preventing PID

MYTH: Emergency contraception pill is the same as abortion pill

Fact: It only stops pregnancy before it starts but cannot end pregnancy which has already started

MYTH: A male condom can get lost in the vagina or uterus and move through a woman's body

Fact: If a condom slips, it will go no further than the vagina and is easily removed without surgery

MYTH: Condoms are not effective in preventing pregnancy and STIs

Fact: They prevent pregnancy and STIs when used correctly

MYTH: Vasectomy makes a person impotent

Fact: It does not affect your ability to erect

MYTH: IUDs prevent pregnancy by causing abortions.

Fact: They work by preventing fertilization

MYTH: A woman cannot get pregnant if she doesn't have orgasm

Fact: Ovulation occurs whether a woman has orgasm or not and so she can get pregnant

MYTH: A woman cannot get pregnant if she plays sex during her periods

Fact: Ovulation can occur earlier than expected and fertilization takes place

MYTH: A woman cannot become pregnant on her first time to have sex

Fact: A woman can get pregnant any time ovulation occurs

MYTH: A woman cannot get pregnant if she douches/bathes/urinates after sex

Fact: Urinating/bathing/douching does not stop sperms that have already entered the uterus

MYTH: A woman cannot get pregnant if she plays sex while standing up or when she is on top

Fact: Positions during sex don't affect fertilization and so she can get pregnant

MYTH: Birth control pills make women to grow beards

Fact: Women grow beards due to high levels of androgen

MYTH: All contraceptive methods are appropriate for all women

Fact: Some factors must be considered to choose an appropriate contraceptive method

SEXUALLY TRANSMITTED DISEASES (STDs)/SEXUALLY TRANSMITTED INFECTIONS (STIs)/VENEREAL DISEASES (VDs)

These are diseases/infections that spread through playing unprotected sex with an infected person

Examples of STDs/STIs/VDs (DISEASES THAT AFFECT THE REPRODUCTIVE ORGANS)

<u>Bacterial STDs</u>	<u>Viral STDs</u>
Gonorrhoea Syphilis Chancroid Chlamydia Lymphogranuloma venereum (LGV)	AIDS Cervical cancer Genital warts Genital herpes Hepatitis B
<u>Fungal STD</u>	<u>Protozoan STD</u>
Candidiasis	Trichomoniasis

INCUBATION PERIOD OF A DISEASE

This is the time taken from exposure to germs until the first signs and symptoms appear

GONORRHOEA

It is caused by the bacterium called **Neisseria gonorrhoeae**

It mainly affects the **urethra**

Its incubation period is **1 to 14 days**

Most men become symptomatic within **2 to 5 days** after exposure

Most women are asymptomatic (have no symptoms)

How does gonorrhoea spread?

Through playing unprotected sex intercourse with an infected person

From the infected mother to the baby during childbirth

SIGNS AND SYMPTOMS OF GONORRHOEA

Signs in men

Pus-like discharge from the penis

Swollen foreskin

Swollen testicles

Symptoms in men

Painful urination

Pain in the testicle

Signs in women

Pus-like discharge from the vagina

Vaginal bleeding between periods

Symptoms in women

Painful urination

Abdominal pain

Effects/dangers of untreated gonorrhoea

It leads to infertility

It causes PID (pelvic inflammatory disease)

It causes blindness in newborn babies

How does untreated gonorrhoea cause sterility in males and females?

Males: It blocks the epididymis

Females: It blocks the oviducts

Prevention and control of gonorrhoea

Abstain from sex

Condoms use when playing sex

Be faithful to your sexual partner

Early treatment of infected ones

Why should a husband and his wife go together for treatment when gonorrhoea is detected?

To prevent re-infection

SYPHILIS

It is caused by the bacterium called **Treponema pallidum**

Its incubation period is **14 to 21 days** after exposure

How does syphilis spread?

Through playing unprotected sex with an infected person

Through infected blood transfusion

From the infected mother to her unborn baby

SIGNS AND SYMPTOMS OF SYPHILIS AT VARIOUS STAGES

Primary stage

Chancres on the penis, vagina, or mouth

Chancres is a painless sore formed during the primary stage of syphilis

Secondary stage

Sore throat

Patchy hair loss

Swollen lymph nodes

Skin rash on palm of hands and soles of feet

Latent stage

Syphilis remains active but with no signs and symptoms

It can only be detected with a blood test

If syphilis is untreated at this stage, a person continues to have it for years

Tertiary stage

It occurs when a person spends 10 to 30 years with untreated syphilis

It starts to affect the internal organs

Brain damage

Heart diseases

Deafness

Stroke

Numbness

Effects of untreated syphilis

It leads to madness/insanity

It leads to deafness

It causes paralysis

It leads to heart diseases

It leads to stillbirths

It leads to loss of body feeling

Prevention and control of syphilis

Abstain from sex

Be faithful to your sexual partner

Condoms use when playing sex

Early treatment of infected ones

CHLAMYDIA

It is caused by a bacterium called **Chlamydia trachomatis**

Its incubation period is **7 to 21 days** after exposure

How does chlamydia spread?

Through playing unprotected sex intercourse with an infected person

From the infected mother to the baby during childbirth

Signs of chlamydia

Discharge from vagina or penis

Swollen testicles

Vaginal bleeding between periods

Symptom of chlamydia

Painful urination

Painful sex

Pain in the testicles

Effects/dangers of untreated chlamydia

It leads to infertility

It increases the risks of ectopic pregnancy

It causes blindness in newborn babies

Prevention and control of chlamydia

Abstain from sex

Condoms use when playing sex

Be faithful to your sexual partner

Early treatment of infected ones

CHANCROID

It is caused by bacteria

Its incubation period is **3 to 7 days** after exposure

How does chancroid spread?

Through playing unprotected sex intercourse with an infected person

Through contact with pus from the genital ulcer of an infected person

Signs of chancroid

Genital ulcer (bubo)

Swollen lymph nodes

Symptoms of chancroid

Painful genital ulcer

Painful sex

Painful lymph nodes

Effects of untreated chancroid

It leads to nonhealing genital ulcer

It causes permanent scars on the genitals

Prevention and control of chancroid

Abstain from sex

Condoms use when playing sex

Be faithful to your sexual partner

Early treatment of infected ones

TRICHOMONIASIS (TRICH)

It is caused by protozoan parasite called **Trichomonas vaginalis**

Its incubation period is **5 to 28 days** after exposure

How does trichomoniasis spread?

Through playing unprotected sex intercourse with an infected person

Signs of trichomoniasis

Vaginal discharge with fishy smell

Redness of the genitals

Discharge from penis

Symptoms of trichomoniasis

Itching in the vagina or penis

Painful urination

Abdominal pain

Painful sex

Effect of untreated trichomoniasis

It increases the risks of getting HIV

Prevention and control of trichomoniasis

Abstain from sex

Condoms use when playing sex

Be faithful to your sexual partner

Early treatment of infected ones

HEPATITIS B

It is caused by a virus called **hepatitis B virus (HBV)**

Its incubation period is **75 days** on average

It affects the liver

How does hepatitis B spread?

Through playing unprotected sex with infected person

Through sharing contaminated needles with an infected person

Through body contact with infected body fluids

From the mother to her baby during birth

Signs of hepatitis B

Dark urine

Vomiting

Jaundice (the skin and white of the eye turn yellow)

Prevention and control of hepatitis B

Immunize with Hep B vaccine

Use condoms during sex

Never share needles with an infected person

Use latex gloves during fisting or fingering

CERVICAL CANCER

It is caused by a virus called **human papillomavirus (HPV)**

It attacks the cervix

Its incubation period is **15 to 20 years** after exposure

How does cervical cancer?

Through playing unprotected sex intercourse with an infected person

Signs of cervical cancer

Smelly vaginal discharge

Frequent urination

Bleeding between periods

Symptom of cervical cancer

Painful urination

Pain in the pelvis

Effects of untreated genital warts

It increases the risk of getting
HIV

It causes abnormal urine flow in
men

Why do health workers carry out "Pap smear" test?

To diagnose cervical cancer

Prevention and control of cervical cancer

Immunize girls with HPV vaccine

Condoms use when playing sex

Abstain from sex

Through surgery

Be faithful to your sexual partner

Through radiation therapy

GENITAL WARTS

It is caused by a virus called **human papillomavirus (HPV)**

Its incubation period is **2 to 3 months** after exposure

How does genital warts spread?

Through playing unprotected sex intercourse with an infected person

Through direct skin to skin contact (handshakes or hugs) with an infected person

Signs of genital warts

Bumps around the penis or vagina

Bleeding from the penis or vagina

Symptom of genital warts

Itching of the vagina or penis

Itchy anus

Effects of untreated genital warts

It increases the risk of getting
HIV

It causes abnormal urine flow in
men

Prevention and control of genital warts

Abstain from sex

Early treatment of infected ones

Be faithful to your sexual partner

Immunisation with HPV vaccine

Condoms use when playing sex

GENITAL HERPES

It is caused by a virus called **herpes simplex virus (HSV)**

Its incubation period is **2 to 12 days** after exposure

Genital herpes has no cure

How does genital warts spread?

Through playing unprotected sex intercourse with an infected person

Through direct skin to skin contact with an infected person

Signs of genital herpes

Sores on the penis or vagina

Painful urination

Symptom of genital herpes

Itching of the penis or vagina

Be faithful to your sexual partner

Prevention and control of genital herpes

Abstain from sex

Do not play sex during herpes outbreak, even with a condom. Some sores may not be covered by the condom

CANDIDIASIS

It is caused by a yeast/fungus called **Candida**

Its incubation period is **2 to 5 days** after exposure

How does candidiasis spread?

Through playing unprotected sex with an infected person

When we fail to clean our genitals after playing sex

Signs of candidiasis

Swelling of the penis or vagina

Sores on the penis or vagina

A thick white vaginal discharge

Symptoms of candidiasis

Itching of penis or vagina **Painful sex**
Painful urination

Prevention and control of candidiasis

- Abstain from sex
- Be faithful to your sexual partner
- Avoid extra marital sex
- Keep the vagina clean and dry
- Wash the vagina with lemon leaves put in warm water
- Wipe from front to back after using a toilet
- Avoid sharing underwear with an infected person

Mention the two STIs prevented by HPV vaccine

Mention the two STIs that can cause infertility if untreated

Gonorrhoea Chlamydia

Mention the two STIs that can cause blindness in newborn babies

Gonorrhoea and Chlamydia

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

Vaginal fluids

Semen

Breast milk

BODY FLUIDS IN WHICH HIV CANNOT SPREAD

Tears

Urine

Saliva

Sweat

SOCIAL PRACTICES THROUGH WHICH AIDS VIRUS (HIV) CANNOT SPREAD

Hugging AIDS patient

Touching AIDS patient

Shaking hands with AIDS patient

Sitting close to AIDS patients

Sharing latrines with AIDS patient

Washing clothes of AIDS patient

Sharing utensils with AIDS patient

Normal kissing AIDS patient

Sharing bedding with 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	Chronic dry cough
Rapid weight loss	Chronic diarrhoea
Severe night sweats	Sores on the mouth
Oral thrush (white coating in mouth)	

Symptoms of AIDS

General body weakness(tiredness)	Loss of appetite
Chronic fever	

CONDITIONS MISTAKEN FOR AIDS

Alcoholism	Malnutrition
------------	--------------

DISEASES MISTAKEN FOR AIDS

Tuberculosis	Measles
Typhoid	Skin cancer

EFFECTS OF HIV/AIDS TO:

An Individual

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

Family

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

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

Factors that can make a person take PEP pills

Breaking of condom when playing sex with untrusted partner

After unprotected sex among discordant couple

Rape

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

PMTCT: Prevention of mother to Child Transmission

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 users	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 THERE ARE MORE WOMEN WITH HIV 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

Their vagina is large and more vulnerable to sexual secretions than the hard skinned penis

WAYS OF CARING FOR AIDS PATIENTS

Advising them to take ARVs

Counselling them

Feeding them on a balanced diet

Giving them company

Advising them to promote personal hygiene

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

Community leaders

Health workers

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 overcome fear

It enables a person to live longer and useful with HIV

It enables a person to prevent spreading HIV/AIDS to others

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 INFECTIONS)

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

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

Tuberculosis

Candidiasis

Pneumonia

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

Frequent urination

Bloody urine or cloudy urine

Pus discharge from penis and vagina

Symptoms of UTIs

Painful urination

Pain during sex

Pain in lower abdomen

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

Abnormal menstrual bleeding

Smelly vaginal discharge

Symptoms of PID

Pain in lower abdomen

Painful urination

Pain during sex

Fever

Dangers of untreated PID (effects of untreated STDs)

Ectopic pregnancy

Painful menstruation

Infertility (sterility/barrenness)

How does untreated PID lead to infertility?

It blocks the oviducts

GENERAL PREVENTION AND CONTROL OF STDs/STIs/VDs

Abstain from sex until marriage

Keep the genital parts clean

Be faithful to your sexual partner

Keep latrines clean

Condom use during sex

Immunisation with HPV vaccine

Avoid sex when under the influence of drugs

Always have HIV test with your partner before marriage

Use of PEP and PrEP

LIFE SKILLS TO SAFEGUARD AGAINST STDs

Peer resistance

Assertiveness

Self-awareness

Critical and creative thinking

Self esteem

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 prevent early pregnancy/teenage pregnancy (adolescent pregnancy)

They promote care for AIDS

patients

EXAMPLES OF PIASCY MESSAGES FOR ADOLESCENTS

Say no to sex (abstain from sex)

Avoid risks to stay safe

Say no to early marriage

Avoid bad touches

Avoid gifts for sex

Premarital sex is risky

Stay Virgin

Follow your religion to stay safe

AIDS kills

Using violence to get sex is wrong

AIDS has no cure

Body changes at puberty are not

Choose to delay sex

signs to start sex

Virginity is healthy

Learn how AIDS is transmitted

Early sex affects reproductive
system

Avoid dark corners

HIV damages the immune system

AIDS patients need care and
support

PARAMOUNT SCIENCE NOTES

PRIMARY SEVEN

TERM ONE

TOPIC ONE: MUSCULOSKELETAL SYSTEM

MUSCULOSKELETAL SYSTEM

- This is the body system made up of bones, muscles, tendons, cartilages and ligaments

Elements of the musculoskeletal system

- Bones
- Tendons
- Ligaments
- Muscles
- Cartilages

SKELETON

- This is the structure that supports the body of an organism
- This is the supportive structure of an organism

TYPES OF SKELETONS

- Endoskeleton
- Exoskeleton
- Hydrostatic skeleton

ENDOSKELETON

- This is a type of skeleton found inside the body of an organism
- ✓ It is made up of **bones** and **cartilage**
- ✓ It is common in all **vertebrates**

Name any three body parts mainly made up of cartilage

- Trachea (wind pipe)
- Nose
- Outer ear (pinna)

Examples of organisms with endoskeleton

- human being
- frog
- tortoise
- goat
- toad
- chameleon
- monkey
- tilapia
- duck
- turtle

EXOSKELETON

- This is a type of skeleton found outside the body of an organism
- ✓ It is made up of a hard covering called **cuticle**
- ✓ The hard cuticle consists of **calcium** and **phosphorous**
- ✓ It is common in all **arthropods**

Examples of organisms with exoskeleton

- housefly
- tick
- millipede
- mosquito
- crab
- centipede
- cricket
- lobster
- spider
- prawn

Write down two functions of exoskeleton to an organism

- It supports the body of an organism
- It protects the soft parts of an organism

Mention one disadvantage of an exoskeleton to an organism.

- It prevents increase in size (it prevents growth)

How do organisms with exoskeleton grow (increase in size)?

- By moulting (ecdysis)

What is moulting?

- This is the shedding of the outer skin in some animals
- This is the shedding of cuticle (exoskeleton) in arthropods

Why do insects undergo moulting?

- To increase in size (to grow)

HYDROSTATIC SKELETON

- This is a type of skeleton where the body of an organism is filled with a fluid under pressure
- ✓ The fluid enables an organism to move and have shape.

Examples of organisms with hydrostatic skeleton

- | | | |
|-------------|--------------|--------------|
| ▪ Earthworm | ▪ squid | ▪ star fish |
| ▪ Tapeworm | ▪ octopus | ▪ jelly fish |
| ▪ slug | ▪ tapeworm | |
| ▪ snail | ▪ sea urchin | |

FUNCTIONS OF THE SKELETON TO AN ORGANISM

- It gives the body shape
- It supports the body
- It helps in body movement (locomotion)
- It protects delicate internal organs
- It provides surface for muscle attachment
- It produces blood cells in the bone marrow
- It stores and releases mineral salts and fats

How does the circulatory system benefit from the skeleton?

- The ribs protect the heart
- The bone marrow help in making blood cells

A TABLE SHOWING PARTS OF SKELETON AND THE BODY ORGANS PROTECTED

PART OF SKELETON	ORGAN(S) PROTECTED
Skull (cranium)	<ul style="list-style-type: none"> ▪ Brain ▪ Eyes ▪ Tongue ▪ Ears ▪ Nose
Ribcage	<ul style="list-style-type: none"> ▪ Heart ▪ Lungs
Pelvis	<ul style="list-style-type: none"> ▪ Kidneys ▪ Female reproductive organs
Backbone (spine or vertebral column)	<ul style="list-style-type: none"> ▪ Spinal cord

HUMAN SKELETON

- This is a frame work of bones in the human body
- ✓ The skeleton of an adult human is made up of **206 bones**
- ✓ A new born baby has **300 bones**

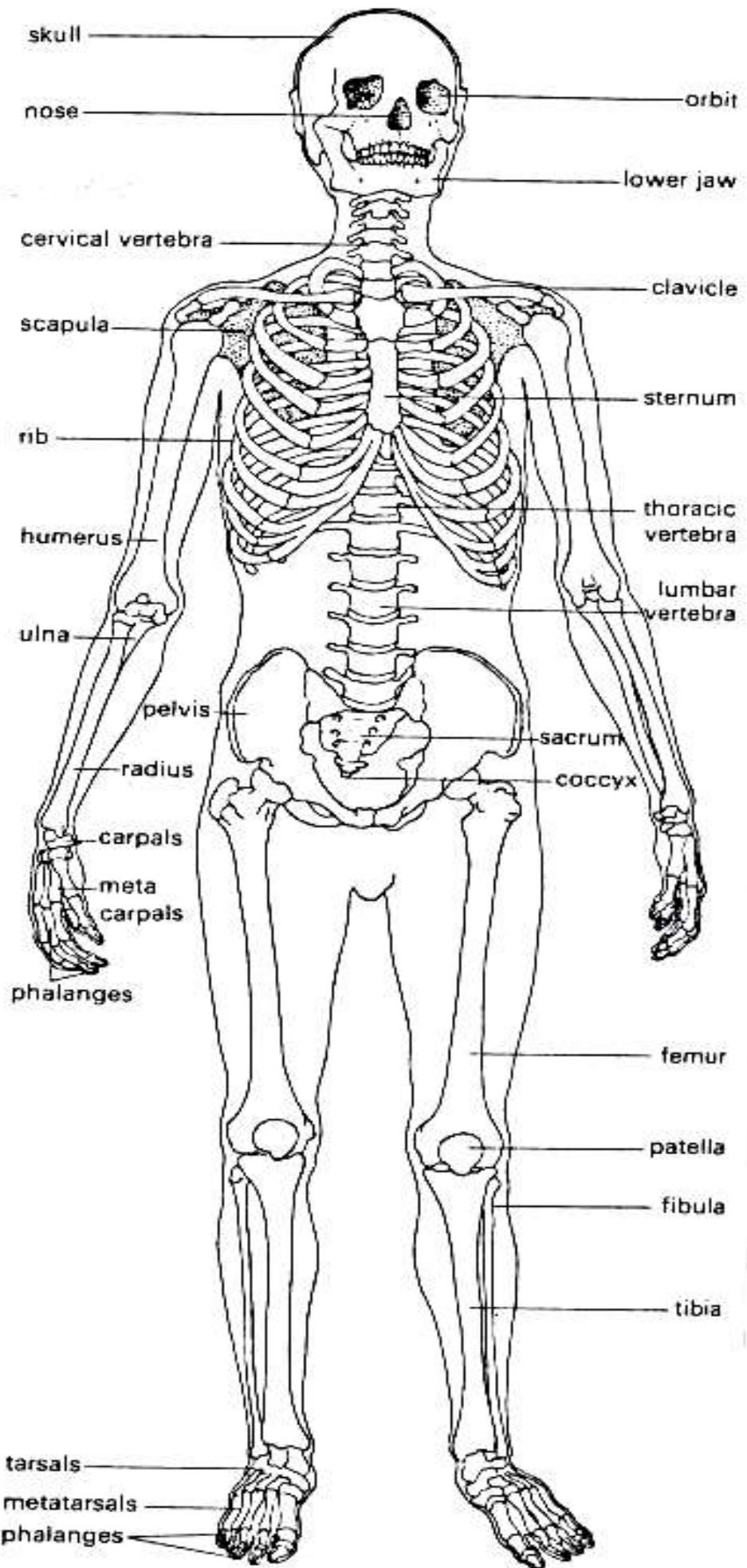
Why do new born babies have more bones than adults?

- Some bones fuse together as a person grows

Why is the human skeleton called frame work of bones?

- It is made up of many bones but all working together

THE STRUCTURE OF THE HUMAN SKELETON



Name the four main parts of the human skeleton.

- Skull
- Backbone
- Limbs
- Limb girdles

REGIONS OF THE HUMAN SKELETON

- Axial skeleton
- Appendicular skeleton

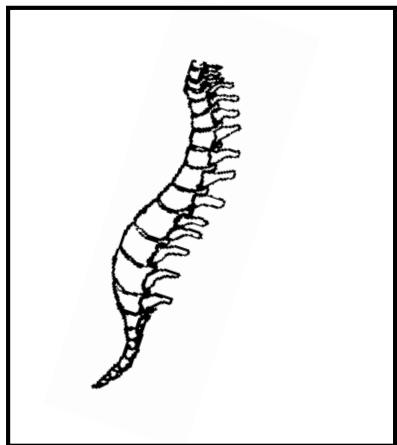
AXIAL SKELETON

- It consists of the **skull** and **backbone**
- It provides attachment for the ribs

Backbone

- It is also called **spine/vertebral column**
- It protects the spinal cord
- It has 33 bones
- Bones of the backbone are called **vertebrae**

A diagram showing a backbone



Name the five regions of the backbone

- **Cervical region:** It is found in the neck and has **7** vertebrae
- **Thoracic region:** It is found in the chest and has **12** vertebrae
- **Lumbar region:** It is found in the abdomen and has **5** vertebrae
- **Sacral region:** It is found in the pelvic girdle and has **5** vertebrae
- **Coccyx region:** It is found in the tail and has **4** vertebrae

SKULL

- It protects the brain, eyes, tongue, ears and nose
- It has 22 bones
- It is made up of the cranium and mandible and maxilla
- The brain is enclosed in the part of skull called cranium

APPENDICULAR SKELETON

- It consists of limbs and limb girdles
- Limbs include; legs and arms
- Limb girdles include; pelvis (pelvic girdle) and pectoral girdle (shoulder girdle)

BONES

- This is the hardest tissue in the body of vertebrates
- ✓ The **femur** is the longest bone and the **stapes (stirrup)** in the ear is the shortest

By what process are bones formed?

- Ossification

Name the class of food required for proper growth and formation of bones

- Mineral salts

Name two mineral salts that make bones strong.

- Calcium
- Phosphorus

Identify the vitamin that helps in strong bone formation.

- Vitamin D

How does Vitamin D help in formation of strong bones?

- It increases absorption of calcium into the bones

TYPES/CLASSES/GROUPS OF BONES

- ✓ Bones are classified according **to their shape**
- Long bones ▪ Flat bones ▪ Sesamoid bones
- Short bones ▪ Irregular bones

LONG BONES

- These are found in limbs (arms and legs)

Examples of long bones

Long bones	Body parts where they are found
Humerus	Arms
Radius	
Ulna	
Femur	Legs
Fibula	
Tibia	

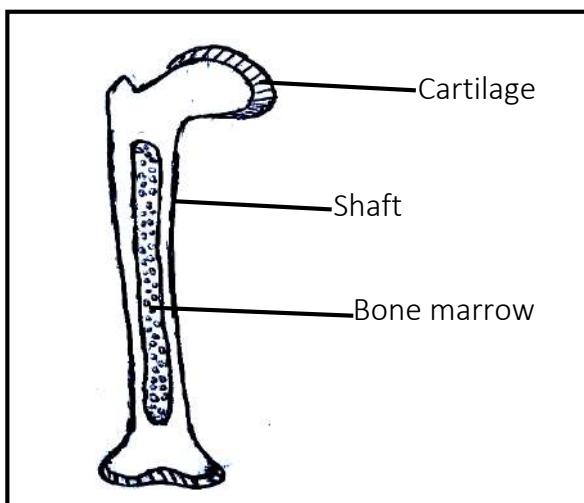
Name the longest and strongest bone in the human body.

- Femur

Importance of long bones in the human body

- They help in body movement
- They support body weight

A diagram showing parts of a bone



Importance of each part of a bone

Shaft

- It stores the bone marrow

Bone marrow

- It is where blood cells are made
- It stores fats

Cartilage

- It reduces friction at a joint
- It absorbs shock

SHORT BONES

- They are cube shaped
- These are found in the hands, feet, wrists, ankles and ear.

Examples of short bones

Short bones	Body parts where they are found
Carpals	Wrists
Metacarpals	Hands
Tarsals	Ankles
Metatarsals	Feet
Phalanges	Fingers and toes
Ossicles (hammer, anvil and stapes)	Ear (Middle ear)

Name the shortest bone in the human body

- Stapes (stirrup)

Importance of short bones in the human body

- They provide support and stability with little movement
- They absorb shock

FLAT BONES

- These are thin bones with broad surfaces

Examples of flat bones

- | | |
|--|--|
| <ul style="list-style-type: none"> ▪ Scapula (shoulder blade) ▪ Sternum (breastbone) ▪ Bones of the skull (cranial bones) | <ul style="list-style-type: none"> ▪ Pelvis ▪ Ribs |
|--|--|

Importance of flat bones in the human body

- They provide places for muscle attachment
- They protect the internal organs

IRREGULAR BONES

- These are bones with complex shapes

Examples of irregular bones

- | | |
|--|--|
| <ul style="list-style-type: none"> ▪ Vertebrae (bones of the backbone) ▪ Jawbones (maxilla and mandible) | <ul style="list-style-type: none"> ▪ Sacrum ▪ Coccyx |
|--|--|

Importance of irregular bones in the human body

- | | |
|--|--|
| <ul style="list-style-type: none"> ▪ They protect the internal organs | <ul style="list-style-type: none"> ▪ They give the body shape |
|--|--|

SESAMOID BONES

- These are small round bones embedded in tendons

Example of sesamoid bone

- Patella (knee cap)

Importance of sesamoid bones in the human body

- The patella allows smooth movement of a knee
- The patella protects the knee joint (protects the tendon and ligament at the knee joint)

BONES AND THEIR SCIENTIFIC NAMES

Bone	Scientific name
Thigh bone	Femur
Upper arm bone	Humerus
Shoulder blade	Scapula
Backbone	Spine/vertebral column/spinal column
Kneecap	Patella
Hipbone	Pelvis
Breastbone	Sternum
Skull	Cranium
Collarbone	Clavicle
Lower arm (little finger/pinkie)	Ulna
Lower arm (thumb)	Radius
Lower jawbone	Mandible
Upper jawbone	Maxilla
Wrist bone	Carpal
Ankle bone	Tarsal
Palm of hand	Metacarpals
Sole (arch) of foot	Metatarsals
Bones at the tip of toes and fingers	Phalanges

BONE MARROW

- This is a soft tissue found in the bone

Types of bone marrow

- Red bone marrow
- Yellow bone marrow

Red bone marrow

- It is found in short bones
- It is where red blood cells, white blood cells and platelets are made

Besides red bone marrow, where else are white blood cells made?

- Spleen
- Lymph nodes

Yellow bone marrow

- It is found in shaft of long bones
- It stores fats

FUNCTIONS OF BONE MARROW

- It is where red blood cells, white blood cells and platelets are made
- It stores fats

JOINTS

- A joint is where two or more bones meet in the body

State the importance of joints.

- They allow body movement

Mention the two main categories/groups of joints

- Immovable joints
- Movable joint

IMMOVABLE JOINTS

These are joints which do not allow any movement

- Immovable joints are sometimes called **fixed joints**

Give a reason why immovable joints do not allow any movement

- The bones are tightly fixed together

Example of immovable (fixed) joint in the human body

- Suture joints (joints of the skull/cranial joints)
- Gomphosis (joint between the tooth and jaw bone)

Name one part of the human body where immovable joints are found

- Skull

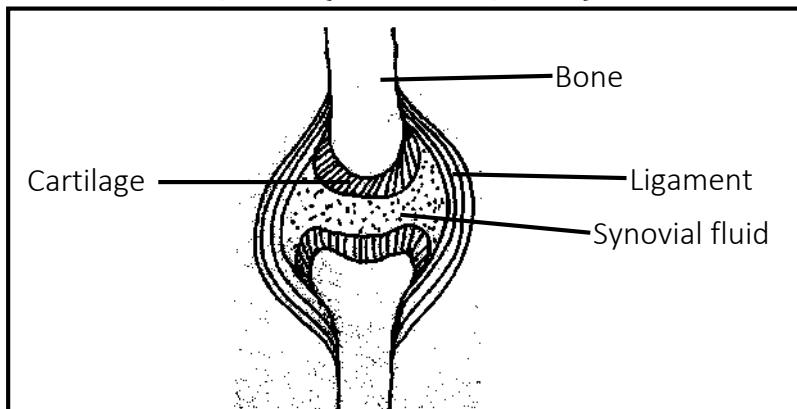
MOVABLE JOINTS

- These are joints which allow movement

Examples of movable joints

- Hinge joint
- Ball and socket joint
- Pivot joints
- Gliding joints

A DIAGRAM SHOWING A JOINT (MOVABLE JOINT)



FUNCTIONS OF EACH PART OF AMOVABLE JOINT

SYNOVIAL MEMBRANE (SYNOVIUM)

- It produces the synovial fluid

SYNOVIAL FLUID

- It reduces friction at a joint

How does the synovial fluid reduce friction at a joint?

- By making the joints slippery (by lubricating the joint)

CARTILAGE

- ✓ This is a thick non-vascular tissue found at the end of joints
- It reduces friction at a joint
- It absorbs shock at a joint

How does a cartilage reduce friction at a joint?

- By preventing bones from rubbing each other

How is a cartilage able to reduce friction at a joint?

- It is smooth and slippery

LIGAMENT

- This is a structure (tissue) which joins bone to a bone

Function of a ligament

- It joins a bone to a bone

TENDON

- This is a structure (tissue) which joins a muscle to a bone

Function of a tendon

- It joins a muscle to a bone

TYPES OF JOINTS

- Hinge joint
- Ball and socket joint
- Pivot joints
- Gliding joints
- Suture joints

HINGE JOINTS

- These are joints that allow movement in one direction (plane)
- ✓ They allow movement in 180°

Why hinge joints are called so?

- They allow movement similar to that of a door on its hinges

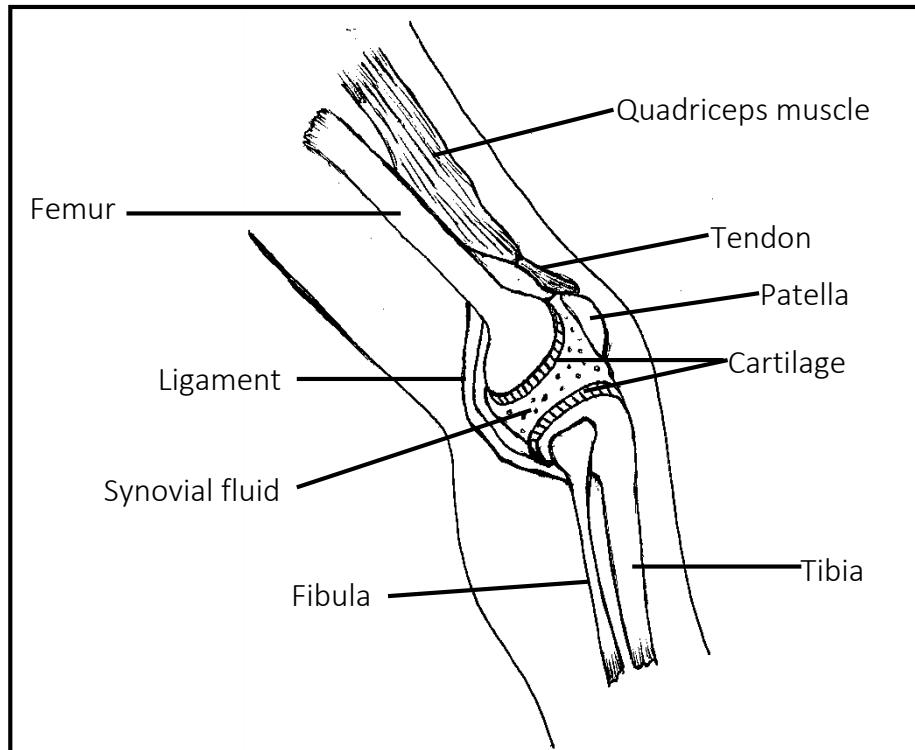
Examples of hinge joints

- Elbow joint
- Knee joint

Parts of the body with hinge joints

- Elbow
- Knee

A DIAGRAM SHOWING A HINGE JOINT



Importance of the knee cap (patella)

- It protects the knee joint
- It allows smooth movement of the knee joint

BALL AND SOCKET JOINTS

These are joints which allow movement in all directions

- These are joints which allow movement in 360°

Why ball and socket joints are called so?

- The ball shaped end of a bone fits into a socket shaped end of another bone.

Mention four forms of movement allowed by ball and socket joint

- | | |
|------------|-----------------|
| ▪ Forward | ▪ Circular form |
| ▪ Backward | ▪ Side ways |

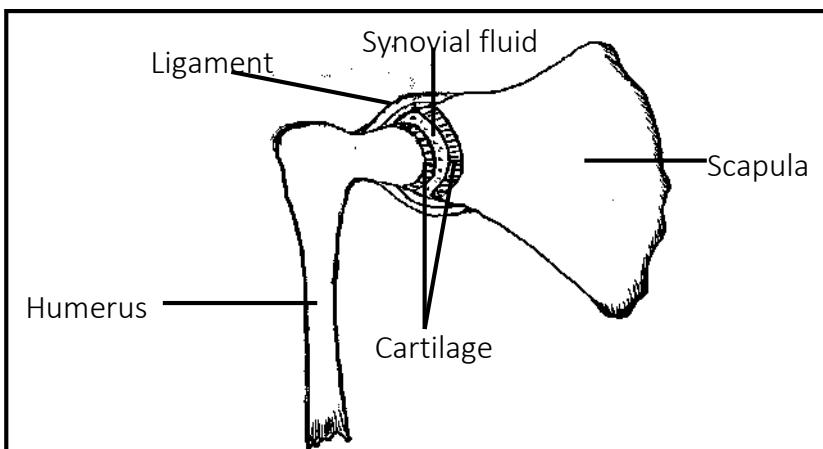
Examples of ball and socket joints

- | | |
|------------------|--------------------------|
| ▪ Shoulder joint | ▪ Hip joint/pelvis joint |
|------------------|--------------------------|

Parts of the body with gliding joints

- | | |
|------------|--------------|
| ▪ Shoulder | ▪ Hip/pelvis |
|------------|--------------|

A diagram showing a ball and socket joint



GLIDING JOINTS

- These are joints formed by bones that move smoothly over the surface of each other
- They are sometimes called plane joints

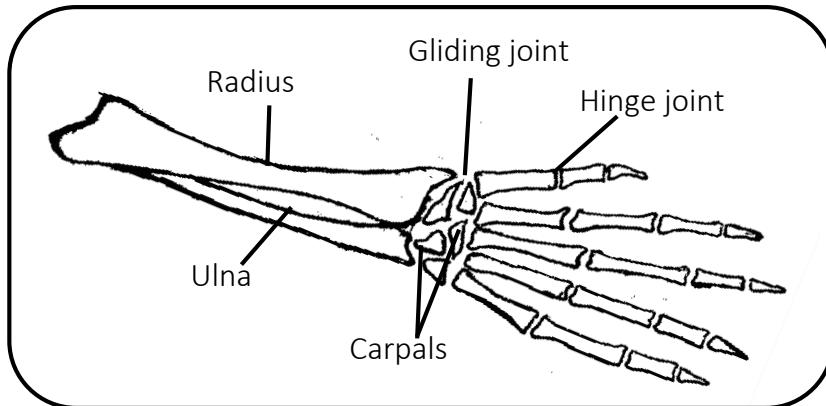
Examples of gliding joints

- Wrist joint
- Ankle joint

Parts of the body with gliding joints

- Wrist
- Ankle

A diagram showing a gliding joint



PIVOT JOINTS

- These are joints which allow rotation of certain body parts on other parts

Example of pivot joint

- Neck joint

Part of the body with pivot joints

- Neck

Bones that make up the pivot joint at the neck

- Atlas
- Axis

How are pivot joints useful to people?

- They help us to nod our heads (help us to move our heads up and down)

SUTURE JOINTS

- These are joints between the bones of the skull

Why are suture joints called immovable joints?

- They do not allow any movement

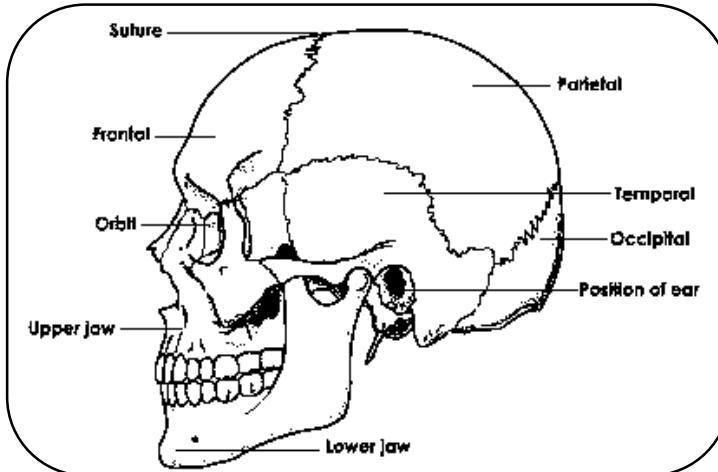
In which part of the body are suture joints found?

- Skull

Why are suture joints saw-like?

- To prevent any movement

A DIAGRAM SHOWING SUTURE JOINTS



Bones that make up suture joints (examples of cranial bones)

- Frontal bone
- Temporal bone
- Parietal bone
- Occipital bone

Where in the skull are eyes found?

- In the eye sockets (orbita)

CONDITIONS THAT MAY MAKE JOINTS FAIL TO FUNCTION PROPERLY

- Dislocation
- Fracture
- Sprain
- Strain

Name the disease that causes stiffness and swelling of the joint.

- Arthritis (Lyme disease)

MUSCULAR SYSTEM

- This is the body system made up of muscles

MUSCLE

- This is an elastic tissue in the body of animals

How do muscles work?

- By contracting and relaxing

TYPES OF MUSCLES

- Voluntary muscles (skeletal muscles)
- Involuntary muscles (smooth muscles)
- Cardiac muscles

VOLUNTARY/SKELETAL MUSCLES

- These are muscles whose movement is controlled by one's will (brain)

Why are voluntary muscles also called skeletal muscles?

- They are attached to the bones (skeleton)

FUNCTIONS OF SKELETAL (VOLUNTARY) MUSCLES

- They help in body movement
- They help to maintain body posture

EXAMPLES OF VOLUNTARY/SKELETAL MUSCLES

- Biceps (muscle of forearm)
- Triceps (muscle of forearm)
- Quadriceps (muscle of thigh)
- Hamstrings (muscle of thigh)
- Abdominal muscle (muscle of abdomen)
- Deltoids (muscles of shoulders)
- Pectoral muscles (muscles of chest)
- Gluteal muscles (muscles of buttocks)

Name the muscle that connects the scapula to the radius

- Biceps

Name the muscle that connects scapula, the humerus and ulna

- Triceps

INVOLUNTARY/SMOOTH MUSCLES

- These are muscles whose movement is not controlled by one's will (brain)
- ✓ Their movement is automatic
- ✓ We have little or no control over them.
- ✓ They are also called **visceral muscles**

Why are involuntary muscles also called smooth muscles?

- They have a smooth uniform appearance when seen under microscope

Functions of smooth (involuntary) muscles

- They aid movement of substances in body organs
- They protect the digestive, respiratory and circulatory organs

Examples of the involuntary/smooth muscles

- Muscles of the alimentary canal (gut)
- Muscles of the reproductive system
- Muscles of the blood vessels
- Muscles of the excretory system
- Ciliary muscles of the eye
- Sphincter muscles of the urinary system

CARDIAC MUSCLES

- These are muscles whose movement is made by muscles themselves
- ✓ They are the special muscles of the heart
- ✓ They do not receive impulses from the nervous system
- ✓ They only stop working when the person is dead

Why are cardiac muscles also called myogenic muscles?

- Their movement is made by the muscles themselves

What special name is given to the muscles of the heart?

- Cardiac muscles

FUNCTION OF CARDIAC MUSCLES

- They enable the heart to pump blood

Example of cardiac muscles

- Muscles of the heart

Name the blood vessel that supplies heart muscles with food nutrients and oxygen.

- Coronary artery

ANTAGONISTIC MUSCLES

- These are muscles that work in pairs and oppose the action of each other
- This is a pair of muscles that oppose the action of each other

Examples of antagonistic muscles

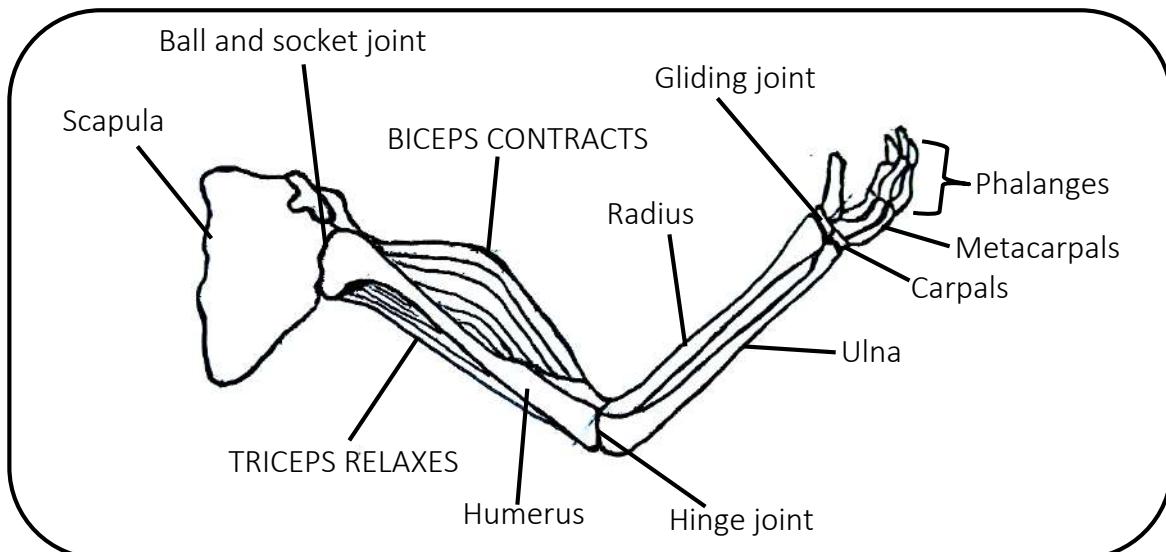
- Biceps and triceps muscles
- Quadriceps and hamstrings

Why biceps and triceps are called antagonistic muscles

- They work in pairs and oppose the action of each other
- They oppose the action of each other

A DIAGRAM SHOWING THE ANTAGONISTIC MUSCLES OF THE FOREARM

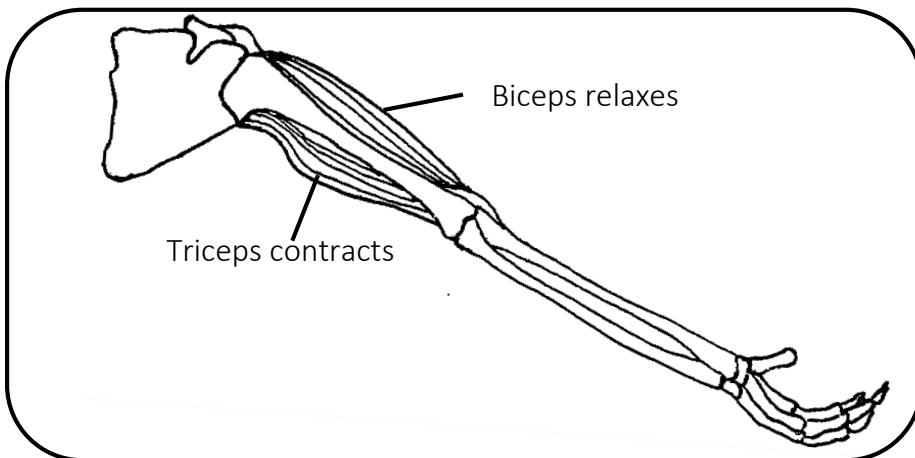
1. WHEN THE FOREARM IS RAISED (BENT)



What happens to biceps and triceps when the forearm is raised (bent)?

- The biceps contracts
- The triceps relaxes

2. WHEN THE FOREARM IS STRAIGHT



What happens to biceps and triceps when the forearm is straight (lowered)?

- The biceps relaxes
- The triceps contracts

FLEXOR MUSCLE

- This is a muscle which contracts to bend the limb (arm)

Why is biceps called a flexor muscle?

- It contracts to bend the arm

EXTENSOR MUSCLE

- This is a muscle that contracts to straighten the limb (arm)

Why is triceps called an extensor muscle?

- It contracts to straighten the arm

FUNCTION OF MUSCLES

- They help in body movement
- They enable us to do heavy duties
- They help to join bones in the body
- They protect some internal organs
- They help in tissue respiration to produce energy

DISEASES OF THE SKELETAL AND MUSCULAR SYSTEM

Diseases of the skeletal system

- Poliomyelitis
- Tuberculosis/Spinal tuberculosis
- Leprosy
- Rickets
- Cancer of bones
- Osteomyelitis

Diseases of muscular system

- Tetanus
- Leprosy
- Poliomyelitis

POLIOMYELITIS (POLIO)

- It is an immunizable waterborne disease
- It is caused by a virus

Name the germ (virus) that causes polio

- Poliovirus

Which vector spreads poliomyelitis?

- Cockroach

How does poliomyelitis spread?

- Through drinking contaminated water
- Through eating contaminated food

Sign of poliomyelitis

- Paralysis of the limb
- Stiffness of the neck
- Stiffness of the back

Symptoms of poliomyelitis

- Muscle weakness
- Headache
- Vomiting
- Fever
- Neck pain
- Back pain

Effect of poliomyelitis to an individual

- It leads to lameness

Ways of preventing and controlling poliomyelitis

- Immunization using polio vaccines (IPV & OPV)
- Drinking boiled water
- Proper use of latrines (proper disposal of human wastes)
- Wash hands with clean water and soap before eating food

TUBERCULOSIS

- It is an immunizable airborne disease
- If it is not detected and treated early, it can spread from the lungs to the bones and spine
- It is caused by a bacterium

Name the germ (bacterium) that causes tuberculosis

- Mycobacterium tuberculosis

Which part of the human skeleton is mainly affected by spinal tuberculosis?

- Backbone (spine)

How does tuberculosis spread?

- Through inhaling contaminated air
- Through drinking contaminated milk from tubercular cows

Name the respiratory organ mainly affected by Tuberculosis

- Lungs

Signs of tuberculosis of bones/spinal tuberculosis

- Hunchback (humpback)
- Paralysis of the legs
- Cold abscess

Symptoms of tuberculosis of bones/spinal tuberculosis

- Backache
- Pain at joints
- Pain in the spine while walking

Ways of preventing and controlling tuberculosis

- Immunization using BCG vaccine
- Isolate and treat the infected persons
- Drink boiled or pasteurized milk

RICKETS

- It is a deficiency disease that affects bones

What causes rickets?

- Lack of Vitamin D in the diet

Besides vitamin D deficiency, give other cause rickets?

- Lack of Calcium and phosphorus in the diet

Signs of rickets

- Bow-legs or knock-knee legs
- Poor teeth formation
- Common fractures

Symptom of rickets

- Weak bones of the legs

Way of preventing and controlling rickets

- Feeding on food rich in vitamin D, calcium and phosphorus
- Sunbathing during morning

LEPROSY

- It attacks both muscles and bones
- It is caused by a bacterium

Name the germ (bacterium) that causes leprosy

- Mycobacterium leprae

Which vector spreads leprosy?

- Cockroach

Name the human body organ mainly affected by untreated leprosy.

- Skin

How does leprosy spread?

- Through direct body contact with an infected person

Effects of leprosy

- Loss of fingers and toes
- Loss of fingernails and toenails
- Wasting of muscles

Ways of preventing and controlling leprosy

- Isolate and treat the infected person
- Avoid sharing towels, basins, clothes and beddings with an infected person
- Treat early cases with antibiotics

OSTEOMYELITIS

- It is a bacterial disease
- It causes inflammation of the bone and bone marrow

TETANUS

- It mainly affects muscles
- It is caused by a bacterium found in the soil

Name the germ (bacterium) that causes tetanus

- Clostridium tetani

How does tetanus bacterium enter the human body (how does tetanus spread)?

- Through fresh cuts and dirty wounds
- Through cutting the umbilical cord with dirty instrument

Signs of tetanus

- Stiff muscles
- The baby refuses suckling the mother's breasts
- Spasms when touched

Symptom of tetanus

- Difficulty in breathing

Why tetanus is called LOCK JAW disease?

- It makes the jaws of a baby stiff

Ways of preventing and controlling of tetanus

- Immunization with DPT vaccine or TT vaccine
- Early treatment of the infected person
- Always keep cuts and wounds clean

DISORDERS OF THE SKELETAL AND MUSCULAR SYSTEM

Disorders of skeletal system

- Fracture
- Dislocation
- Deformation of bones
- Backache

Disorders of muscular system

- Strain
- Sprain
- Muscle cramp
- Hernia
- Prolapse

Dislocation

- This is the displacement of a bone from a joint

Sprain

- This is an injury on a ligament (this is a stretched ligament)

Strain

- This is an injury on a muscle or tendon (this is a stretched muscle)

Signs of strains, sprains and dislocation

- Swelling of the injured part
- Difficulty in moving the injured part

Symptom of strains, sprains and dislocation

- Pain at the injured part

First aid for sprains and strains

- Rest the injured part
- Apply ice pack on the injured part
- Wrap a clean bandage around the injured part
- Elevate the injured part

First aid for dislocation

- Rest the injured part
- Apply ice pack on the injured part
- Provide a crutch to let the casualty walk
- Use a stretcher to carry the casualty who cannot walk

Hernia

- This is when muscles move from their position and are constricted within a narrow opening

Prolapse

- This is when muscles are weakened and unable to support tissues

Deformation of bones

- This is the growth of bent bones

FRACTURE

- This is a broken or cracked bone in the body

Causes of fractures

- Falls
- Heavy blows
- Unnecessary jumping
- Car knocks
- Fighting

What disorder of the skeletal system occurs due to excessive stress on bones?

- Fracture

General signs of fractures

- A snap of the bone is felt
- Difficulty in moving the fractured limb
- Swelling of the fractured part

Symptom of fractures

- Pain on the fractured part

TYPES OF FRACTURES

- Compound fracture (open fracture)
- Simple fracture (closed fracture)
- Comminuted fracture
- Greenstick fracture
- Depressed fracture
- Complicated fracture

COMPOUND FRACTURE

- This is the type of fracture where a broken bone breaks and comes out of the skin (flesh)

Signs of compound fracture

- The broken bone is seen outside the skin
- Bleeding on fractured part

SIMPLE FRACTURE

- This is the type of fracture where a bone breaks and remains inside the skin (flesh)

Signs of simple fracture

- The broken bone may be seen near the skin
- Swelling of the fractured part
- Bruise at the injured part

Symptom of simple fracture

- Pain on the fractured part

GREENSTICK FRACTURE

- This is the type of fracture where a bone is bent but broken on one side
- It is common in babies

Why is green stick fracture common in babies (young children)?

- They have weak bones

COMMUNITED FRACTURE

- This is when a bone breaks into many pieces
- A broken bone is crushed

DEPRESSED FRACTURE

- This is when a bone of the skull is pushed inside

COMPLICATED FRACTURE

- This is the type of fracture where a bone breaks and damages an internal body organ e.g lungs, heart or intestines
- It can occur when a rib is broken

FIRST AID FOR FRACTURES

- Tie splints around the fractured part

To keep the broken bone in one position

- Use arm sling to hold the broken arm in one position
- Use a stretcher to carry a casualty who cannot walk
- Provide a crutch (walking stick) to help the casualty in walking (for stability when walking)

Why are antibiotics applied on a compound fracture?

- To prevent bacterial infections

Why is it dangerous for the first aider to attempt putting broken/displaced bone in its position?

- It can lead to further injuries

EQUIPMENT USED TO GIVE FIRST AID TO FRACTURES

- | | |
|-------------|--------------------------|
| ▪ Arm sling | ▪ Crutches/walking stick |
| ▪ Stretcher | ▪ Wheelchair |

Splints

- To keep the broken bone in one position

Stretcher

- It is used to carry a casualty who cannot walk

Why is a stretcher not kept in a first aid box?

- It is too big to fit in a first aid box

Crutch/walking stick

- It helps a casualty with a broken leg to walk

How do crutches help a casualty with a broken leg in walking?

- By reducing the body weight put on the broken leg

Arm sling

- To keep the broken arm in one position

POSTURE

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

OR

- This is the way of positioning the body when an action takes place

Importance of good posture

- It prevents deformation of bones (helps in proper bone formation)
- It prevents back and chest pain
- It prevents dislocation
- It helps the body organs to function properly

Dangers of bad posture

- It leads to deformation of bones
- It leads to back and chest pain
- It leads to dislocation
- It leads to abdominal pain and indigestion

WAYS OF MAINTAINING (KEEPING) MUSCULOSKELETAL SYSTEM HEALTHY

- Performing regular physical exercises
- Feeding on food rich in calcium, phosphorus and vitamin D
- Maintaining good posture
- Immunizing children against tetanus, polio and tuberculosis
- Avoid unnecessary climbing of trees

IMPORTANCE OF PERFORMING PHYSICAL EXERCISES

- It reduces body weight
- It makes the joints flexible
- It reduces the risk of heart attack
- It makes the heart muscles grow stronger
- It breaks fatigue (body weakness)
- It makes food digestion easy
- It reduces the risks of sprains and strains
- It helps the heart to pump more blood to the muscles

THEME: MATTER AND ENERGY

MATTER

- This is anything that occupies space and has weight.

Properties of matter.

- Matter occupies space
- Matter has weight
- Matter is made up of molecules

Name any four states of matter

- | | |
|-------------------------|-----------------------|
| ▪ Solid state (solid) | ▪ Gaseous state (gas) |
| ▪ Liquid state (liquid) | ▪ Plasma |

Plasma consists of partially ionized gas and electrons (e.g. sun and stars)

ENERGY

- This is the ability to do work

TYPES OF ENERGY

- Kinetic energy
- Potential energy

Kinetic energy

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

Potential energy

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

FORMS OF ENERGY

- | | |
|-----------------------------------|---------------------|
| ▪ Heat energy | ▪ Magnetism |
| ▪ Sound energy | ▪ Mechanical energy |
| ▪ Light energy | ▪ Chemical energy |
| ▪ Electrical energy (electricity) | |

ELECTRICITY

- This is the form of energy produced by the flow or presence of charged particles

Why is electricity regarded as a form of energy?

- It can do work (it does work)

Name the two charged particles involved in electricity

- Electrons
- Protons

An atom

- This is the smallest indivisible particle of an element

Molecule

- This is a group of two or more atoms joined together

Name the three atomic particles (particles which make up an atom)

- | | | |
|-----------|-------------|------------|
| ▪ Protons | ▪ Electrons | ▪ Neutrons |
|-----------|-------------|------------|

Protons and **neutrons** are found in the nucleus of an atom

Electrons are found on the shell/orbit/energy level around the nucleus of an atom

Electrons

- These are negatively charged particles of an atom

Protons

- These are positively charged particles of an atom

Neutrons

- These are uncharged particles of an atom (neutrally charged particles)

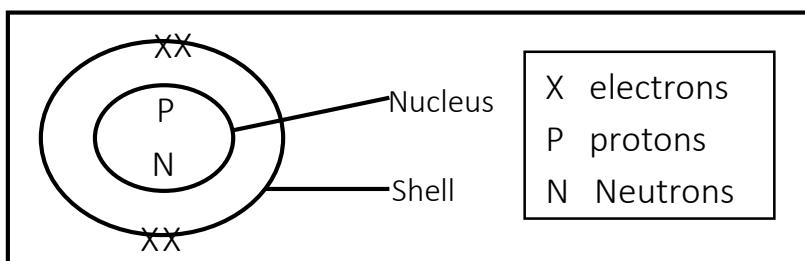
When does a body (an atom) become positively charged?

- If it loses an electron

When does a body (an atom) become negatively charged?

- If it gains an electron

A diagram showing an atom



USES/IMPORTANCE/APPLICATIONS OF ELECTRICITY

- It is used for cooking
- It is used for ironing
- It is used for lighting in houses and compounds
- It is used for charging phones
- It is used for security in electric fences
- It is used to make electromagnets
- It is used to power elevators (lifts) in buildings
- It is used to run machines in factories/industries

ADVANTAGES OF USING ELECTRICITY

- It is quick to use (It saves time)
- It is clean to use (it produces clean and neat work)
- It does not pollute the environment
- It conserves trees/plants
- It can easily be changed to other forms of energy

Why is electricity said to be environmental friendly?

- It conserves plants/trees
- It does not pollute the environment

How does the use of electricity conserve trees?

- It reduces deforestation for wood fuel

DANGERS (DISADVANTAGES) OF USING ELECTRICITY

- It can shock people to death
- It can burn the building
- It is expensive to install

SOURCES OF ELECTRICITY

- These are things that produce electricity

Examples of natural sources of electricity

- | | |
|--------------------------|----------------|
| ▪ Sun | ▪ Tides |
| ▪ Clouds | ▪ Fossil fuels |
| ▪ Fast flowing water | ▪ Uranium |
| ▪ Steam from hot springs | |

Examples of artificial sources of electricity

- | | |
|-------------|------------------------------|
| ▪ Dry cells | ▪ Accumulators/car batteries |
| ▪ Wet cells | ▪ Telephone batteries |

TYPES OF ELECTRICITY

- Static electricity
- Current electricity

STATIC ELECTRICITY

This is the type of electricity in which electrons do not flow

- It is also called **stationary electricity**

How is static electricity produced/form?

- By rubbing insulators against each other

Name the force that enables production of static electricity

- Friction

Electrostatic force

This is the force that operates between static electric charges

- Electric charges is measured by an **electroscope**

Types of electric charges

- Positive charge (cation)
- Negative charge (anion)

State the law of charges (law of electrostatics)

- Like charges repel while unlike charges attract each other

HOW TO PRODUCE STATIC ELECTRICITY BY RUBBING INSULATORS

- Get tiny pieces of paper and put them on the table
- Rub a plastic ruler on your hair several times, it will be charged
- Put the ruler near the pieces of paper on the table
- The papers will be attracted by the ruler

Note

- The ruler is negatively charged and the pieces of paper are positively charged

EXAMPLES OF STATIC ELECTRICITY

- Lightning
- Electrostatic induction
- Rubbing balloons on your head to make hair stand
- Walking on a carpeted floor
- Getting shock when touching a metallic doorknob

IMPORTANCE (USES) OF STATIC ELECTRICITY

- It helps in photocopying documents
- It helps in spray painting
- It helps in filtering smoke from chimneys
- Lightning fixes nitrogen into the soil

LIGHTNING

- It is a form of static electricity in nature

What causes lightning?

- Sudden electric discharge between clouds and the ground

How is lightning formed?

- When negatively charged clouds rub against positively charged clouds

THUNDER

- This is the sound caused by discharge of atmospheric electric charge

How is thunder formed?

- When air around the path of lightning bolt expands rapidly

Why do we always see lightning before we hear thunder on a rainy day?

- Light travels faster than sound

Name three forms of energy produced during lightning

- Light energy
- Heat energy
- Sound energy

ADVANTAGES OF LIGHTNING

- It fixes nitrogen into the soil
- It is a natural source of light

How does lightning help to fix nitrogen into the soil?

- It changes atmospheric nitrogen into nitrates added to soil in rain

DANGERS (EFFECTS) OF LIGHTNING)

- It strikes people and animals to death
- It destroys trees
- It destroys houses (it causes fire that destroys buildings)
- It damages of electric appliances

WAYS OF PROTECTING AGAINST DANGERS OF LIGHTNING (SAFETY MEASURES AGAINST LIGHTNING)

- Put lightning conductors on buildings
- Avoid standing under tall trees when it is raining
- Avoid flying kites when it is raining
- Avoid swimming in open water during thunderstorm
- Avoid walking in open grounds during thunderstorm
- Avoid answering phone calls during thunderstorm
- Switch off electrical devices when it is raining
- Wearing rubber shoes to walk on ground when it is raining

How do people protect themselves from the louder sound of thunder after seeing lightning?

- They cover their ears with hands

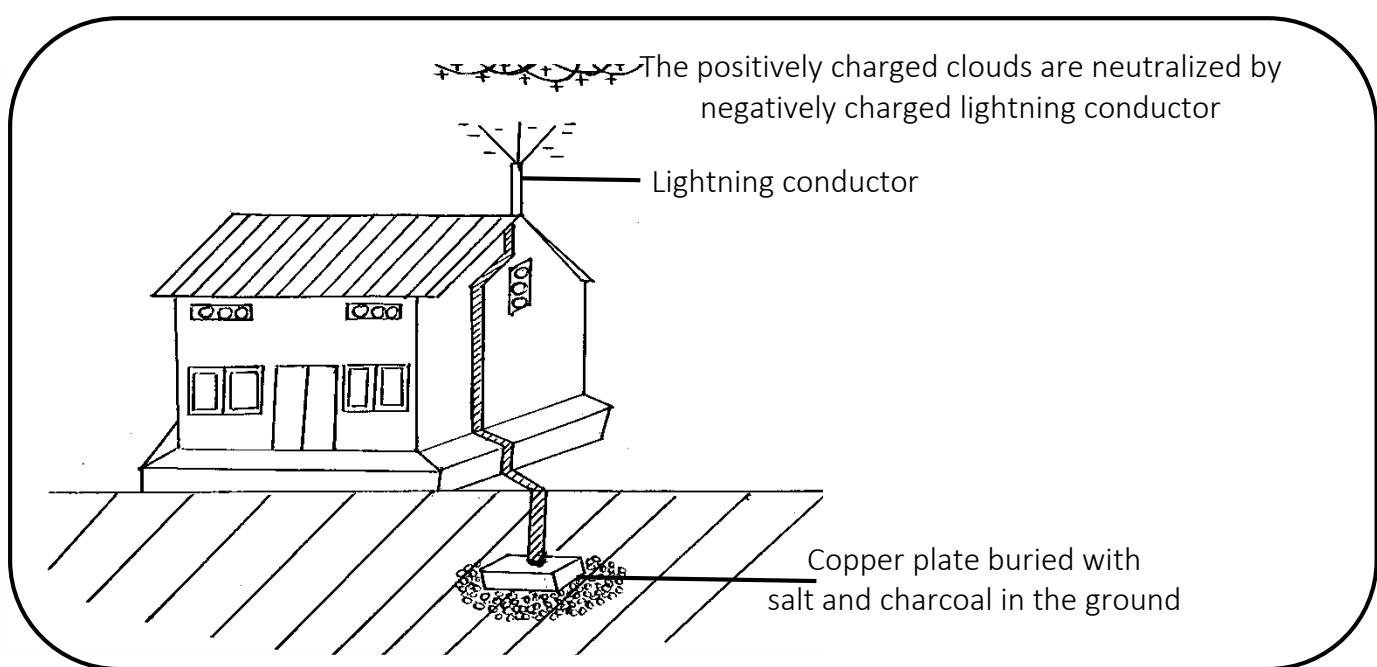
What do we call the abnormal fear of thunder and lightning?

- Astrapobia

LIGHTNING CONDUCTOR

- This is a device put on buildings to provide safe path of lightning into the ground
- ✓ It has a metal rod with spikes on top connected to copper strip and then to ground rod buried in the soil

AN ILLUSTRATION SHOWING LIGHTNING CONDUCTOR



Function of lightning conductor on a building

- It protects the building against lightning

How does a lightning conductor work?

- By trapping lightning charges and directs them safely into the ground

Why is the ground rod (copper plate) buried with charcoal and salt in the ground?

- To neutralize lightning charges
- To improve earthing resistance

Give a reason why the upper end of lightning conductor is pointed (made with spikes).

- Charges concentrate on sharp points

What happens when a charged cloud passes near the lightning conductor?

- It is discharged

What happens when a charged cloud passes near the earth's surface?

- Lightning strikes the ground, trees, buildings or animals

Why is a car safe to protect against lightning?

- It has a metal cage that directs lightning charge through the tyres to the ground

Why does lightning strike trees?

- Lightning strikes the nearest conductor and moisture inside trees is a better conductor than air

Why does lightning always strike tall objects in an area (e.g. tall buildings and trees)?

- It takes the shortest path to the positive charge
- They are more closer to lightning charges than other objects

How does an umbrella increase the risk of being struck by lightning?

- It can make a person to be the tallest object in an area

CURRENT ELECTRICITY

- This is the type of electricity which involves the flow of electrons
- ✓ Electrons flow from one point to another through a conductor

TYPES (KINDS) OF CURRENT ELECTRICITY

- Direct current electricity (DC)
- Alternating current electricity (AC)

DIRECT CURRENT ELECTRICITY

- This is the type of current electricity which flows in one direction
- ✓ It flows from the source to the appliance.

Sources of direct current electricity

- Dry cells
- Wet cells/simple cells
- Lead-acid batteries/accumulators/car batteries

Examples of direct current electricity

- Electricity produced by dry cells
- Electricity produced by wet cells
- Electricity produced by lead acid batteries

Disadvantages of direct current electricity (DC)

- It cannot be stepped up or down
- It flows in one direction

ALTERNATING CURRENT ELECTRICITY (AC)

- This is the type of current electricity which flows in both directions
- ✓ It flows forward and backward
- ✓ It can be stored as chemical energy and reproduced as direct current

Advantages of alternating current electricity

- It can be stepped up or down
- It can be stored

Examples of alternating current electricity and their sources

- **Hydroelectricity:** fast flowing water
- **Thermal electricity:** fossil fuels
- **Geothermal electricity:** steam from hot springs
- **Nuclear/atomic electricity:** uranium
- **Solar electricity:** sun

DIFFERENCES BETWEEN ALTERNATING CURRENT AND DIRECT CURRENT

- AC flows in both directions while direct current flows in one direction
- AC can be stored while DC cannot be stored
- AC can be stepped up or down while DC cannot be stepped up or down

HYDROELECTRICITY

- This is the electricity produced by fast flowing water
- ✓ At a power station, kinetic energy of moving water turns turbines connected to generators that produce electricity

What energy change takes place at a waterfall for turbines to produce hydroelectricity?

- Kinetic energy changes to electrical energy

How is hydroelectricity from main power stations transmitted to different parts of the country?

- Through electric cables

Disadvantage of using hydroelectricity

- It is expensive to pay bills
- It can cause electric shocks

THERMAL ELECTRICITY

- This is electricity produced by burning fuels like coal and crude oil

Devices that burn fuels to produce thermal electricity

- Generators
- Car engines

State the energy change that occurs in a generator to produce thermal electricity

- Mechanical energy changes to electrical energy

Disadvantages of using thermal electricity compared to hydroelectricity

- It pollutes the environment unlike hydroelectricity
- It is more expensive than hydroelectricity

GEOTHERMAL ELECTRICITY

This is electricity produced by steam from hot springs.

- In this case, steam power turns turbines connected to strong generators

ATOMIC (NUCLEAR) ELECTRICITY

- This is electricity produced by burning uranium in a nuclear reactor.

By what process is chemical energy in uranium converted into electrical energy?

- Nuclear fission

State the energy change that occurs in generation of nuclear electricity.

- Chemical energy changes to electric energy

SOLAR ELECTRICITY

- This is electricity got from the sun

Solar cell

- This is a device which changes light energy from the sun to electrical solar electricity

Solar panel (photovoltaic panel)

- This is a group of connected solar cells

Name one material commonly used to make solar panels

- Silicon

Why are solar panels always painted blue or black?

- To absorb more light from the sun

What energy change occurs in a solar panel?

- Light energy from the sun changes solar electricity

Solar battery

- It stores and produce solar electricity

Appliances that use solar electricity

- | | | |
|---------------------|-----------------|--------------------|
| ▪ Solar heaters | ▪ Satellites | ▪ Solar road signs |
| ▪ Solar calculators | ▪ Solar radios | |
| ▪ Solar ovens | ▪ Solar torches | |

Uses of solar electricity

- For cooking
- For lighting
- For recharging mobile phones

Advantages of using solar electricity (why is solar electricity said to be environmental friendly?)

- It conserves trees
- It does not pollute the environment

How does the use of solar electricity conserve plants/trees?

- It reduces deforestation for wood fuel

Disadvantages of using solar electricity

- It is not effective on rainy days
- It is expensive to buy solar panels and batteries

Advantages of using solar electricity over hydroelectricity

- Solar electricity does not involve paying electric bills like hydroelectricity
- Solar electricity does not involve deforestation while hydroelectricity sometimes requires use of electricity poles

DIFFERENCES BETWEEN CURRENT ELECTRICITY AND STATIC ELECTRICITY

- In current electricity, electrons flow while in static electricity, electrons do not flow
- In current electricity, only electrons are active while in static electricity, both electrons and protons are active
- In current electricity, charges are inside the conductor while in static electricity, charges are on the surface of the insulator
- Current electricity occurs in conductors while static electricity occurs in insulators
- Current electricity induces magnetic field while static electricity does not induce magnetic field
- Current electricity exists for long time while static electricity exists for short time
- Current electricity is measured by electricity meter while static electricity is measured by electroscope

AN ELECTRIC CIRCUIT

- This is the complete path through which electricity flows
- This is the complete path through which electric current flows

ELECTRIC CURRENT (I)

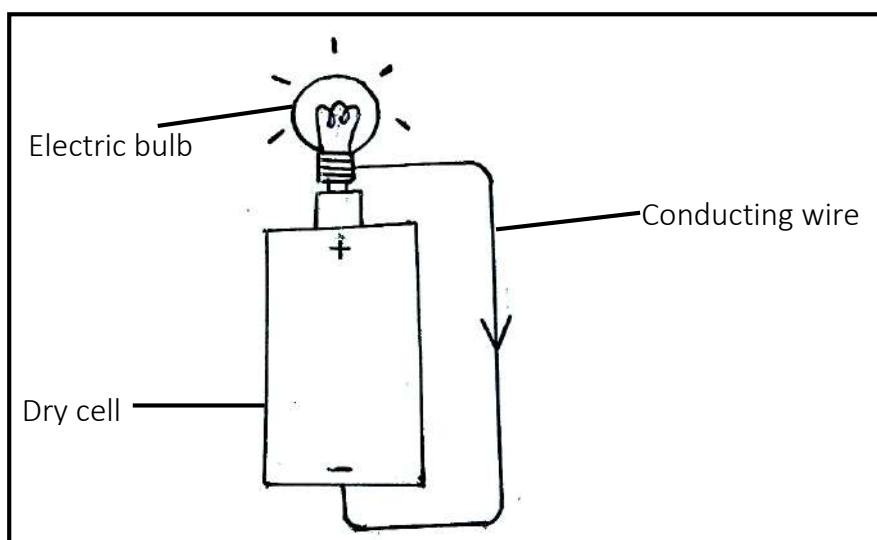
- This is the rate of flow of electric charge in a conductor
- This is the flow of electrons in a conductor

FLOW OF ELECTRONS AND ELECTRIC CURRENT (ELECTRICITY) IN A ELECTRIC CIRCUIT

i) Flow of current (electricity)

- Current flows from the **positive terminal to the negative terminal**

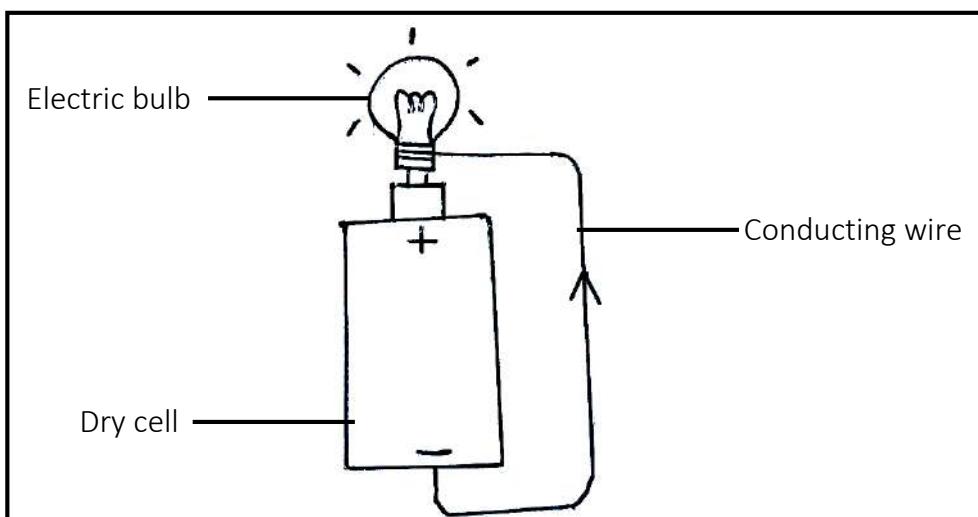
A diagram showing the flow of current (electricity)



ii) Flow of electrons

- Electrons flow from the **negative terminal to the positive terminal**

A diagram showing the flow of electrons in a simple electric circuit



When is a circuit said to be complete?

- When there is complete flow of current and the appliance is working

When is a circuit said to be incomplete?

- When there is incomplete flow of current and the appliance is not working

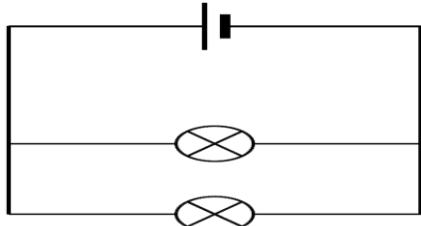
TYPES OF CIRCUITS

- Parallel circuit
- Series circuit

PARALLEL CIRCUIT

- This is the circuit where components are connected on separate loops of wires

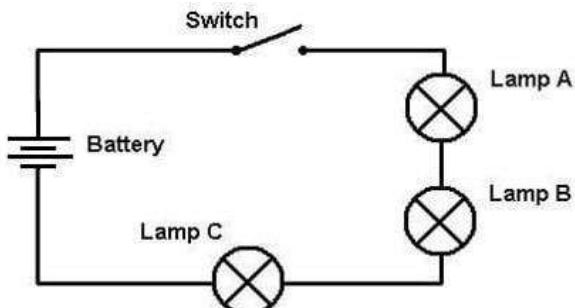
A DIAGRAM SHOWING A PARALLEL CIRCUIT



SERIES CIRCUIT

- This is the circuit where components are connected on the same loop of wire

A DIAGRAM SHOWING A SERIES CIRCUIT



DIAGRAMS SHOWING WRONG ARRANGEMENT OF DRY CELLS

ILLUSTRATION I

- When a positive terminal of one dry cell is connected to the positive terminal of another dry cell

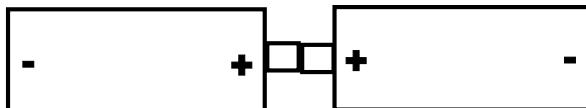
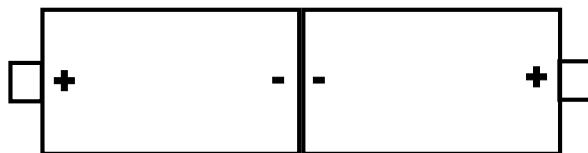


ILLUSTRATION II

- When a negative terminal of one dry cell is connected to the negative terminal of another dry cell



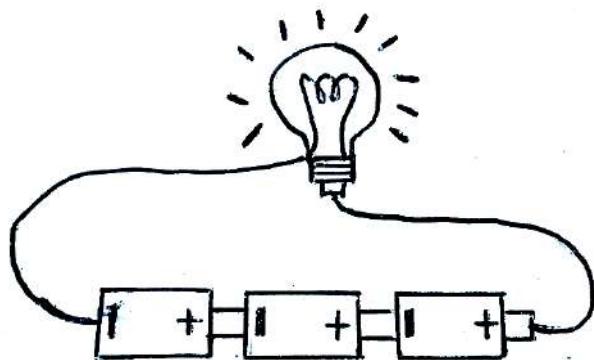
CORRECT ARRANGEMENT (CONNECTION) OF DRY CELLS

- Series connection
- Parallel connection

SERIES CONNECTION

- This is when the negative terminal of a dry cell is connected to the positive terminal of another dry cell in the circuit

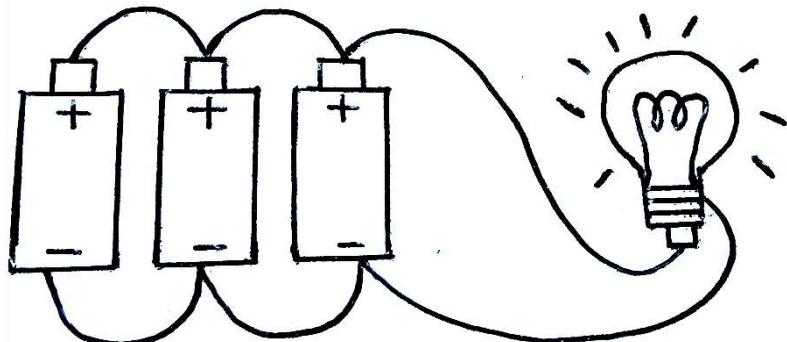
A DIAGRAM SHOWING SERIES CONNECTION OF DRY CELLS



PARALLEL CONNECTION

- This is when all positive terminals of dry cells are joined and all negative terminals are also joined in the circuit

A diagram showing parallel connection of dry cells



COMPONENTS (PARTS) OF AN ELECTRIC CIRCUIT, THEIR SYMBOLS AND FUNCTIONS.

COMPONENT	SYMBOL	FUNCTION
Dry cell (battery)		<ul style="list-style-type: none">▪ It produces electricity▪ It changes chemical energy to electrical energy
Bulb		<ul style="list-style-type: none">▪ It produces light▪ It changes electrical energy to heat and light energy
Switch		<ul style="list-style-type: none">▪ It breaks or completes the circuit at one's will
Fuse		<ul style="list-style-type: none">▪ It breaks the circuit in case of high voltage (too much flow of current)
Wire/conductor		<ul style="list-style-type: none">▪ It conducts electricity in the circuit

Ammeter		<ul style="list-style-type: none"> It measures electric current
Voltmeter		<ul style="list-style-type: none"> It measures voltage (potential difference/electromotive force)
Ohmmeter		<ul style="list-style-type: none"> It measures electrical resistance
Resistor	OR	<ul style="list-style-type: none"> It regulates electric current that flows in the circuit

DIAGRAMS SHOWING ELECTRIC CIRCUITS

DIAGRAM 1

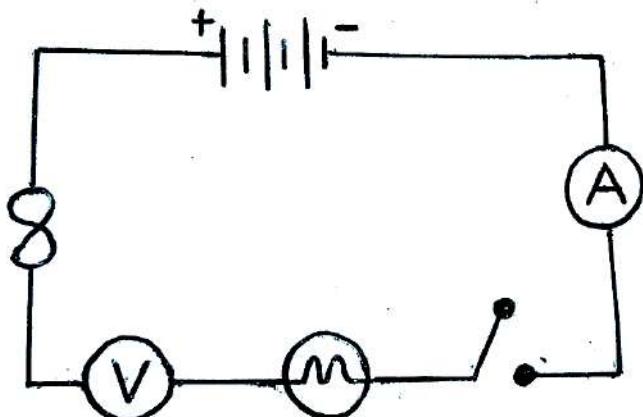
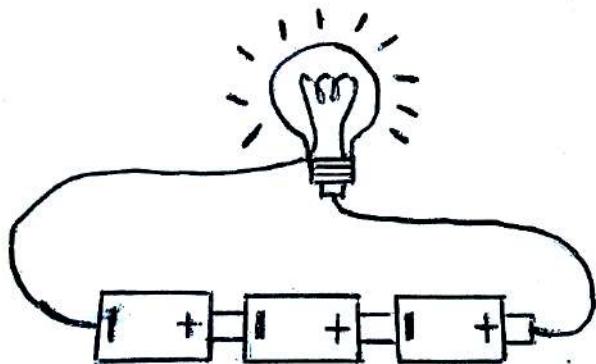


DIAGRAM 2



ENERGY CHANGES THAT OCCUR WHEN A CIRCUIT IS COMPLETE

In a dry cell

- Chemical energy changes to electrical energy

In a bulb

- Electrical energy changes to heat and then heat to light energy

FUNCTION OF EACH COMPONENT OF AN ELECTRIC CIRCUIT

DRY CELL (BATTERY)

- It produces electricity
- It changes chemical energy to electrical energy

What type of energy is stored in a dry cell?

- Chemical energy changes to electrical energy

What energy change occurs in a dry cell when the circuit is complete?

- Chemical energy changes to electrical energy

WIRE

- It conducts electricity in the circuit

SWITCH

- It breaks or completes the circuit at one's will

FUSE:

- It breaks the circuit in case of high voltage (too much flow of current)

How is the function of a fuse similar to that of a switch?

- Both break the circuit

How is a fuse different from a switch in terms of function?

- A fuse breaks the circuit in case of high voltage while a switch breaks or completes the circuit at one's will

ELECTRIC BULB

- It produces light
- It changes electrical energy to heat and light energy

What energy change occurs in the bulb when the circuit is complete?

- Electrical energy changes to heat and light energy

AMMETER:

- It measures electric current
- ✓ Electric current is measured in **Ampères (A)**

VOLTMETER

- It measures voltage/potential difference/electromotive force
- ✓ Voltage is measured in **Volts (V)**

Electromotive force (Emf)

- This is the potential energy divided by electric charge

Potential difference (PD)

- This is the difference in electric charges between two points in a circuit

OHMMETER

- It measures electrical resistance
- ✓ Electrical resistance is measured in **Ohms**

RESISTOR

- It regulates electric current that flows in the circuit

ELECTRICITY METER

- It measures the electricity used

In which units is electricity used at home measured?

- Kilowatt-hour (KWH)

WATTMETER

- It measures electric power
- ✓ Electric power is measured in **Watts (W)**

ELECTROSCOPE

- It measures electric charge
- ✓ Electric charge is measured in **Coulombs**

CAPACITANCE METER

- It measures capacitance
- ✓ Capacitance is measured in **Farad (F)**

RHEOSTAT

- It is used to adjust electrical resistance in a circuit

Uses of rheostat in our daily life

- It controls speed of a car
- It is used as car light dimmer

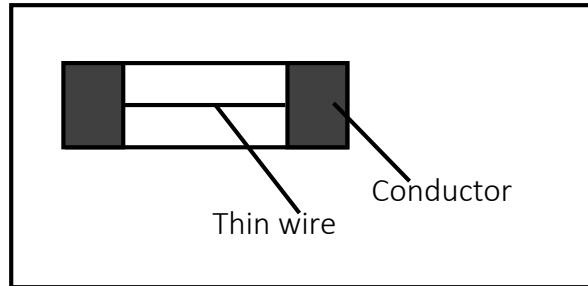
CIRCUIT BEAKER

- ✓ It is an automatic switch that helps the fuse to make electricity supply at home safer
- It opens the circuit when overloaded

A FUSE

- This is a safety device that breaks the circuit in case of high voltage
- It has thin wire made from an alloy called **solder** (a mixture of tin and lead)

A DIAGRAM SHOWING A FUSE



Why is a fuse made of a thin wire?

- To easily melt in case of high voltage

Why is the thin wire of a fuse made from solder?

- Solder has very low melting point

State the function of a fuse in the circuit.

- It breaks the circuit in case of high voltage

How does a fuse work?

- By melting in case of high voltage

How is a fuse adapted to its function?

- It has thin wire with a very low melting point.

Why is a fuse called a safety (protective) device?

- It protects electric devices from being damaged by high voltage

CONDITIONS THAT MAY LEAD A FUSE TO MELT (BLOW)

- High voltage
- Short circuit
- Overloading the circuit
- When the fuse is very old

Advantages of a fuse

- It protects electric devices from being damaged by high voltage
- It reduces the risks of electric fires in houses

ELECTRICAL RESISTANCE

- This is the conductor's opposition to the flow of current
- ✓ It is measured by **ohmmeter** in **ohms**

Importance of electrical resistance

- It helps to produce more heat and light

Why are filaments of water heaters and electric bulbs coiled?

- To increase electrical resistance

FACTORS THAT DETERMINE ELECTRICAL RESISTANCE

- Thickness of the wire
- Length of the wire
- Temperature of the wire

Thickness of the wire

- Thick wires have lower electrical resistance than thin wires

Length of the wire

- Longer wires have higher electrical resistance than short wires

Temperature of the wire

- Electrical resistance increases with increase in temperature

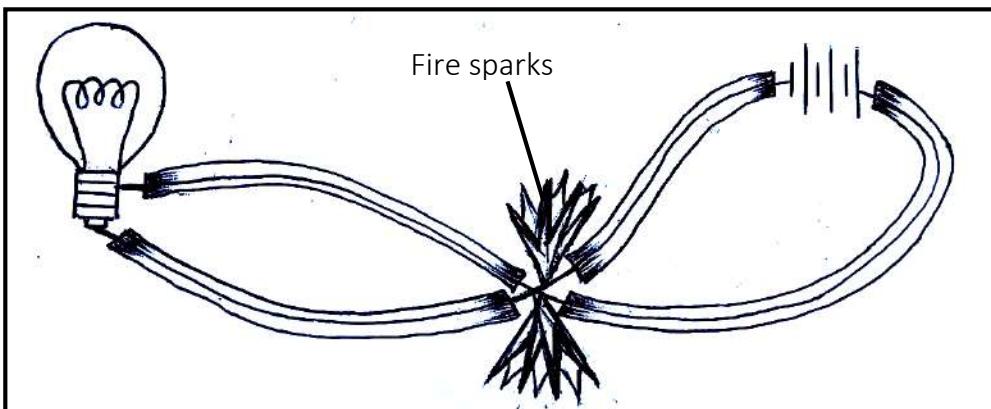
SHORT CIRCUIT

- This is the path of electricity with low resistance to current
- This is the shortest path of current flow

State the main cause of short circuit

- When two bare wires with current meet (get into contact)

A DIAGRAM SHOWING A SHORT CIRCUIT



Sign of short circuit

- Fire sparks at the point of contact

CONDITIONS THAT MAY LEAD TO SHORT CIRCUITS (OTHER CAUSES OF SHORT CIRCUITS)

- Poor wiring
- Overloading the circuit
- High voltage in the circuit
- Use of faulty electric devices
- Poor insulation on electric wires
- Pouring water in electric devices
- Pushing metallic objects in electric sockets
- Wrong connection of wires in electric devices

What can make bare wires to come into contact?

- Rat damage on insulators of wires
- Dampness which spoils insulators of wires
- Use of very old wires with spoilt insulators

DANGERS (EFFECTS) OF SHORT CIRCUITS

- They destroy electric devices
- They lead to electric shocks (electrocution)
- They cause fire that may burn the building

WAYS OF PREVENTING SHORT CIRCUITS

- Electric wires should be covered with insulators
- Electric repairs and wiring should be done by experts
- Avoid overloading the circuits
- Avoid pushing metallic objects in electric sockets
- Avoid pouring water in electric devices

INSULATORS AND CONDUCTORS OF ELECTRICITY

ELECTRIC CONDUCTORS

- These are materials which allow electricity to pass through them easily

Why are conductors able to conduct electricity in solid state?

- They have free moving electrons

EXAMPLES OF CONDUCTORS OF ELECTRICITY

Metallic conductors

- | | | |
|-------------|---------|------------|
| ▪ Silver | ▪ Zinc | ▪ Lead |
| ▪ Copper | ▪ Brass | ▪ Tungsten |
| ▪ Gold | ▪ Tin | ▪ Steel |
| ▪ Aluminium | ▪ Iron | ▪ Mercury |

Non-metallic conductors

- Graphite (carbon)
- Wet wood

Liquid conductors /electrolytes

What is an electrolyte?

This is a liquid or gel that can conduct electricity

- | | |
|----------------------------------|---------------------------|
| ▪ Dilute acids | ▪ Alkalies |
| ▪ Hard water (undistilled water) | ▪ Lemon juice |
| ▪ Salt solution | ▪ Ammonium chloride paste |

Examples of dilute acids used as electrolytes

- | | |
|----------------------------|----------------------|
| ▪ Dilute sulphuric acid | ▪ Dilute nitric acid |
| ▪ Dilute hydrochloric acid | ▪ Dilute citric acid |

NOTE

- Hard water is a good conductor of electricity but poor conductor of heat
- All metals conduct electricity except **bismuth**
- Wet wood is a good conductor of electricity because **it contains mineral salts**
- **Silver** is the best conductor of electricity, followed by pure copper, gold and then aluminium
- Copper, silver and aluminium are used **to make electric wires**

Why is hard water called an electrolyte?

- It has mineral salts that conduct electricity

Why are silver and gold not commonly used conductors yet they are the best conductors?

- They are very expensive

Give two reasons why copper and aluminium are the most commonly used conductors

- They are cheap
- They are pliable (easily bent)

Give two reasons why most wires that carry electricity to long distances are made out of aluminium

- It is cheap
- It is light

State the main reason why copper wires are not commonly used to conduct electricity to a long distance

- Copper is heavy

Why is gold more desirable than silver in making electricity wires yet silver is the best conductor?

- Gold does not corrode

APPLICATIONS (USES) OF CONDUCTORS

- | | |
|--|------------------------------------|
| ▪ They are used to make electric wires | ▪ They are used to make flat irons |
| ▪ They are used to make cooking utensils | ▪ They are used in welding |

How are conductors useful at school?

- Metallic wires are used to carry electricity from one point to another
- Metallic saucepans and kettles are used for cooking

ELECTRIC INSULATORS

- These are materials which do not allow electricity to pass through them
- ✓ They are also called **poor/bad conductors of electricity**

Why can't insulators conduct electricity even in molten?

- They do not have free moving electrons (they have fixed electrons)

Examples of insulators of electricity

- | | | |
|---------------|-------------|------------------------|
| ▪ Rubber | ▪ Dry paper | ▪ Gold |
| ▪ Dry wood | ▪ Porcelain | ▪ Silk |
| ▪ Plastic | ▪ Ceramic | ▪ Distilled/pure water |
| ▪ Air | ▪ Diamond | ▪ Quartz |
| ▪ Cotton wool | ▪ Asbestos | |
| ▪ Dry clothes | ▪ Glass | |
- ✓ **Diamond** is a bad conductor of electricity **but** a good conductor of heat

Why is distilled water regarded as a non-electrolyte (Why can't pure water conduct electricity)?

- It lacks mineral salts

A dry cloth is an insulator of electricity. Why does it conduct electricity when soaked in tap water?

- Tap water contains mineral salts

APPLICATIONS (USES) OF INSULATORS

- They are used to cover electric wires
- ✓ To prevent short circuits
- ✓ To prevent electric shocks
- They are used to make handles of flat irons
- They are used to make handles of electric cooking utensils
- They are used to make electric plugs and sockets

Why do electricians wear rubber gloves?

- To prevent electric shocks (electrocution)

PORCELAIN

- This is a white clay-like substance

Products from porcelain

- Electric plugs
- Electric sockets
- Handles of electric kettles
- Lamp holders

Why are parts of some electric devices made out of porcelain?

- To prevent electric shock

ELECTRIC PLUGS AND SOCKETS:

ELECTRIC SOCKET

- This is an opening in which a plug is fitted

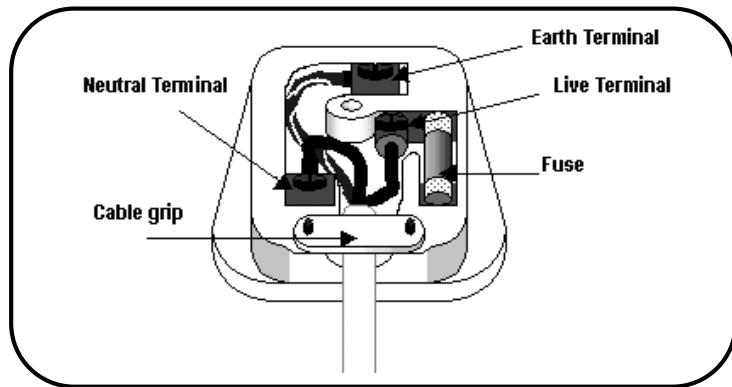
TYPES OF ELECTRIC PLUGS

- Two pin plug
- Three pin plug
- ✓ A three pin plug has a fuse while a two pin plug has no fuse

THREE PIN PLUG

- It has a fuse, neutral wire pin, live wire pin and the earth wire pin

A diagram showing the three pin plug



FUNCTION OF EACH COMPONENT OF THE THREE PIN PLUG

Live wire pin (live terminal)

- It is where live wire is connected

Neutral wire pin (neutral terminal)

- It is where neutral wire is connected

Earth wire pin (earth terminal)

- It is where earth wire is connected

Fuse

- It breaks the circuit at one's will

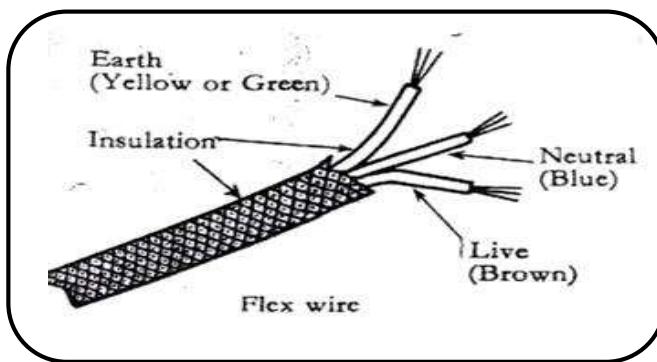
Cable grip

- It holds the wires in one position

Appliances which use three pin plug

- Flat iron
- Electric cooker
- Water heater
- Hot plate
- Electric kettle/percolator
- Refrigerators

A DIAGRAM SHOWING A CONDUCTING WIRE/FLEX WIRE/ELECTRIC CABLE)



LIVE WIRE

- ✓ It is **red** or **brown** in colour
- It carries electricity from the source to the appliance

NEUTRAL WIRE

- ✓ It is **blue** or **black** in colour
- It carries electricity from the appliance back to the source

EARTH WIRES

- ✓ It is **yellow or green** in colour
- It carries electricity into the ground to prevent electric shocks
- It prevents leakage of electric leakage to prevent electric shocks

INSULATOR

- It prevents short circuit
- It prevents electric shock

ELECTRIC CELLS

- These are devices that store and produce electricity
- ✓ They store chemical energy

State the energy change that occurs in electric cells.

- Chemical energy changes to electric energy

What type of current electricity is produced by electric cells?

- Direct current electricity

TYPES OF ELECTRIC CELLS

- Primary cells
- Secondary cells

PRIMARY CELLS

- These are electric cells that cannot be recharged

Examples of primary cells

- Dry cells
- Simple cells

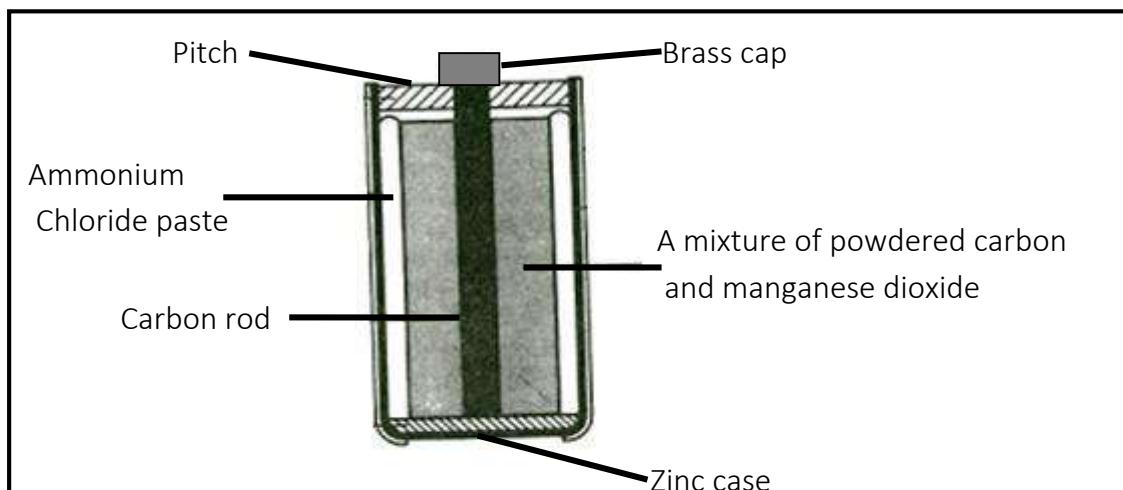
A DRY CELL

- It is a portable primary cell
- It stores chemical energy

Examples of dry cells

- Zinc-carbon dry cell (e.g. in radios)
- Mercury dry cell (e.g. in watches)
- Alkaline dry cell (e.g. in digital cameras)

A DIAGRAM OF A DRY CELL



Brass cap

- It acts as contact for the positive terminal

Zinc case

- It acts as the negative terminal (anode)
- It holds the content of the dry cell

Pitch (top seal)

- It prevents the electrolyte (jelly) from drying up

Ammonium chloride paste

- It acts as the electrolyte (It helps in transfer of electrons)

Why are dry cells less prone to leaking?

- They have low moisture electrolyte

Carbon rod

This is a non-metallic conductor of electricity in a dry cell.

It is made from **graphite**.

- It acts as the positive terminal (cathode)
- It conducts electricity

Manganese dioxide

- It prevents polarization (It acts as a depolarizing agent)

Why do dry cells leak when exhausted?

- Due to polarization

Why are dry cells just thrown when exhausted?

- They cannot be recharged
- The chemical energy in dry cells cannot be recharged

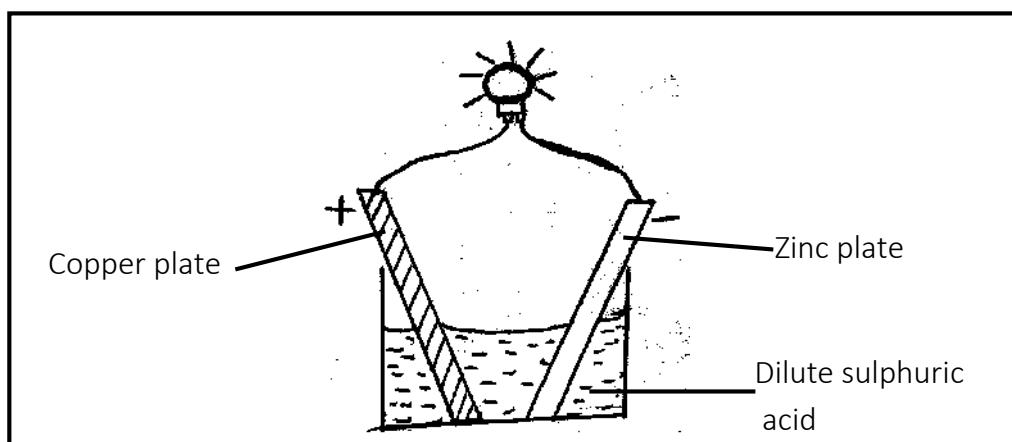
Functions of carbon powder in the dry cell

- It retains moisture of electrolyte
- It increases electrical conductivity of manganese (IV) oxide

A SIMPLE CELL (WET CELL)

- This is a primary cell made by dipping copper and zinc plates into dilute sulphuric acid.
- ✓ It converts chemical energy into electric energy

A DIAGRAM SHOWING A SIMPLE CELL



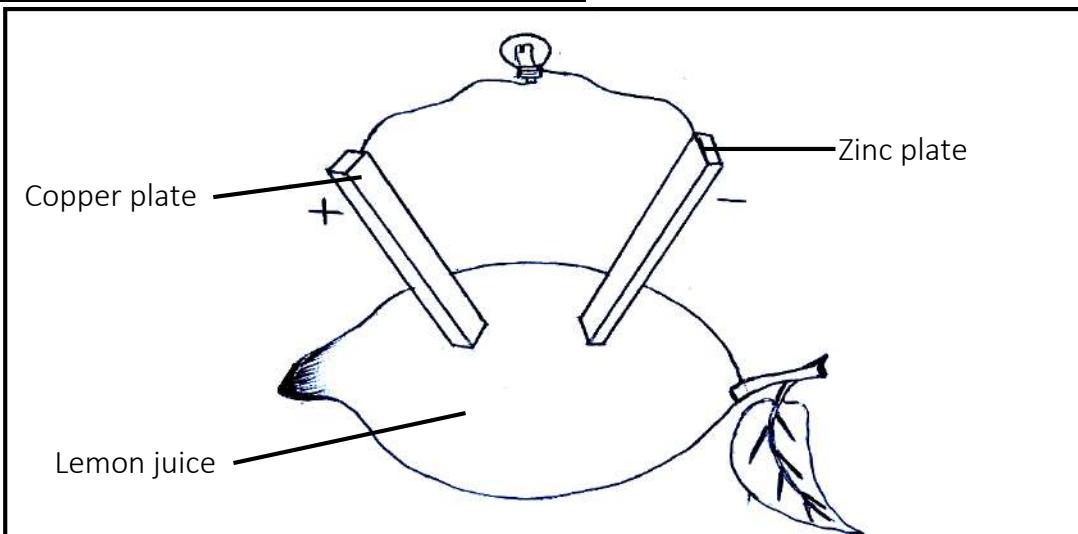
Fruits that can be used to make a simple cell at home

- Lemon fruit
- Lime fruit
- Orange fruit
- Grape fruit

A LEMON SIMPLE CELL

- It consists of a lemon fruit and two electrodes of different metals

A DIAGRAM SHOWING A LEMON SIMPLE CELL



Copper plate

- It acts as the positive terminal (cathode)

Zinc plate

- It acts as the negative terminal (anode)

Dilute sulphuric acid/lemon juice acid

- It acts as an electrolyte
- An electrolyte helps in the transfer of electrons

Bulb

- It produces light

ELECTROLYTE

- This is a liquid or gel that can conduct electricity

ELECTROLYTES USED IN PRIMARY CELLS

- Dilute sulphuric acid
- Lemon juice acid (citric acid)
- Ammonium chloride paste

What enables lemon fruit to conduct electricity?

- It contains lemon juice acid

Why is the electrolyte in a simple cell always put in glass container?

- To prevent an acid from destroying the container (to resist corrosion by an acid)

ELECTRODE

- This is a piece of metal that conducts electricity when put in an electrolyte
- ✓ The negative electrode is called **anode**
- ✓ The positive electrode is called **cathode**

ELECTRODES USED IN PRIMARY CELLS

i) Dry cell

- Copper plate
- Zinc plate

ii) Simple/wet cell

- Carbon rod
- Zinc case

DEFECTS OF SIMPLE CELLS (FACTORS THAT AFFECT THE EFFICIENCY OF SIMPLE CELLS)

- Polarization
- Local action

1. POLARIZATION

- This is when bubbles of hydrogen gas cover the copper plate and stop the flow of electrons

How can polarization be minimized?

- By brushing off bubbles of hydrogen gas
- By adding potassium dichromate in an acid

2. LOCAL ACTION

- This is when bubbles of hydrogen gas come out of the zinc plate.

How can local action be minimized?

- By coating the zinc plate with mercury

ADVANTAGES OF DRY CELLS TO WET CELLS

- Dry cells are portable while wet cells are bulky
- Dry cells produce more electricity than wet cells
- Dry cells produce electricity for a longer time than wet cells
- Dry cells can be used in all directions while wet cells can be used in upright direction only
- Dry cells do not leak while wet cells leak

DISADVANTAGES OF PRIMARY CELLS (DRY CELLS AND SIMPLE CELLS)

- They cannot be recharged
- They produce low voltage

SECONDARY CELLS:

- These are electric cells which can be recharged
- ✓ Secondary cells store **chemical energy**

State the energy change that occurs in a working secondary cell

- Chemical energy changes to electrical energy

Examples of secondary cells

- Car battery (Lead acid battery)
- Telephone battery (Lithium-ion/Li-ion battery)
- Solar battery (solar cells)
- Nickel cadmium battery

A car battery has voltage of **12 volts**

SIMILARITIES BETWEEN PRIMARY CELLS AND SECONDARY CELLS

- Both store chemical energy
- Both produce electricity

DIFFERENCES BETWEEN PRIMARY CELLS AND SECONDARY CELLS

- Secondary cells can be recharged while primary cells cannot be recharged
- Secondary cells produce more electricity than primary cells
- Secondary cells consist of many cells while primary cells consist of one cell
- Secondary cells last longer than primary cells

CALCULATIONS ABOUT VOLTAGE

- A dry cell has a voltage of **1.5 volts**
- A car battery has voltage of **12 volts**

Example I

Kato's radio uses seven dry cells. Find the voltage needed if he is to use it to listen to news.

$$\begin{aligned} \text{1 dry cell} &= \text{1.5 volts} \\ \text{7 dry cells} &= 7 \times 1.5 \text{ Volts.} \\ &= \text{10.5 volts} \end{aligned}$$

Example II

If a torch uses 2 dry cells, calculate its voltage.

$$\begin{aligned} \text{1 dry cell} &= \text{1.5 Volts} \\ \text{2 dry cells} &= 2 \times 1.5 \text{ Volts.} \\ &= \text{3 Volts} \end{aligned}$$

Example III

A torch uses 9 Volts. Find the number of dry cells required to light its bulb.

$$\begin{aligned} \text{1.5 V} &= \text{1 dry cell} \\ \text{9 V} &= 9 \div \text{15 dry cells} \\ &\quad \frac{10}{15} \\ &= \frac{9 \times 10}{15} \text{ dry cells} \\ &= \text{6 dry cells} \end{aligned}$$

Example IV

A radio uses 24 Volts. How many pairs of dry cells does it use?

$$\begin{aligned} \text{24 V} &= \text{1 dry cell} \\ \text{24 V} &= 24 \div \text{15 dry cells} \\ &\quad \frac{10}{15} \\ &= \frac{24 \times 10}{15} \text{ dry cells} \\ &= \frac{8}{2} \text{ dry cells} \\ &= \text{4 pairs of dry cells} \end{aligned}$$

Activity

1. A radio uses 5 dry cells. Calculate the voltage used by a radio.
2. A torch uses 15V. Calculate the number of dry cells needed to light the torch.
3. A pair of dry cells costs sh.1600. How much money is needed to buy dry cells for a radio that uses 15 volts?

AN ELECTRIC BULB

- This is a device that changes electrical energy to heat and light energy

State the energy change that occurs in an electric bulb

- Electrical energy changes to heat and light energy

Write down three energy changes that can occur in an electric bulb

- Electrical energy changes to heat energy
- Heat energy changes to light energy
- Electrical energy changes to light energy

TYPES OF ELECTRIC BULBS

- Incandescent bulbs
- LED bulbs/Energy saving bulbs
- Fluorescent bulbs

What does LED stand for?

- Light Emitting Diode

Advantages of using LED bulbs

- They use less electricity
- They last longer
- They produce bright light

Disadvantage of using LED bulbs

- They are expensive to buy

Advantage of using incandescent bulbs

- They produce both heat and light

Disadvantage of using incandescent bulbs

- They use a lot of electricity
- They do not last longer

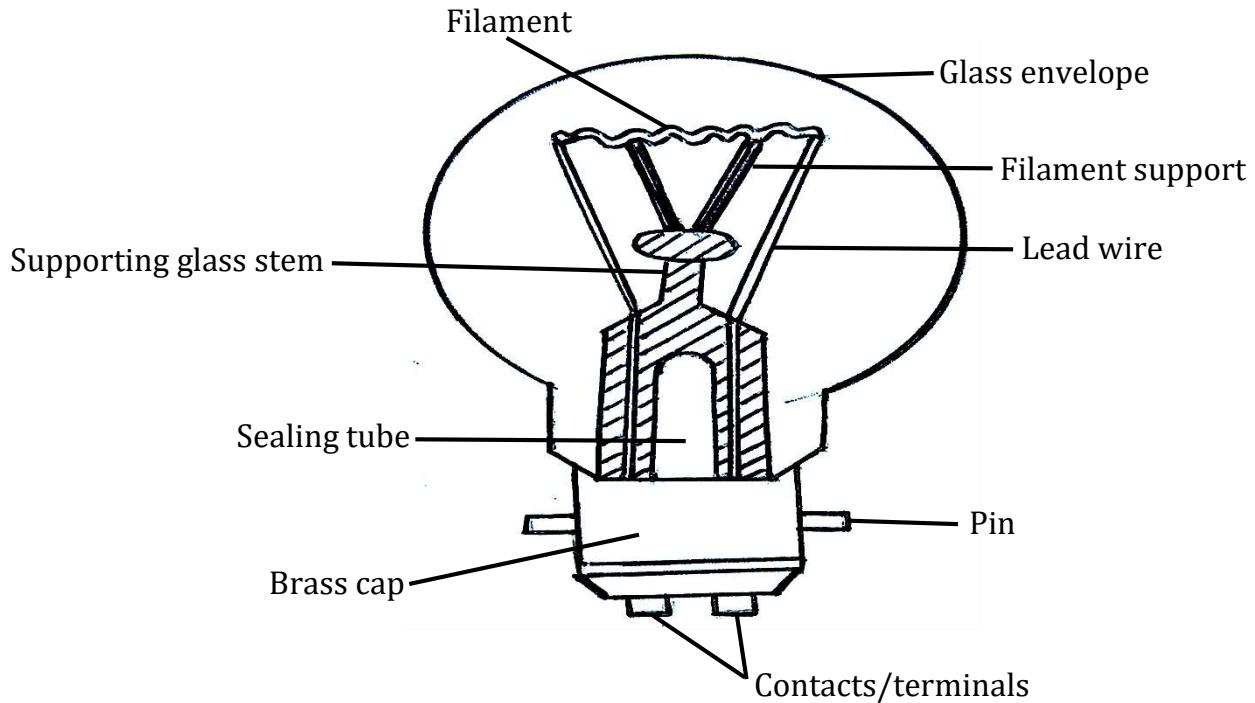
Advantages of using fluorescent bulbs

- They produce bright light
- They last longer

Disadvantages of using Fluorescent bulbs

- They are expensive to buy
- They contain mercury which is poisonous

A DIAGRAM SHOWING AN ELECTRIC (INCANDESCENT) BULB



IMPORTANCE OF EACH PART OF AN ELECTRIC BULB

Glass envelope

- It protects the inner parts of an electric bulb
- It keeps gases put inside the bulb

Why does a hot electric bulb break when cold water is poured on it?

- It is due to sudden contraction

Why is the glass envelope made transparent?

- To allow out light

Name two gases commonly used in electric bulbs

- Argon
- Nitrogen

Other rare/noble/inert gases used in electric bulbs

- | | |
|-----------|----------|
| ▪ Neon | ▪ Helium |
| ▪ Xenon | ▪ Radon |
| ▪ Krypton | |

What type of gas is commonly filled in light bulbs?

- Inert gas (noble/rare gas)

Apart from rare gases, name other gas used in electric bulbs

- Nitrogen

Functions of gases (argon and nitrogen) put in electric bulbs

- To prevent the filament from burning up
- To prevent blackening of the glass envelope

How are the gases (argon and nitrogen) put in electric bulbs adapted to their function?

- They are non-reactive

What happens to the electric bulb when the gases put inside it are used up?

- The filament burns up
- The glass envelope blackens

Lead wire

- It conducts/takes electricity to the filament

Filament:

- It changes electrical energy to heat and light energy

Adaptations of the filament to its function

- It has high melting point
- It is coiled to increase electrical resistance

Why is the filament of an electric bulb made of a thin coiled wire?

- To increase electrical resistance

Name the metal from which the filament is made.

- Tungsten

Name the mineral from which the filament is obtained.

- Wolfram

Why is the filament of electric bulb made from tungsten?

- It has a high melting point

Why is the filament made a metal with high melting point?

- To prevent burning up when heated to very high temperatures

What energy change occurs on the filament of an electric bulb?

- Electrical energy changes to heat and light energy

Write down two energy changes that occur in the filament of an electric bulb

- Electrical energy changes to heat energy
- Heat energy changes to light energy

The diagrams below show electric bulbs. Use them to answer questions.



Which of the bulbs above will produce brighter light?

- Bulb X

Give a reason for your answer in (a) above

- Bulb X has more filament coils than bulb Y

Which of the bulbs above will produce dim light?

- Bulb Y

Give a reason for your answer in (c) above

- Bulb Y has less filament coils than bulb X

NOTE

- An electric bulb with more filament coils produces brighter light than an electric bulb with less filament coils

Filament support

- It holds the filament

Supporting glass stem

- It holds the filament support

Terminals/contacts

- They allow electricity into the bulb

Sealing tube

- It prevents oxygen from entering the bulb

Cement

- It fixes the sealing tube in the brass cap

Brass cap

- It enables the bulb to be fixed in the lamp holder

Pins

- They hold the bulb in the lamp holder

Insulating material

- It separates the terminals

FACTORS THAT CAN MAKE AN ELECTRIC BULB FAIL TO WORK

- When the bulb/filament has blown
- When the dry cells are arranged poorly
- When the bulb is not well fixed
- When the circuit is not complete
- When the dry cells are used up/exhausted

FACTORS THAT CAN MAKE A LIGHTING BULB STOP LIGHTING

- When the filament blows
- When the dry cells are used up/exhausted
- When the fuse melts
- When the switch is opened

A TORCH (ELECTRIC TORCH)

- Most torches use dry cells.
- The dry cells in a torch are arranged in series

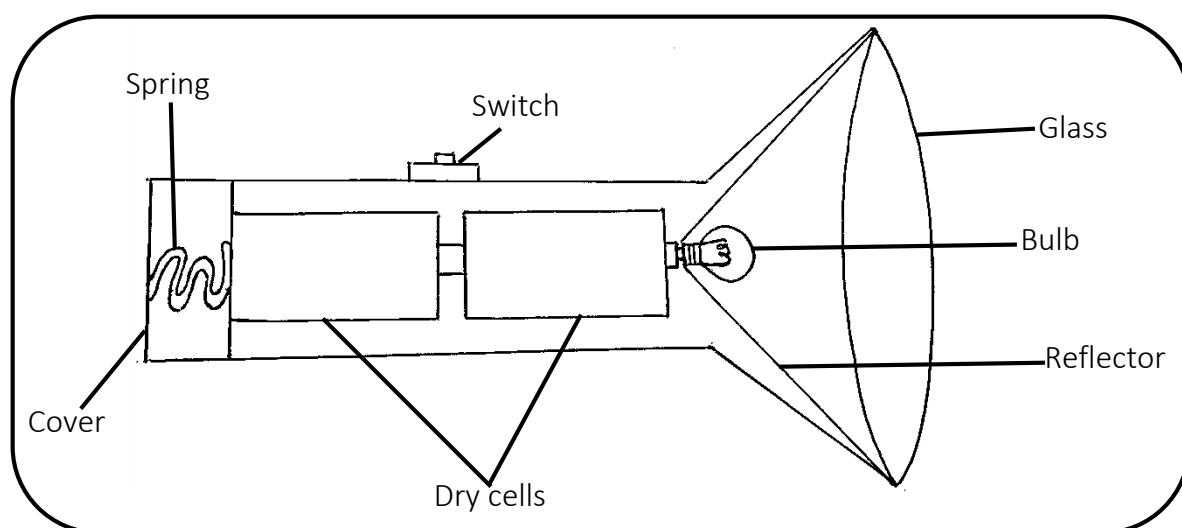
On which principle does a torch work?

- Electricity flows in a complete circuit

Why does a torch has no fuse?

- It uses low voltage

A DIAGRAM SHOWING A TORCH



FUNCTION OF EACH PART OF A TORCH

Glass

- It protects the bulb
- It allows out light

Why is the torch made with a transparent glass?

- To allow out light

Bulb

- It produces light
- It changes electrical energy to heat and light energy

Switch

- It breaks or completes the circuit at one's will

Dry cells

- They produce electricity

What form of energy is stored in a dry cell?

- Chemical energy

State the energy change that occurs in a working dry cell

- Chemical energy changes to electrical energy

Spring

- It keeps the dry cells tightly together
- It acts the contact for the negative terminal contact

Cover

- It prevents the dry cells from falling out

Reflector:

- It directs lights into a diverging beam

Metallic plate (conductor)

- It transmits electrons to the bulb

Factors that can make a torch fail to work

- When the dry cells are arranged poorly
- When the spring is rusty
- When the bulb is fixed loosely
- When the dry cells are used up (exhausted)
- When the bulb uses a higher voltage than the dry cells can produce
- When the bulb is blown

Factors that can make a working torch to go off

- When the bulb blows
- When the dry cells are used up

OTHER DEVICES RELATED TO ELECTRICITY

- Generator
- Dynamo
- Electric motor
- Transformer

Devices that change mechanical energy to electrical energy

- Generator
- Dynamo
- Alternator

GENERATOR

- This is a device that burns fossil fuels to produce thermal electricity

How does a generator produce electricity?

- By changing mechanical energy (kinetic energy) to electrical energy

State the energy change that occurs in a generator

- Mechanical energy (kinetic energy) is changed to electrical energy

How does a generator change mechanical energy to electrical energy?

- By rotating coils of wire in a strong magnetic field

State the function of the magnet in a generator?

- It changes mechanical energy to electrical energy

WAYS OF MAKING A GENERATOR PRODUCE MORE ELECTRICITY

- By increasing the number of turns in the coil
- By increasing the speed of rotation
- By increasing the magnetic field/increasing the strength of a magnet

EXAMPLES OF FUELS USED IN A GENERATOR

- Petrol
- Diesel

Uses of a generator

- It produces electricity for lighting
- It produces electricity for cooking
- It produces electricity to run machines

On which principle does a generator work?

- Electromagnetic induction

What form of electricity is produced by a generator?

- Thermal electricity

What type of current electricity is produced by a generator?

- Alternating current electricity (A.C)

DYNAMO

- A dynamo produces electricity by changing mechanical energy to electrical energy.
- It uses a **permanent magnet** that rotates around a coil of copper wire

On which principle does a dynamo work?

- Electromagnetic induction

State the energy change that occurs in a dynamo.

- Mechanical energy changes to electrical energy

How does a bicycle tyre help in production of electricity using a dynamo?

- It turns the dynamo knob connected to a permanent magnet to produce electricity

WAYS OF MAKING A DYNAMO PRODUCE MORE ELECTRICITY

- By increasing the speed of rotation
- By increasing the number of turns in the coil

What advice can you give to a bicyclist to make the bicycle headlamp connected to a dynamo produce brighter light?

- I would advise the bicyclist to increase the speed of rotation (to ride faster)

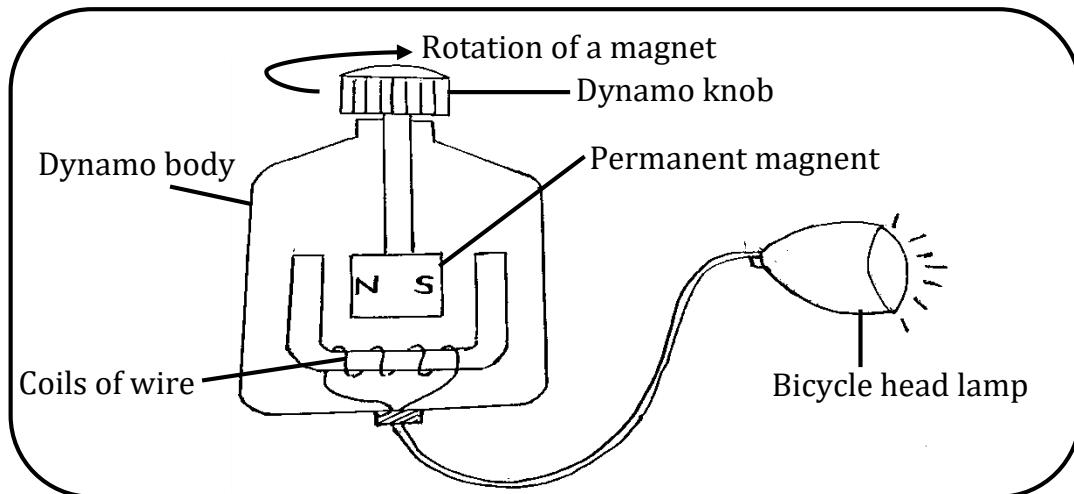
USES OF DYNAMOS

- They produce electricity to light bicycle headlamps
- They help to charge batteries in vehicles.

What type of current electricity is produced by a dynamo?

- Direct current electricity (D.C)

A DIAGRAM SHOWING A DYNAMO



SIMILARITIES BETWEEN A GENERATOR AND A DYNAMO.

- Both change mechanical energy to electrical energy
- Both work on the principle of electromagnetic induction

In which way is a dynamo similar to a generator?

- A dynamo produces direct current electricity while a generator produces alternating current electricity

ELECTRIC MOTOR (MOTOR)

- This is a device that changes electrical energy to mechanical energy

State the energy change that occurs in an electric motor

- Electrical energy changes to mechanical energy

Examples of devices that use electric motors

- | | |
|-------------------|-------------------|
| ▪ Electric fan | ▪ Cassette player |
| ▪ Juice blender | ▪ Milling machine |
| ▪ Washing machine | ▪ Electric car |
| ▪ CD player | |

USES OF MOTORS IN OUR DAILY LIFE

- They are used to start some car engines
- They are used in electric fans
- They are used in CD players
- They are used in juice blenders
- They are used in milling machines
- They are used in cassette players

How does a motor differ from a dynamo/generator/alternator?

- A motor changes electrical energy to mechanical energy while a dynamo/generator changes mechanical energy to electrical energy

TRANSFORMER

- This is a device that increases or reduces electricity/voltage in an area

A SYMBOL SHOWING A TRANSFORMER



Function of a transformer

- It steps up or down electricity in an area
- It increases or reduces electricity in an area

TYPES OF TRANSFORMERS

- Step up transformer
- Step down transformer

STEP UP TRANSFORMER

- It increases electricity in an area

STEP DOWN TRANSFORMER

- It reduces electricity in an area

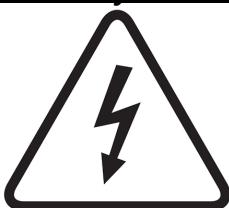
A SYMBOL SHOWING THE DANGER OF ELECTRICITY



Why is the symbol shown above put on electric poles?

- To warn people against the danger of electricity

The symbol below is related to electricity. Use it to answer questions.



What does this symbol show about electricity?

- High voltage

State the purpose of putting the above symbol on high voltage electrical devices and electric poles with high voltage cables?

- To warn people against the risk of electric shock (electrocution)

SAFETY PRECAUTIONS WHEN HANDLING ELECTRICITY AND ELECTRICAL APPLIANCES

- Electric wires should be well insulated
- Electric repairs should be done by experts
- Never touch a naked live wire
- Never urinate on electric wires
- Never push metallic objects into electric sockets
- Never touch an electric wire that has fallen from electric poles
- Avoid overloading the circuit
- Never touch working electric devices with wet hands.
- Never play with electricity from main power lines
- Never stand under a tree during thunderstorm

ELECTRIC APPLIANCE

- This is a device that uses electricity to work.

DOMESTIC DEVICES THAT USE ELECTRICITY (ELECTRIC APPLIANCES)

- | | | |
|----------------------|-----------------------|-------------------|
| ▪ Electric flat iron | ▪ Electric flat iron | ▪ Electric cooker |
| ▪ Refrigerator | ▪ Electric fan | ▪ Electric kettle |
| ▪ Water heater | ▪ Electric charger | ▪ Microwave oven |
| ▪ DVD player | ▪ Electric hair dryer | ▪ Electric bulb |
| ▪ Television | ▪ Air conditioner | ▪ Juice blender |
| ▪ Computer | ▪ Electric torch | ▪ Washing machine |

ENERGY TRANSFORMATIONS RELATED TO ELECTRICITY

ELECTRIC APPLIANCES	ENERGY CHANGE
▪ Flat iron ▪ Electric cooker ▪ Water heater ▪ Hot plate ▪ Electric kettle/percolator	Electrical energy changes to heat energy
❖ Dry cell ❖ Wet cell ❖ Car battery ❖ Telephone battery ❖ Solar battery	Chemical energy changes to electrical energy
✓ Electric bulb	Electrical energy changes to heat and light energy
● Generator ● Dynamo ● Alternator	Mechanical energy changes to electrical energy (kinetic energy changes to electrical energy)
➢ Electric motor ➢ Electric fan ➢ Washing machine ➢ Juice blender	Electrical energy changes to mechanical energy (electrical energy changes to kinetic energy)
⇒ Solar cell (solar panel)	Light energy from sun changes to electrical energy (sunlight changes to electrical energy)
➲ Loudspeakers ➲ Electric bell	Electrical energy changes to sound energy
➲ Microphone	Sound energy changes to electrical energy

ELECTRICITY IN UGANDA

- It is monitored by **Electricity Regulatory Authority (ERA)**
- ERA replaced **Uganda Electricity Board (U.E.B)**

RESPONSIBILITIES OF ERA

- It gives licenses to companies that generate and sell electricity in Uganda
- It supervises the quality of electricity generated
- It monitors the generation, transmission and distribution of Electricity in Uganda

AIMS/OBJECTIVES OF ERA

- To conserve the environment through rural electrification
- To promote industrialization in villages

ROLES OF COMPANIES THAT WERE FORMED AFTER PRIVATIZING U.E.B

1. UGANDA ELECTRICITY GENERATION COMPANY LIMITED (U.E.G.C.L)

- It generates hydroelectricity in Uganda

2. UGANDA ELECTRICITY TRANSMISSION COMPANY LIMITED (U.E.T.C.L)

- It transmits electricity from the main source to other parts of Uganda
- It exports Uganda's electricity to some countries

How is electricity generated at Jinja transmitted to other parts of Uganda?

- Through electric cables

3. UGANDA ELECTRICITY DISTRIBUTION COMPANY LIMITED (U.E.D.C.L)

- ✓ U.E.D.C.L is now called **UMEME LTD**
- It connects customers to electricity poles
- It distributes electricity bills to customers
- It disconnects defaulters
- It recommends new customers to get electricity

PROBLEMS FACED BY UMEME LTD

- Some people steal electricity wires
- Some people steal oil from transformers
- Some people burn bushes and destroy electricity poles
- Some UMEME officers are corrupt
- Some customers bypass the electricity meter to give wrong readings
- Some people illegally loop electricity from electric wires on poles

How do the electricity companies in Uganda work?

- U.E.T.C.L buys electricity from U.E.G.C.L and sells it to UMEME LTD
- U.E.G.C.L sells its electricity to U.E.T.C.L which then sells it to UMEME LTD

What do we call the extension of electricity to villages?

- Rural electrification

How does rural electrification conserve the environment?

- It reduces deforestation for wood fuel

TOPIC: MAGNETISM

MAGNETISM

- This is the force that enables a magnet to attract magnetic substances

MAGNET

- This is a material that can attract magnetic substances

MAGNETIC MATERIALS

- These are materials that can be attracted by a magnet.

EXAMPLES OF MAGNETIC MATERIALS

- Iron
- Cobalt
- Steel
- Nickel

I Can See Now

Uses of magnetic materials

- They are used to make magnets

NON MAGNETIC MATERIALS

- These are materials that cannot be attracted by magnets

Examples of non-magnetic materials

- | | | |
|-----------|------------|----------|
| ▪ Rubber | ▪ Glass | ▪ Silver |
| ▪ Plastic | ▪ Cloth | ▪ Brass |
| ▪ Wood | ▪ Aluminum | |
| ▪ Paper | ▪ Copper | |

How can a person separate a mixture of iron filings and maize flour?

- By using a magnet

Why is it difficult to separate iron from steel using a magnet?

- Both are magnetic materials

How can a person make use of a magnet to identify pure gold?

- Pure gold is repelled by a magnet

POLES OF A MAGNET (MAGNETIC POLES)

- These are regions at the ends of a magnet where magnetism is concentrated (strongest)

Name the two magnetic poles

- North Pole
- South Pole

A DIAGRAM SHOWING THE TWO POLES OF A MAGNET



- ✓ North Pole is sometimes painted **red** and South Pole is sometimes painted **blue**

TYPES OF MAGNETS

- Natural magnets
- Artificial magnets

NATURAL MAGNETS

- These are magnets that exist in nature.

Examples of natural magnets

- Earth
- Lodestone (Magnetite)
- ✓ The earth and Lodestone **permanent magnets** in nature

EARTH

- This is a giant magnet with iron in its centre

Why is the earth regarded as a magnet?

- It has the North pole and South pole
- It causes a freely suspended bar magnet to rest in North-South direction

Why can't we feel the earth as a magnet?

- It has a weak magnetic field

LODESTONE

- This was the first magnet to be discovered by people
- It is a natural magnetic rock
- It always points in the North-South direction at rest

Why is lodestone called a magnet?

- It has the North pole and the South pole

ARTIFICIAL MAGNETS

- These are magnets made by people

TYPES/GROUPS OF ARTIFICIAL MAGNETS

- Permanent magnets
- Temporary magnets

PERMANENT MAGNETS

- These are magnets that keep their magnetism for a long time
- Permanent magnets are named according to their shapes

MATERIALS USED TO MAKE PERMANENT MAGNETS

- Steel
- Nickel
- Cobalt

Why is steel used to make permanent magnets?

- Steel is difficult to be demagnetized

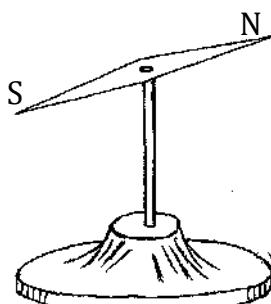
EXAMPLES / TYPES (SHAPES) OF PERMANENT MAGNETS



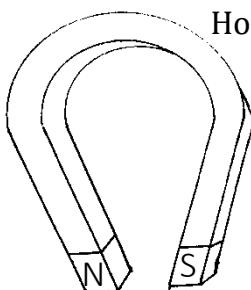
Bar magnet



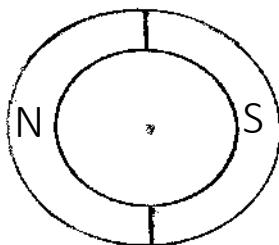
Cylindrical magnet



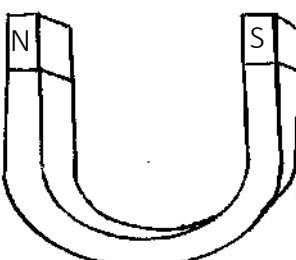
Needle shaped magnet
(magnetic compass needle)



Horseshoe magnet



Ring magnet



U-shaped magnet



A diagram showing the Earth's magnetic field lines. A vertical line represents the Earth's axis. Magnetic field lines emerge from the North Pole (top) and enter the South Pole (bottom). The label "North Pole" is positioned to the left of the top line, and "South Pole" is positioned to the right of the bottom line.

Disc magnet

DEVICES THAT USE PERMANENT MAGNETS

- Dynamo
 - Loudspeaker
 - Refrigerator
 - Microphone
 - Sound amplifier
 - Radio

TEMPORARY MAGNETS

- These are magnets that lose magnetism in a short time
 - ✓ They are commonly made from **soft iron**

Why soft iron is commonly used to make temporary magnets

- Soft iron is easy to be demagnetized

State two examples of temporary magnets

- Electromagnet
 - Induced magnet

Mention one disadvantage of temporary magnets.

- They lose magnetism in a short time

DEVICES THAT USE TEMPORARY MAGNETS

- Electric bell
- Generator
- Electric motor
- Circuit breaker
- Television
- Crane

PROPERTIES OF IRON AND STEEL

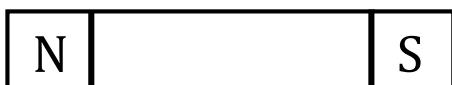
- Iron makes temporary magnets while steel makes permanent magnets
- Iron is easy to magnetize while steel is difficult to magnetize
- Iron loses magnetism in a short time while steel keeps magnetism for a long time

LAW OF MAGNETS (LAW OF MAGNETISM)

- Like poles of magnets repel while unlike poles attract each other

PROPERTIES OF MAGNETS

1. A magnet has two poles, namely; North Pole and South Pole.



2. Magnets are strongest at poles (magnetism is concentrated at the poles)

ILLUSTRATION I

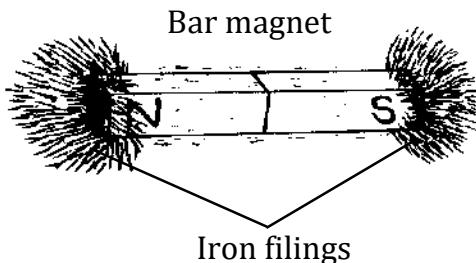
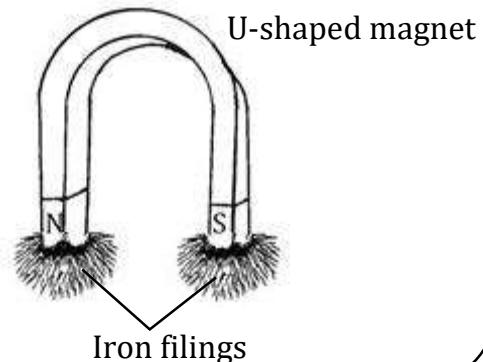


ILLUSTRATION II



3. A freely suspended bar magnet rests in the north-south direction.

ILLUSTRATION I

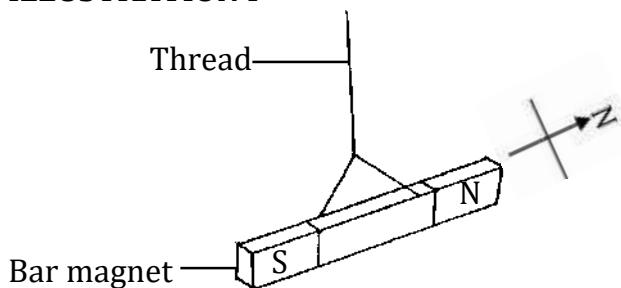
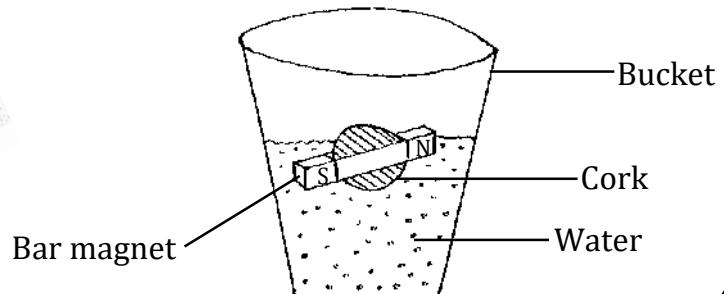


ILLUSTRATION II



IMPORTANCE OF THE PROPERTY OF MAGNETS SHOWN ABOVE

- It is used in a magnetic compass to find directions
- It enables us to name the poles of a magnet

Why does a freely suspended bar magnet rest in North to South direction?

- The north pole of a bar magnet is attracted by the magnetic south pole of the earth and its south pole is attracted by the magnetic north pole of the earth.

Why is the North Pole a bar magnet sometimes called the north-seeking pole?

- It points towards the north when a bar magnet is suspended freely

Why is the South Pole a bar magnet sometimes called the south-seeking pole?

- It points towards the south when a bar magnet is suspended freely

State the importance of a thread in the experiment above.

- It holds the bar magnet when suspended freely

4. Magnetic lines of force run from North Pole to South Pole.

ILLUSTRATION I

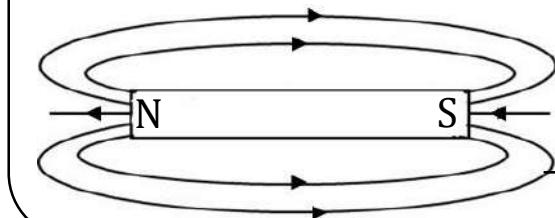
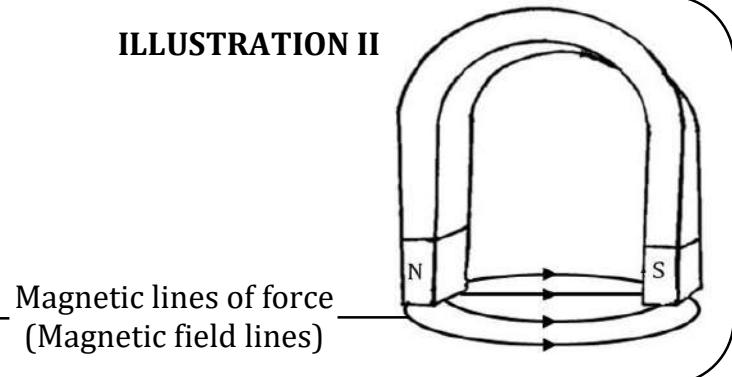


ILLUSTRATION II



Magnetic lines of force
(Magnetic field lines)

5. Like poles of magnets repel.

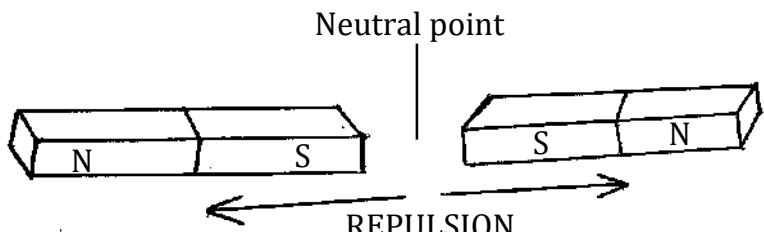
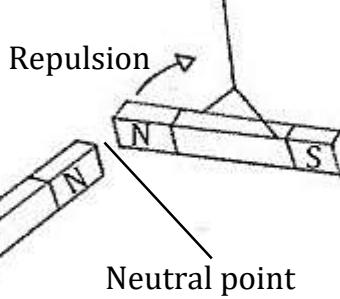


ILLUSTRATION I

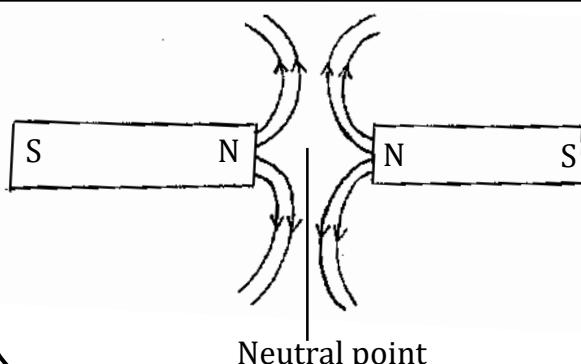


ILLUSTRATION III

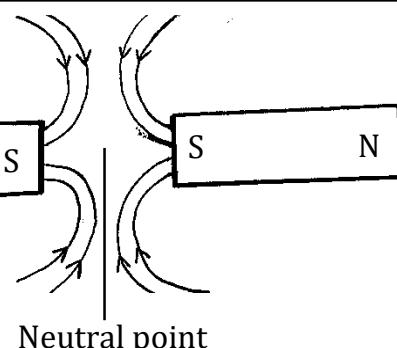


ILLUSTRATION IV

What is a neutral point?

- This is the point where the resultant magnetic field is zero
- This is a point between like poles of magnets at which magnetism is not felt

When does repulsion of magnets occur?

- When like poles of magnets are brought close to each other

6. Unlike poles of magnets attract each other.

ILLUSTRATION I

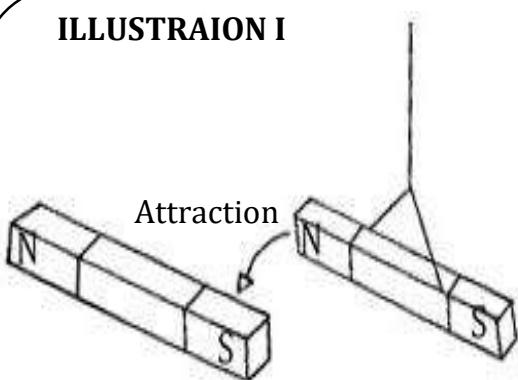


ILLUSTRATION II

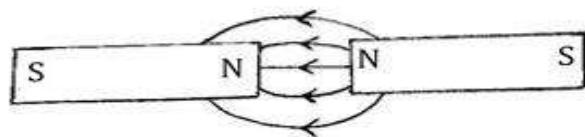
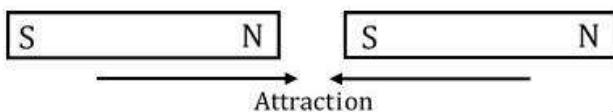


ILLUSTRATION III



When do magnets attract each other?

- When unlike poles of magnets are brought close to each other.

7. Magnetism can pass through non-magnetic materials.

ILLUSTRATION I

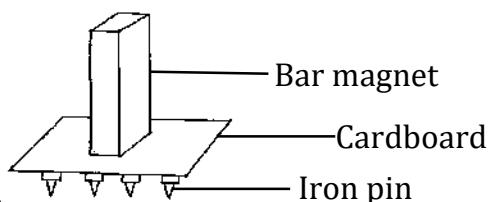
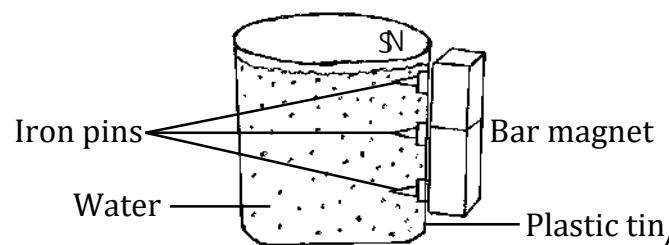


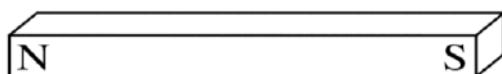
ILLUSTRATION II



IMPORTANCE OF THE PROPERTY OF MAGNETS SHOWN ABOVE

- It enables us to separate magnetic materials from non-magnetic materials
- It enables doctors (oculists) to remove iron bits from the eye of a casualty
- It enables meteorologists to reset Six's thermometer

8. If a magnet is broken into pieces, each piece becomes an independent magnet.



9. Magnets become weaker with age.

How can we prevent magnets from becoming weaker as a result of aging?

- By keeping magnets in iron keepers.

DIAGRAMS SHOWING IRON KEEPER

ILLUSTRATION I

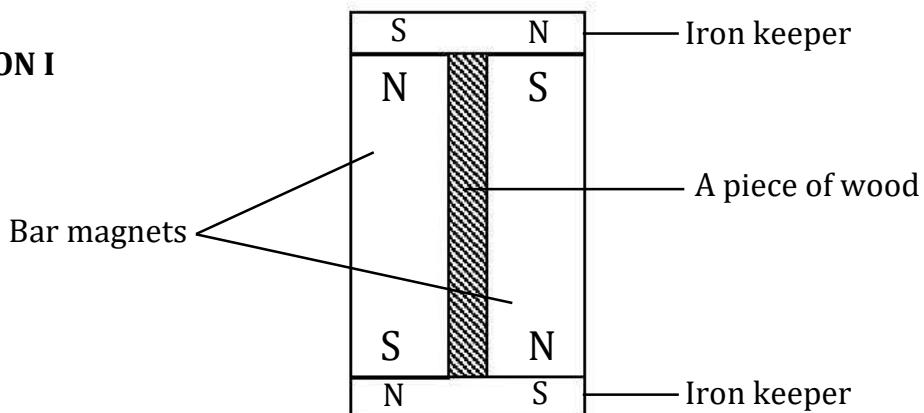


ILLUSTRATION II

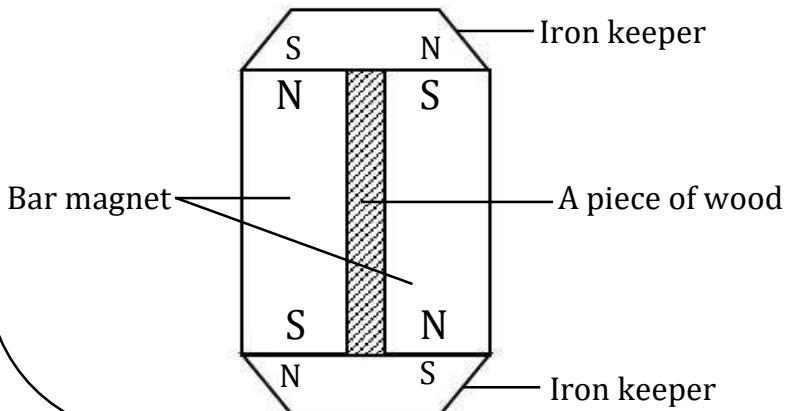
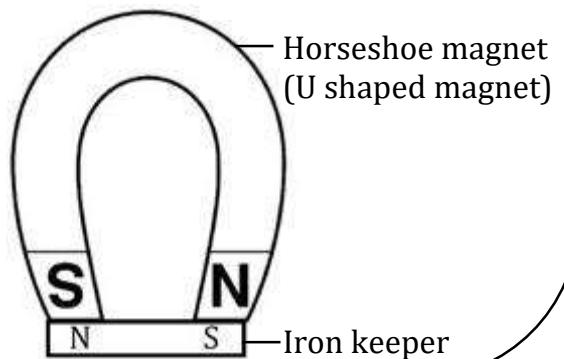


ILLUSTRATION III



State the function of the piece of wood placed between bar magnets.

- To prevent attraction between unlike poles of bar magnets

State the importance of iron keepers.

- They prevent demagnetization

How do iron keepers protect magnets from becoming weaker with age / prevent demagnetization?

- They complete magnetic circuit and preserve strength of the bar magnet
- They become induced magnets and their poles neutralize the poles of the bar magnet

10. Magnetism acts in the magnetic field

MAGNETIC FIELD

- This is the area around a magnet where magnetism acts.
- ✓ A magnet cannot attract a magnetic material outside its magnetic field

MAGNETIC LINES OF FORCE (MAGNETIC LINES OF FORCE)

- These are lines that indicate the direction of magnetic field around a magnet

CHARACTERISTICS OF MAGNETIC FIELD LINES (MAGNETIC LINES OF FORCE)

- They do not intersect (do not cross each other)
- They run from North Pole to South pole

MAGNETISATION

- This is the way of making magnets
- This is the process of turning a magnetic material into a magnet

METHODS OF MAGNETIZATION (WAYS OF MAKING MAGNETS)

- Induction method
- Electrical method
- Stroking method / Touch method

INDUCTION METHOD

- This is the method of making magnets by attaching a magnetic material to a permanent magnet
- ✓ Unlike poles are formed at the ends of the new magnet

Name the magnets made by induction method

- Induced magnets

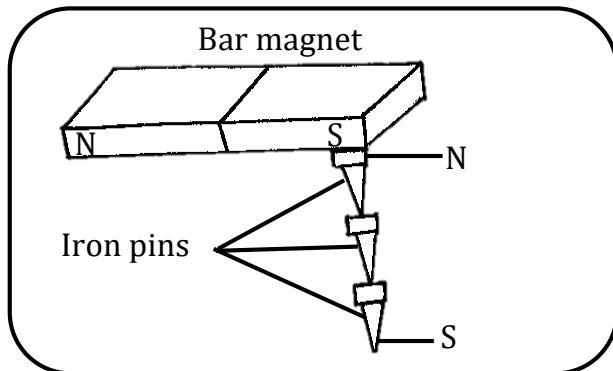
What type of magnets are made by induction method?

- Temporary magnets

Why are induced magnets sometimes regarded as temporary magnets?

- They lose magnetism in a short time

DIAGRAM SHOWING INDUCTION METHOD



How do the iron pins above acquire magnetism?

- By induction

State what will happen to the iron pins when the bar magnet is removed

- The iron pins will fall down / fall off

Give a reason for your answer

- They have lost magnetism

FACTORS THAT AFFECT THE STRENGTH OF INDUCED MAGNETS

- Strength of the permanent magnet (inducing magnet)
- Nature of the magnetic substance
- Distance between the permanent magnet (inducing magnet) and the magnetic substance.

STROKING METHOD

- This is the method of making magnets by rubbing a bar magnet over a magnetic material several times

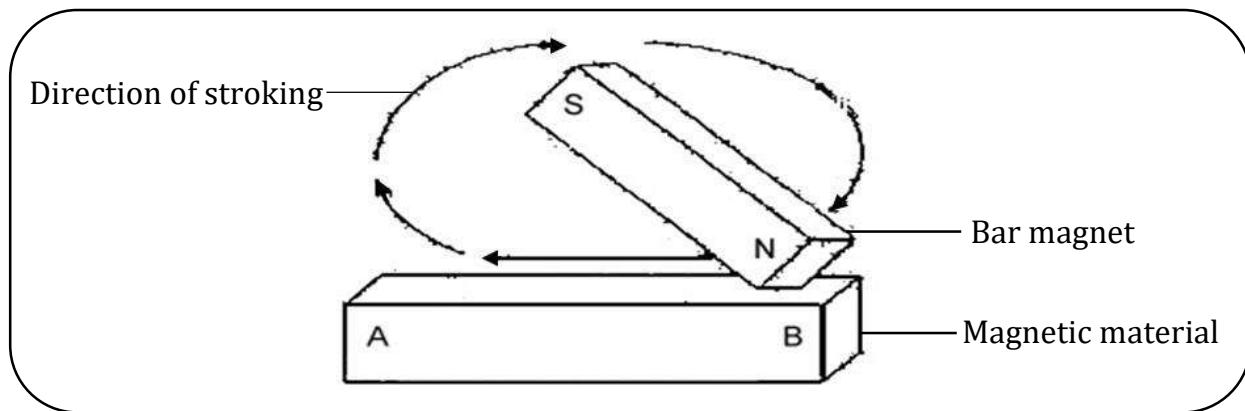
WAYS OF STROKING (METHODS/TYPES OF STROKING)

- Single stroke method/single touch method/single stroking
- Double stroke method/double touch method/double stroking

SINGLE STROKING (SINGLE TOUCH METHOD)

- This is when one pole of a bar magnet is rubbed from end to end of a magnetic material several times in the same direction
- ✓ The end of a magnetic material first stroked becomes the same pole as the magnet used while the end last stroked becomes the opposite pole to that of the magnet used

AN ILLUSTRATION SHOWING SINGLE TOUCH METHOD



Which poles will A and B become after stroking sever times?

- A - South pole
- B - North pole

Why should the stroking pole and direction be maintained?

- To prevent disorganizing the dipoles of a magnet

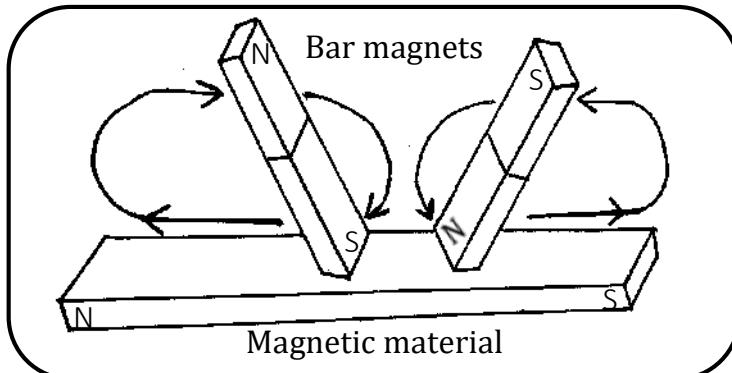
What do arrows in the diagram represent?

- The direction of stroking

DOUBLE STROKING (DOUBLE TOUCH METHOD)

- This is when two bar magnets with different poles exposed and a cork or wood in between are placed in the centre and rubbed over a magnetic material several times
- ✓ In this method, rubbing begins from the centre to the end of a magnetic material.
- ✓ Opposite poles are formed at the ends last touched

A DIAGRAM SHOWING DOUBLE TOUCH METHOD



Name the magnets made by stroking (touch) methods

- Stroked magnets

Why is the magnetic material sometimes placed over two supporting bar magnets during double touch method?

- To increase the strength of magnetization

DISADVANTAGES OF STROKING METHOD

- It is tiring
- It is time consuming / it wastes a lot of time

ELECTRICAL METHOD

- This is a method of making magnets using electricity.

Name the magnets made by electrical method

- Electromagnets

What type of magnets are electromagnets?

- Temporary magnets

How is an electromagnet made?

- By placing a magnetic material (iron or steel bar) in a solenoid with direct current

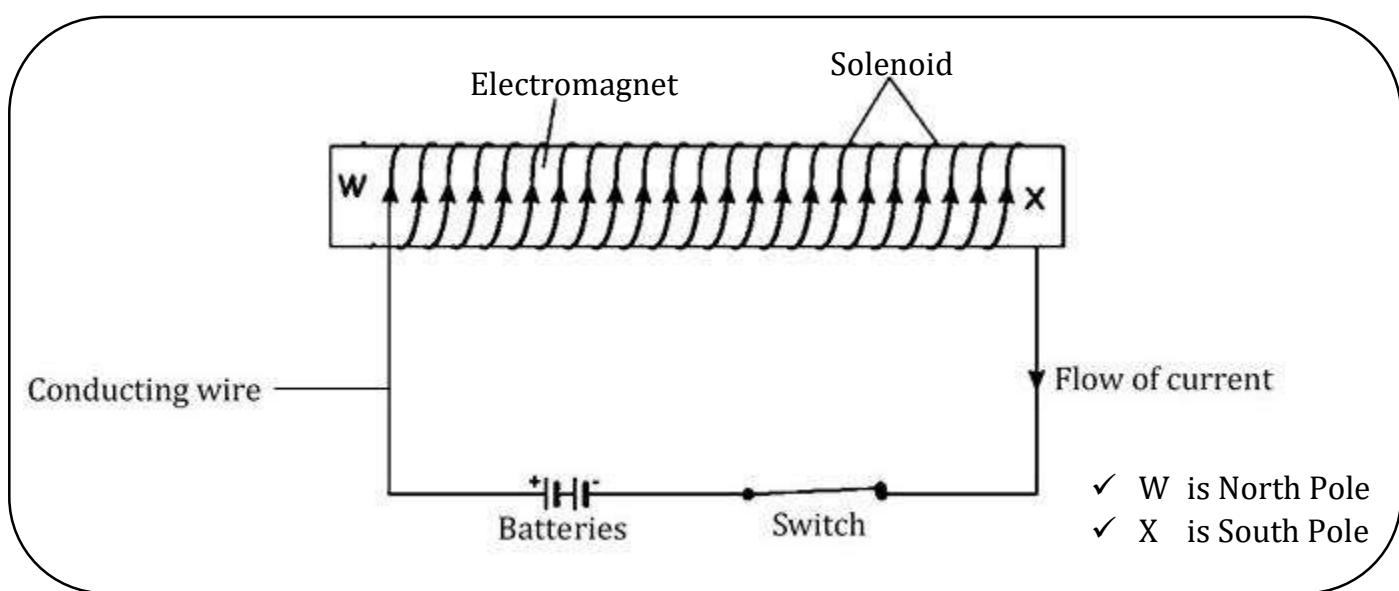
What is a solenoid?

- This is a coil of insulated wires wound on a metal bar

Give a reason why wires of a solenoid should be insulated?

- To prevent short circuits

AN ILLUSTRATION SHOWING ELECTRICAL METHOD OF MAGNETIZATION



How does the iron bar in the solenoid become magnetized?

- When direct current flows through the solenoid

WAYS OF INCREASING THE STRENGTH OF AN ELECTROMAGNET

- Increasing the current or voltage
- Increasing the number of turns in the coil (Adding more coils in the solenoid)
- Using soft iron core in the solenoid (Using soft iron instead of steel in the solenoid)

Advantage of using electrical method of magnetization

- The strength of an electromagnet can be increased

DETERMINING POLARITY OF ELECTROMAGNETS.

1. USING CLOCK RULE:

- If current flows in a clockwise direction into a solenoid, where it enters becomes the South Pole and if it flows in anti-clockwise direction, where it enters becomes the North Pole.

ILLUSTRATION I

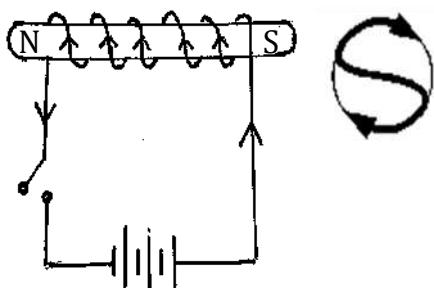
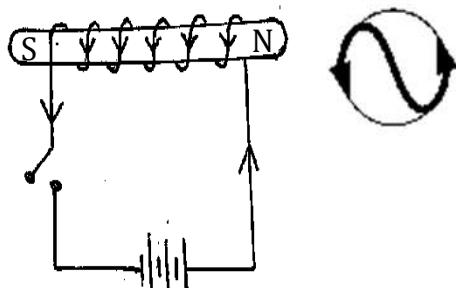


ILLUSTRATION II



2. USING RIGHT HAND RULE:

- If the right hand is wrapped around a magnetic material, the four fingers point to the direction of current flow while the thumb points to the North Pole.

ILLUSTRATION I

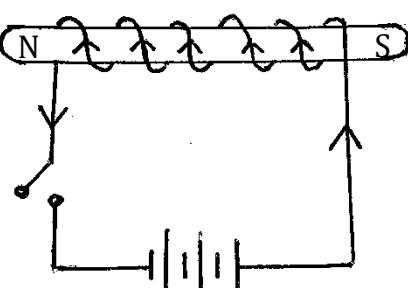


ILLUSTRATION II

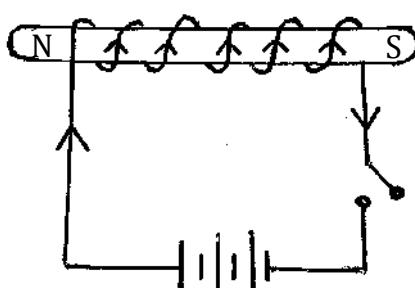


ILLUSTRATION III

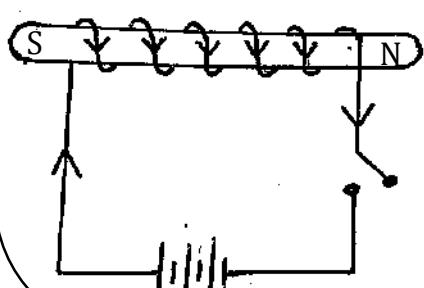
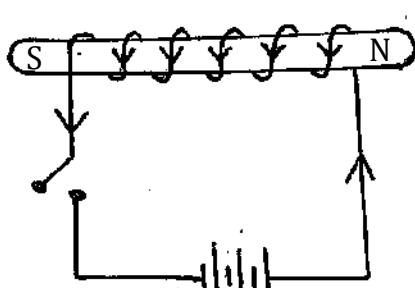


ILLUSTRATION IV



DEVICES THAT USE ELECTROMAGNETS

- Electric bell
- Generator
- Circuit breaker
- Telephone earpiece
- Crane
- Electric motor
- Transformer

USES OF ELECTROMAGNET

- It is used in electric bells
- It is used in cranes to lift magnetic scrap metals
- It is used in electric motors and generators
- It is used in circuit breakers
- It is used in telephone earpiece

What type of current electricity is used to make electromagnets?

- Direct current electricity

How can electromagnets be demagnetized?

- By passing it in alternating current
- By switching off the source of current

DEMAGNETIZATION

- This is a way of destroying magnets
- This is the way of making a magnet lose its magnetism

WAYS OF DESTROYING MAGNETS (DEMAGNETIZATION)

- By strong heating
- ✓ It misaligns the magnetic domains
- By hammering (strong hitting)
- ✓ It disorients (misaligns) magnetic dipoles / domains
- By leaving a magnet to rust
- By keeping magnets without iron keepers
- By keeping like poles of a magnet close together for a long time
- By keeping a magnet in East-west direction for a long time
- By placing an electromagnet in a solenoid with alternating current
- ✓ A.C disorients the magnetic dipoles

WAYS OF PREVENTING DEMAGNETIZATION

- By painting magnets to prevent rusting
- By keeping magnets in iron keepers
- Avoid hammering the magnet
- Avoid heating the magnet
- By keeping magnets while facing North-south direction
- Avoid keeping magnets with like poles close together

USES (APPLICATIONS) OF MAGNETS IN DAILY LIFE

- They are used in electric bells
- They are used in loudspeakers
- They are used in circuit breakers
- They are used in electric motors
- They are used in MRI scanners
- They are used in magnetic compasses to show direction
- They are used in cranes to lift heavy magnetic metals
- They are used in generators to produce electricity
- They are used in refrigerators to keep the doors closed
- They are used to separate magnetic substances and non-magnetic substances
- They are used by doctors to remove iron bits from eyes of a casualty
- They are used by cobblers and electricians to hold small magnetic pins
- They are used to hold magnetic cutlery in kitchens
- They are used in earpiece and telephone receivers to amplify sound
- They are used to tighten ladies' bags and belts
- They help trains to move along magnetic rails

Write MRI in full

- Magnetic Resonance Imaging

GROUPS OF PEOPLE WHO USE MAGNETS

- | | | |
|------------|------------------|--------------------|
| ▪ Sailors | ▪ Electricians | ▪ Doctors/oculists |
| ▪ Pilots | ▪ Chefs | |
| ▪ Cobblers | ▪ Meteorologists | |

DEVICES THAT USE MAGNETISM ONLY

- Magnetic tape
- Magnetic compass

DEVICES THAT USE BOTH ELECTRICITY AND MAGNETISM

- | | | |
|------------------|----------------|----------------|
| ▪ Electric bell | ▪ Refrigerator | ▪ MRI scanners |
| ▪ Electric motor | ▪ Microphone | |
| ▪ Generator | ▪ Loudspeaker | |

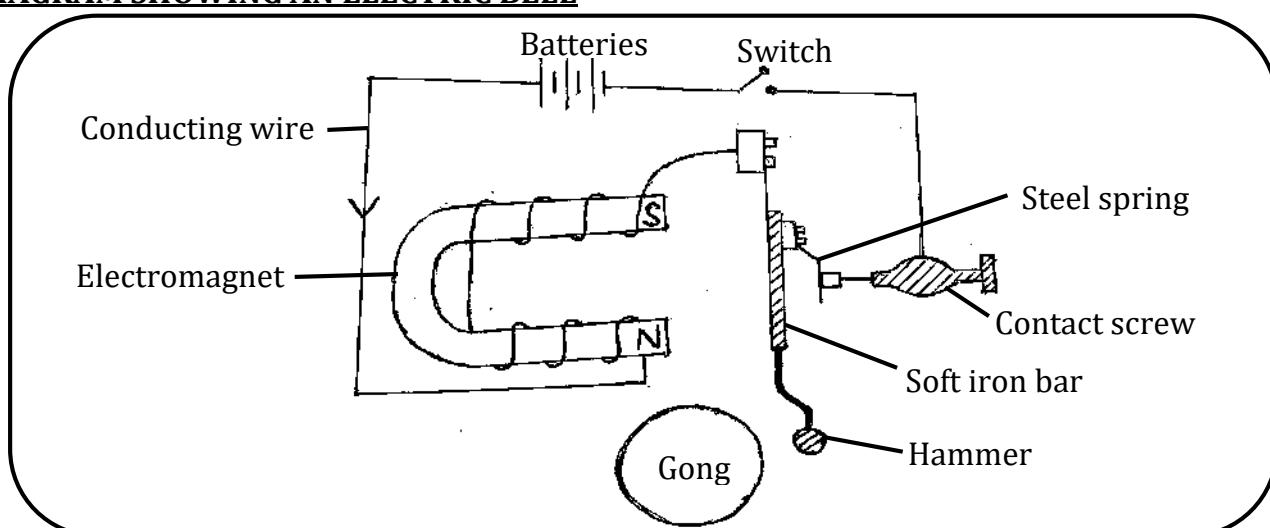
ELECTRIC BELL

- It works on the principle of electromagnetism

IMPORTANCE OF AN ELECTRIC BELL

- It produces sound for communication

A DIAGRAM SHOWING AN ELECTRIC BELL



FUNCTIONS OF EACH PART OF AN ELECTRIC BELL

Switch

- To break or complete the circuit at one's will

Batteries

- To produce electricity

Conducting wire

- It is the passage of electricity

Hammer (Iron striker)

- It hits the gong to produce sound

Gong

- It produces sound when hit

Electromagnet

- It attracts the soft iron bar for the hammer to hit the gong

Steel spring

- It pulls the soft iron for the contact to touch the contact screw

IN FOUR SENTENCES, EXPLAIN HOW AN ELECTRIC BELL WORKS

- When the switch is closed, current flows through the electromagnet
- The electromagnet attracts soft iron bar and the hammer hits the gong to produce sound
- The soft iron bar pulls the steel spring away from the contact screw, the circuit is broken and the electromagnet is demagnetized
- The steel spring pulls back the soft iron bar to touch the contact screw, current flows and the whole cycle is repeated

TOPIC: ENERGY RESOURCES IN THE ENVIRONMENT

ENERGY

- This is the ability to do work
- ✓ It is measured in **Joules (J)**

RESOURCE

- This is anything that people use to meet their needs

ENERGY RESOURCE

- This is anything that produces useful energy

EXAMPLES OF ENERGY RESOURCES

- Animals
- Plants
- Air or wind
- Water
- Sun
- Fossil fuels
- Minerals

TYPES OF ENERGY RESOURCES

- Renewable energy resources
- Non-renewable energy resources

1. RENEWABLE ENERGY RESOURCES

- These are energy resources which can be replaced naturally

Examples of renewable energy resources

- | | |
|-----------|---------------|
| ▪ Plants | ▪ Air or wind |
| ▪ Animals | ▪ Water |
| ▪ Sun | |

Mention two living renewable energy resources

- Animals
- Plants

Mention three non-living renewable energy resources

- | | | |
|-------|---------|-------|
| ▪ Sun | ▪ Water | ▪ Air |
|-------|---------|-------|

Natural processes through which renewable energy resources are maintained/replaced

- | | | |
|----------------|---------------|-------------|
| ▪ Reproduction | ▪ Water cycle | ▪ Air cycle |
|----------------|---------------|-------------|

2. NON-RENEWABLE ENERGY RESOURCE

- These are resources which cannot be replaced naturally

Examples of non-renewable energy resources

- | | |
|----------------|------------|
| ▪ Fossil fuels | ▪ Minerals |
|----------------|------------|

PLANTS AS ENERGY RESOURCES

- Plants are replaced naturally through reproduction

Uses of plants as energy resources

- Some plants provide wood fuel
- Some plants provide food
- Some plant materials are used to make biogas

Energy resources got from plants

- Food
- Wood fuel
- Biogas

Why food is called an energy resource?

- It is burnt in the body to produce energy

Mention three examples of wood fuel

- | | |
|------------|----------------|
| ▪ Firewood | ▪ Saw dust |
| ▪ Charcoal | ▪ Wood shaving |

Write down two uses of wood fuel

- | | |
|--------------------------|---------------------------|
| ▪ It is used for cooking | ▪ It is used for lighting |
|--------------------------|---------------------------|

Dangers of using wood fuel for cooking

- | | |
|--|------------------------------|
| ▪ It pollutes the environment | ▪ It puts soot on utensils |
| ▪ It increases the rate of deforestation | ▪ It leads to global warming |

Name the type of energy stored in wood fuel.

- Chemical energy

State the energy change that occurs when wood is burnt.

- Chemical energy changes to heat and light energy

How is charcoal made?

- By burning wood in limited supply of oxygen

Why is wood covered with soil when making charcoal?

- To limit the supply of oxygen

How is ash formed?

- By burning wood in excess supply of oxygen

WAYS OF CONSERVING PLANTS AS ENERGY RESOURCES

- By practising afforestation
- By practising reforestation
- By practising agroforestry
- Through rural electrification
- By using biogas and electricity
- By using energy saving stoves
- By enforcing strict laws against deforestation
- By using proper methods of harvesting wood
- By educating people about the advantage of plants in the environment

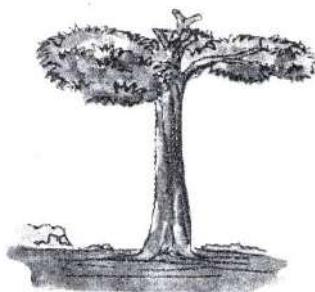
BETTER METHODS OF HARVESTING WOOD

- Coppicing
- Lopping
- Pollarding

1. POLLARDING

- This is the cutting of the top part of a tree.

AN ILLUSTRATION SHOWING POLLARDING



Importance of harvesting trees by pollarding

- It enables fruit trees to produce more and better fruits e.g. mangoes
- It keeps fruit trees short for easy harvesting of fruits.

2. LOPPING

- This is the cutting of side branches of a tree.
- ✓ Mature side branches are harvested as the tree continues to grow

AN ILLUSTRATION SHOWING LOPPING



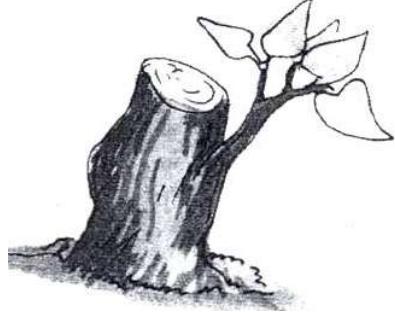
Importance of lopping

- It enables the tree to grow taller
- It enables the tree to continue growing after harvesting firewood

3. COPPIRING

- This is the cutting of the whole tree leaving a short stump.

AN ILLUSTRATION SHOWING COPPIRING (E.G. EUCALYPTUS)



Importance of coppicing

- It allows growth of new shoots
- It provides good wood for timber

Note:

- **Sprouting** means to develop new shoots

Why is pollarding or coppicing not done on some trees (e.g pine, podo and cypress)?

- Some trees cannot grow new branches

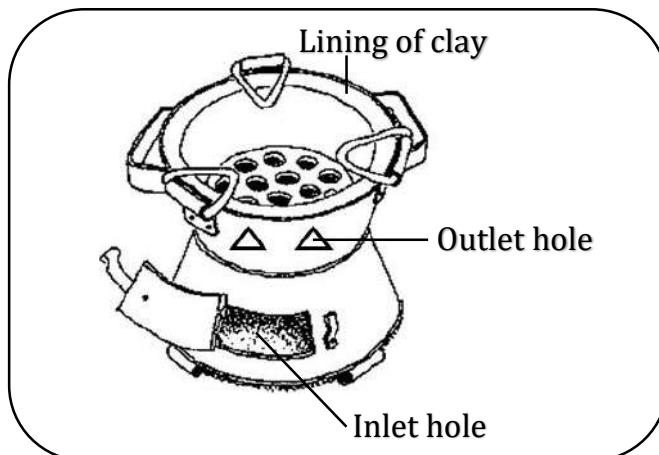
NOTE:

1. **Selective felling:** This is when only mature trees are harvested leaving young trees to grow
2. **Carpet felling:** This is when all mature and young trees are harvested at once.

EXAMPLES OF PLANT FIBRES

- Sisal
- Cotton
- Jute
- Flax
- Hemp
- Raffia

Below is a diagram of a charcoal saving stove. Use it to answer questions



State the importance of each part:

i) Lining of clay

- To prevent heat loss

ii) Outlet hole

- To let out stale air (smoke)

iii) Inlet hole

- To let in fresh air
- To let out ash

How does the use of charcoal saving stoves conserve plants?

- They use less charcoal which reduces the rate of deforestation

Why does a clay charcoal stove use less charcoal?

- Clay keeps heat for a long time (clay prevents heat loss)

ANIMALS AS ENERGY RESOURCES

- Animals are replaced naturally through reproduction

USES OF ANIMALS AS ENERGY RESOURCES

- Some animals are used for transport.
- Some animals are used to plough land
- Some animals are used to pull carts
- Animal wastes are used to make biogas

ENERGY RESOURCES GOT FROM ANIMALS

- Animal labour
- Animal transport
- Biogas

EXAMPLES OF ANIMALS USED FOR TRANSPORT

- Donkey
- Camel
- Horse
- Ox

BEASTS OF BURDEN

- These are animals that do heavy work

Examples of beasts of burden (animals that provide animal labour)

- | | | |
|--|---------|---------|
| ▪ Donkey | ▪ Horse | ▪ Mule |
| ▪ Camel | ▪ Ox | ▪ Llama |
| ✓ Llamas also provide meat and wool production | | |

WAYS OF CONSERVING ANIMALS AS ENERGY RESOURCES

- Treating sick animals
- Regular vaccination
- Proper feeding of animals
- Gazetting game parks
- Enforcing strict laws on poaching
- Using legal fishing methods

EXAMPLES OF ANIMAL FIBRES

ANIMAL FIBRE	ANIMAL
Wool	Sheep/Llama
Mohair	Goat
Silk	Silkworm
Rabbit fur	Rabbit
Chiengora	Dog

SUN AS AN ENERGY RESOURCE

- The sun is the main natural source of energy
- The energy from the sun is called **solar energy**
- Sun's heat reaches the earth by **radiation**

Mention two forms of energy produced by the sun

- Heat energy
- Light energy

USES OF THE SUN AS AN ENERGY RESOURCE

- Sun's heat dries our clothes
- Sun's heat helps in water cycle
- Sun's heat dries harvested crops (helps in food preservation)
- Sun's heat kills germs on beddings
- Sunlight helps in production of solar electricity
- Sunlight enables us to see
- Sunlight helps in photography
- Sunlight helps plants to make starch
- Morning sunlight helps our skin to make vitamin D.

Why is the solar panel painted black?

- To absorb sunlight

State the energy change that takes place in solar panels

- Light energy from the sun changes to solar electricity.

Why is the sun regarded as the primary source of energy?

- ✓ All energy resources originate from the sun directly or indirectly

WATER AS AN ENERGY RESOURCE

- Water is replaced naturally through the water cycle

WATER CYCLE

- This is a natural cycle through which rain is formed

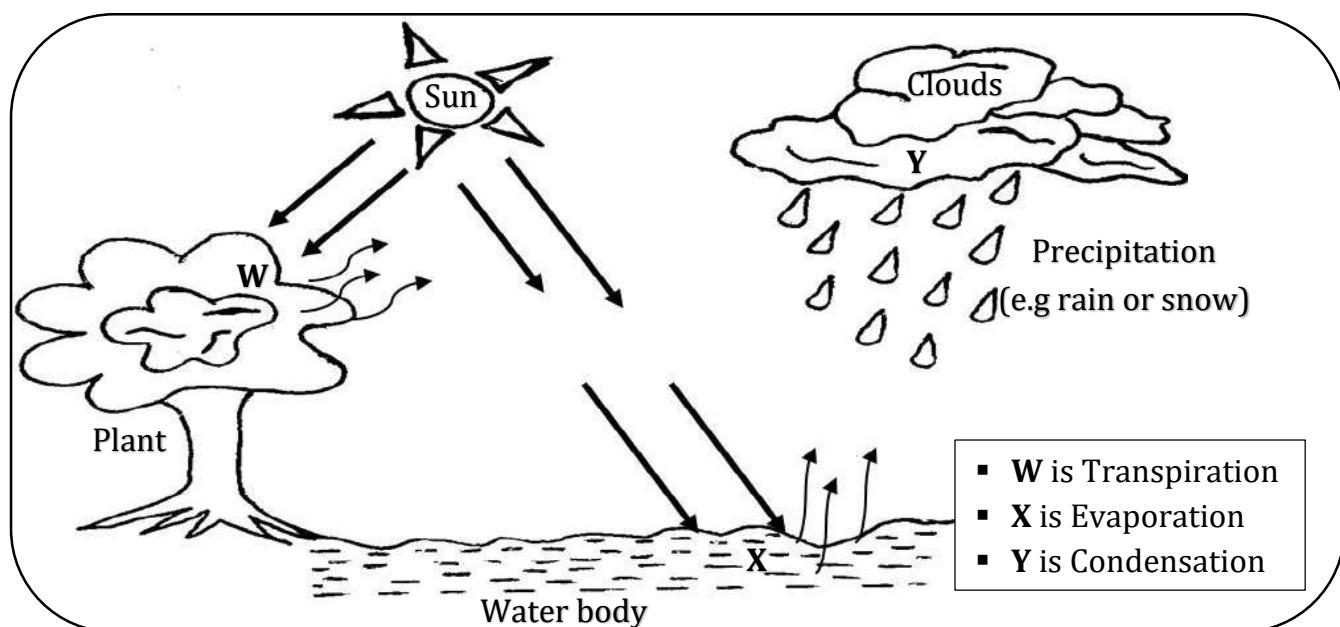
Name the three processes involved in the water cycle

- Evaporation
- Condensation
- Transpiration

HOW DOES THE WATER CYCLE OCCUR?

1. The sun's heat causes evaporation and transpiration
2. Water vapour rises to the atmosphere
3. Condensed water vapour form clouds
4. Heavy clouds fall as rain / precipitation

A DIAGRAM SHOWING THE WATER CYCLE



State the importance of the following in the water cycle:

Sun

- Sun's heat causes evapotranspiration
- Sun's heat causes evaporation on water body and transpiration in plants

Plants

- To carry out transpiration

Water body

- To carry out evaporation

Clouds

- Heavy clouds fall as rain / precipitation

Evaporation and transpiration

- To increase water vapour in the atmosphere

USES OF WATER AS AN ENERGY RESOURCE

- Fast flowing water helps in production hydro electricity
- Tides help in production of tidal electricity
- Steam from hot springs helps in production of geothermal electricity
- Water is used to cool machines in industries
- Steam is used to cook food

ENERGY RESOURCES GOT FROM WATER

- Hydroelectricity
- Tidal energy
- Geothermal energy

TIDES

- This is a regular rise and fall of the sea level

What causes tides?

- Attraction of sea water by the moon and sun

WAYS OF CONSERVING WATER IN THE ENVIRONMENT

- By avoiding water pollution
- By planting trees to help in rain formation
- By avoiding bush burning

MINERALS AS ENERGY RESOURCES

- A mineral is an inorganic substance that occurs naturally in the ground

Examples of minerals that are used as energy resources

- Uranium
- Plutonium

USES OF MINERALS AS ENERGY RESOURCES

- They are burnt to produce atomic/nuclear energy
- They are used to make nuclear weapons/atomic bombs
- They are used as a fuel in nuclear submarines

WAYS OF CONSERVING MINERALS AS ENERGY RESOURCES

- By controlled mining
- Using them sparingly
- Using alternative energy resources

FOSSIL FUELS AS ENERGY RESOURCES

- These are fuels got from remains of plants and animals that died long time ago.
- ✓ Fossil fuels are also known as **fossil minerals**
- ✓ They were formed due to heat and pressure from underground
- ✓ They are got from underground by **mining**

EXAMPLES OF FOSSIL FUELS (FOSSIL MINERALS)

- Crude oil (petroleum)
- Coal
- Natural gas

PETROLEUM (CRUDE OIL)

- This is a liquid fuel got from remains of animals that died long time ago
- ✓ Petroleum is processed in factories called **refineries**
- ✓ Petroleum products are obtained by a refinery process called **fractional distillation**

PETROLEUM PRODUCTS USED AS FUEL (PRODUCTS GOT FROM CRUDE OIL)

- Petrol (gasoline)
- Kerosene (paraffin)
- Diesel
- Jet fuel (aviation fuel)

OTHER PETROLEUM PRODUCTS

- Lubricating oil
- Petroleum jelly (vaseline)
- Pesticides

Uses of crude oil (petroleum) as an energy resource

- It helps in making fuels burnt to produce thermal electricity e.g. petrol and diesel
- It helps in making fuels used in vehicle engines e.g. petrol, diesel and jet fuel
- It helps in making fuels used in stoves for cooking e.g. kerosene
- It helps in making fuels used in lamps for lighting e.g. kerosene
- It helps in making lubricants e.g. lubricating oil
- It helps in making vaseline/petroleum jelly
- It helps in making pesticides
- It is used to make explosives

Name the gas sold in metal cylinders at service stations

- LPG (Liquefied Petroleum Gas)

Give any three uses of LPG

- It is used for cooking
- It is used as fuel in some vehicles
- It is used for heating

COAL

- This is a solid fuel got from remains of plants that died long time ago
- ✓ Coal is black in colour

Products from coal used as fuel

- Coal tar
- Coal gas
- Coke

USES OF COAL AS AN ENERGY RESOURCE

- It is burnt to produce thermal electricity
- It is used to supply heat in power stations
- It is burnt to warm houses
- It is used as a fuel in steam engines
- Coal gas for cooking and lighting
- Coal tar for surfacing roads
- Coal coke is used as fuel in iron ore smelting

NATURAL GAS

- This is a gaseous fossil fuel mined from petroleum deposits.

Uses of natural gas as an energy resource

- It is used for lighting
- It is used for heating
- It is used as fuel in some vehicles
- It is supply heat at power stations

Advantages of using natural gas to other fossil fuels

- Natural gas does not pollute the environment like other fossil fuels

DISADVANTAGES OF USING FOSSIL FUEL

- They are fire hazards
- They are non-biodegradable
- Some fossil fuels pollute the environment
- They are non-renewable
- They are expensive to manage

WAYS OF CONSERVING FOSSIL FUELS AS ENERGY RESOURCES

- Avoid over mining
- Using petroleum products sparingly
- Riding bicycles instead of driving vehicles
- Walking short distances instead of driving vehicles
- Repairing vehicles in dangerous mechanical conditions
- Using biofuels instead of fossil fuels

BIOFUELS

- These are fuels got from living things

Examples of biofuels

- Biogas
- Biodiesel
- Ethanol

Advantages of using biofuels

- They reduce air pollution (they do not pollute the environment)
- They are biodegradable
- They reduce the use of fossil fuels that cause global warming
- They are cheap to make
- Their raw materials are always available

Disadvantages of using biofuels

- They lead to extinction of some plants and animals
- They lead to destruction of habitats for wild animals

PRODUCTION OF BIOGAS

- Biogas is a gas fuel produced when biomass ferments in a biogas digester
- **Biomass** are organic matter (plant materials and animal waste) used to produce energy
- Biogas is made up of mainly **methane gas** and also carbon dioxide
- Biogas is produced in an airtight (pit) tank called **biogas digester**
- Biogas is formed by a process called **anaerobic fermentation (anaerobic decomposition)**
- Anaerobic fermentation (the fermentation in the biogas digester) does not need oxygen
- **Anaerobic bacteria** ferment wastes in the digester to produce biogas
- Anaerobes do not need oxygen for respiration and therefore use **anaerobic respiration**

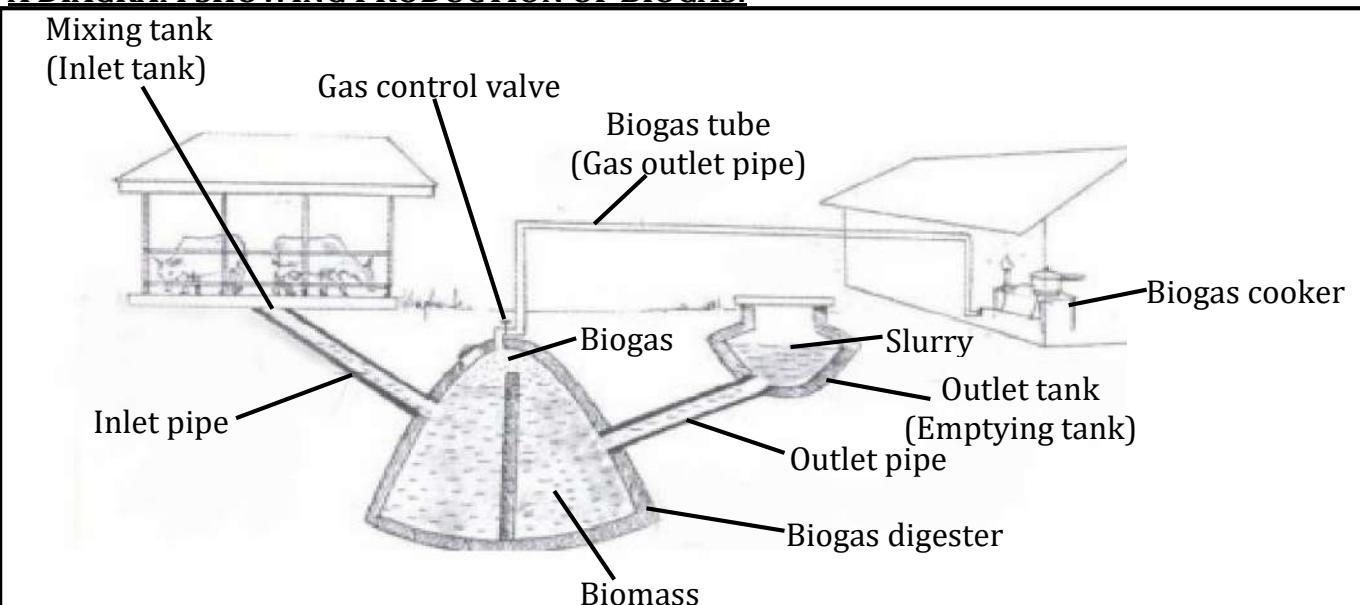
Why are bacteria in the biogas digester called anaerobes?

- They do not need oxygen for respiration.

Examples of biomass (plant materials and animal waste used to make biogas)

- Animal dung
- Urine
- Poultry droppings
- Banana peelings
- Leftover food
- Plant leaves
- Sea weeds
- Human faeces
- ✓ **Biomass** ferments in the digester to produce biogas

A DIAGRAM SHOWING PRODUCTION OF BIOGAS:



FUNCTIONS OF EACH PART OF THE BIOGAS DIGESTER

INLET TANK (MIXING TANK)

- It is where new wastes/biomass are put to refill the digester
- It is where animal dung is mixed with water before it enters the digester

INLET PIPE

- It is the passage of new wastes to the digester

Why should inlet pipe be directed to the bottom centre of the digester?

- For easy stirring of the wastes in the digester

BIOGAS DIGESTER

- It is where wastes ferment to produce biogas

Why should a biogas digester be kept airtight?

- To prevent oxygen from entering
- To prevent biogas from escaping

Why should the walls of the biogas digester be made of concrete?

- To prevent leakage of wastes

Give the importance of water in the biogas digester

- It speeds up fermentation/decomposition

Why is it not advisable to pour acids or detergents in a biogas digester?

- Acids/detergents kill anaerobic bacteria

Give the reasons why the biogas digester should be:

1. Far from kitchens

- To prevent explosion of biogas
- To prevent death of bacteria due to heat

2. Far from trees

- To prevent roots of trees from damaging the digester

3. Above the water table

- To prevent contamination of underground water

4. Buried underground

- To protect it from physical damage
- To protect it from cold temperatures at night and during cold seasons
- To save space

GAS STORAGE TANK (GAS HOLDER)

- It keeps the biogas before use

BIOGAS TUBE

- It takes biogas to the biogas equipment

How are water droplets that collect in biogas tube removed from biogas??

- By using water traps

Why is biogas sometimes passed through carbon filters before use?

- To remove carbon dioxide

GAS CONTROL VALVE

- It is opened to let out biogas for use

OUTLET PIPE

- It is the passage of wastes from the digester

OUTLET TANK (EMPTYING TANK)

- It is where old wastes from the digester are first collected

Explain the meaning of the following:

Sludge

- This is the solid waste that remains after collecting biogas

Effluent

- This is the liquid waste that remains after collecting biogas

NOTE

- **Slurry** is the mixture of organic wastes and sometimes water used as fertilizers

How is slurry useful to crop farmers?

- It is used as manure in crop gardens

USES OF BIOGAS

- It is used for cooking
- It is used for lighting
- It is used for heating

Examples of equipment that uses biogas

- Biogas stoves (biogas cooker)
- Biogas lamps
- Biogas incubators

ADVANTAGES OF USING BIOGAS

- It reduces air and soil pollution (it does not pollute the environment)
- It is cheap to make
- It produces clean work
- It conserves trees
- It is a source of manure for crops
- Its raw materials are always available

Give one advantage of using biogas over natural gas

- Biogas is cheaper than natural gas

How does biogas production benefit crops?

- Sludge is used as organic manure for crops

How does the use of biogas conserve the environment?

- It reduces deforestation for wood fuel
- It does not pollute the environment

How does biogas production promote sanitation?

- It makes use of wastes that smell badly
- It makes use of wastes that pollute water
- It controls disposal of wastes that attract flies

How does biogas production reduce pollution?

- It does not produce smoke that pollutes air
- It makes use of waste that would pollute water
- It makes use of waste that would smell badly

How does biogas production control global warming?

- It reduces the use of petroleum fuels
- It makes use of methane gas which is a greenhouse gas

DISADVANTAGES OF USING BIOGAS

- It contains some impurities
- It cannot be produced on a large scale
- Biogas digesters are less effective in wet season

Why is biogas regarded as a fuel?

- It is burnt to produce energy

FACTORS AFFECTING BIOGAS PRODUCTION

- Temperature
- PH value
- Loading rate (Nutrient supply)
- Retention time
- Stirring (mixing) intensity

WIND AND AIR AS ENERGY RESOURCES

- Air is the mixture of gases
- Wind is air in motion (moving air)

What causes wind?

- Difference in atmospheric pressure between places

COMPONENTS OF AIR

- | | |
|-----------------|-------------------------|
| ▪ Nitrogen: 78% | ▪ Rare gases: 0.97% |
| ▪ Oxygen: 21% | ▪ Carbon dioxide: 0.03% |

USES OF AIR AS AN ENERGY RESOURCE

- Oxygen is used for respiration
- Oxygen supports burning (combustion)
- Carbon dioxide is used to put out fire
- Carbon dioxide is used by plants to make starch
- Carbon dioxide is used to preserve soft drinks
- Nitrogen is used in electric bulbs
- Nitrogen is used by legumes to make plant proteins
- Nitrogen is used to preserve vaccines and semen
- Nitrogen is used to fill the tyres of aeroplane
- Rare gases are used in electric bulbs
- Rare gases are used in weather gas balloons e.g. helium

Why does a gas balloon fly up in air when released?

- The gas inside it is lighter than air outside

Why is a balloon tied to a thread?

- To prevent the gas inside it from escaping

USES OF WIND USED AS AN ENERGY RESOURCE

- | | |
|----------------------------|---------------------------------|
| ▪ It helps in winnowing | ▪ It helps in pollination |
| ▪ It turns windmills | ▪ It helps in drying of clothes |
| ▪ It is used to fly kites | ▪ It helps in seed dispersal |
| ▪ It sails boats and dhows | |

How does wind help in drying of clothes?

- By increasing the rate of evaporation
- By blowing away moisture from clothes

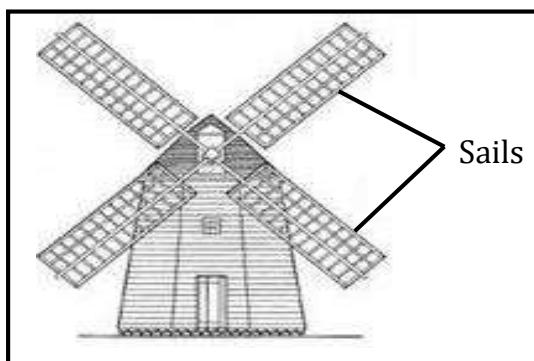
Which property of air enables wind to dry wet clothes at night?

- Air exerts pressure

DANGERS OF WIND IN THE ENVIRONMENT

- Strong wind destroys houses
- Strong wind breaks trees and crops
- Strong wind is an agent of soil erosion
- Strong wind overturns boats on water bodies
- Contaminated wind spreads airborne diseases

A DIAGRAM SHOWING A WINDMILL



Uses of a windmill

- It is used to generate wind electricity.
- It is used to grind seeds and grains.
- It is used to pump water from underground.

Why are windmills not commonly used in Uganda to produce energy?

- Uganda has irregular windy seasons.

ADVANTAGES OF USING WIND AS AN ENERGY RESOURCE

- It cannot get finished/it is replaced naturally
- It conserves other energy resources

CONSERVATION OF ENERGY RESOURCES

- This is the wise use of energy resources

IMPORTANCE OF CONSERVING ENERGY RESOURCES

- It promotes food security.
- It prevents pollution.
- It improves climate.
- It promotes tourism.
- It prevents extinction of plants and animals.

ENVIRONMENT

- Environment refers to all things that surround an organism

TYPES OF ENVIRONMENT

- Biological (biotic) environment
- Physical (abiotic) environment

1. BIOLOGICAL (BIOTIC) ENVIRONMENT

- This is the type of environment made up of living things

COMPONENTS OF BIOLOGICAL (BIOTIC) ENVIRONMENT

- Plants
- Animals
- Fungi
- Bacteria
- Protista
- ✓ **Plants** and **animals** are the main living/organic components of the environment

2. PHYSICAL (ABIOTIC) ENVIRONMENT

- This is the type of environment made up of non-living things

COMPONENTS OF PHYSICAL (ABIOTIC) ENVIRONMENT

- Air
- Water
- Land (soil)
- Sun

IMPORTANCE OF THE ENVIRONMENT TO PEOPLE

- It is a source of food and water
- It is a source of building materials
- It is a habitat for people
- It is a source of craft materials
- It is a source of herbal medicine
- It helps in recreation

ENVIRONMENTAL DEGRADATION

- This is the lowering of the quality of resources in the environment
- This is the destruction of resources in the environment

NATURAL CAUSES OF ENVIRONMENTAL DEGRADATION

- Floods
- Drought
- Landslides
- Mudslides
- Earth quake
- Lightning
- Hail stones
- Strong wind
- Volcanic eruption

HUMAN ACTIVITIES THAT CAUSE ENVIRONMENTAL DEGRADATION

- Over grazing
- Uncontrolled lumbering
- Charcoal burning
- Brick baking
- Brick making
- Industrialization
- Poaching
- Swamp drainage
- Mono cropping/monoculture
- Deforestation

TYPES OF ENVIRONMENTAL DEGRADATION

- Pollution
- Devegetation
- Siltation
- Soil erosion
- Wetland degradation

POLLUTION

- This is the releasing (addition) of harmful substances into the environment

POLLUTANTS

- Pollutants are harmful substances released into the environment

EXAMPLES OF POLLUTANTS

- Plastics
- Polythene papers
- Industrial fumes
- Smoke
- Garbage
- Broken glasses
- Agrochemicals
- Scrap metals

TYPES OF POLLUTION

- Water pollution
- Air pollution
- Soil pollution
- Sound pollution

SOIL POLLUTION

- This is the releasing of harmful substances into the soil

EXAMPLES OF SOIL POLLUTANTS

- Plastics
- Polythene papers
- Scrap metals
- Old engine oil
- Broken glasses
- Agrochemicals herbicides, pesticides and acaricides)

CAUSES OF SOIL POLLUTION

- Dumping polythene papers into the soil
- Dumping plastics into the soil
- Dumping broken glasses into the soil
- Dumping untreated wastes from factories into the soil
- Using herbicides to kill weeds
- Excessive use of artificial fertilizers on farms

EFFECTS OF SOIL POLLUTION

- It leads to soil exhaustion/soil infertility
- It leads to death of soil organisms
- It leads to poor crop yields

CONTROL OF SOIL POLLUTION

- Use organic manure instead of artificial fertilizers
- Ensure proper disposal of polythene bags and plastics (non-biodegradable wastes)
- Use the 5Rs of waste management
- Avoid dumping polythene papers into the soil
- Avoid dumping plastics into the soil
- Avoid dumping broken glasses into the soil
- Avoid dumping untreated wastes from factories into the soil

Write down the 5Rs of waste management

- Recycle
- Reuse
- Return
- Reduce
- Reject/Refuse

NON-BIODEGRADABLE WASTES

- These are wastes that cannot rot/decay

How do non-biodegradable wastes (e.g. plastics and polythene papers) affect the soil?

- They prevent water and air from entering the soil
- They lead to soil exhaustion
- They lead to soil pollution
- They kill soil organisms

WATER POLLUTION

- This is the releasing of harmful substances into water sources

EXAMPLES OF WATER POLLUTANTS

- Soil/mud
- Cow dung
- Human wastes (e.g. faeces and urine)
- Old engine oil
- Garbage
- Agrochemicals

CAUSES OF WATER POLLUTION

- Urinating in water sources
- Bathing in water sources
- Defecating in water sources
- Putting soil in water sources
- Dumping garbage into water sources
- Dumping sewage into water sources
- Dumping old engine oil into water sources
- Washing vehicles in water sources
- Allowing farm animals to drink in water sources

EFFECTS OF WATER POLLUTION

- It leads to water associated diseases
- It leads to death of aquatic plants and animals
- It makes water unsafe for domestic use
- It leads to destruction of water sources

CONTROL OF WATER POLLUTION

- Avoid bathing in water sources
- Avoid washing vehicles in water sources
- Proper disposal of human wastes
- Treating sewage before disposing it
- Fencing open water sources e.g. wells
- Avoid putting soil in water sources
- Avoid dumping garbage into water sources
- Avoid dumping old engine oil into water sources

AIR POLLUTION

- This is the releasing of harmful substances into air

EXAMPLES OF AIR POLLUTANTS

- Smoke
- Industrial fumes or exhaust fumes
- Dust
- Tear gas
- Bad smell from rotting matter

CAUSES OF AIR POLLUTION

- Smoking
- Bush burning
- Burning of rubbish
- Spraying tear gas
- Use of diesel engines
- Allowing smoke from kitchens into air
- Allowing industrial fumes into air

EFFECTS OF AIR POLLUTION

- It leads to some respiratory diseases
- It leads to global warming
- It leads to acidic rain
- It destroys the ozone layer

State the importance of ozone layer to people

- It protects us from direct solar radiations

CONTROL OF AIR POLLUTION

- Avoid smoking
- Avoid bush burning
- Using biogas instead of wood fuel
- Using biofuels instead of fossil fuels
- Avoid using sprays that pollute air
- Treating industrial fumes before release

SOUND POLLUTION (NOISE POLLUTION)

- This is the releasing of noise into the environment

EXAMPLES OF SOUND POLLUTANTS

- Air and road traffic noise
- Construction sites
- Animals
- Factories
- Thunder
- Gunshot
- Disco
- Generators

EFFECTS (DANGERS) OF SOUND POLLUTION

- It leads heart attack
- It leads to deafness
- It causes headache
- It disrupts people's attention

CONTROL OF SOUND POLLUTION

- Putting silencers in engines
- Installing noise insulation in buildings
- Use alternative transport means instead of cars
- Constructing factories and disco halls away from residential houses

DEVEGETATION

- This is the removal of plant cover in an area

CAUSES OF DEVEGETATION

- Industrialization
- Human settlement
- Road construction
- Bush burning
- Deforestation
- Overgrazing
- Overstocking

EFFECTS OF DEVEGETATION

- It leads to soil erosion
- It destroys habitats for wild animals
- It leads to extinction of some plants
- It leads to drought
- It leads to global warming
- It leads to desertification

CONTROL OF DEVEGETATION

- Practising afforestation
- Practising agroforestry
- Practising rotational grazing
- Avoid uncontrolled bush burning
- Using electricity instead of wood fuel
- Educating people about the importance of vegetation

SILTING

- This is the deposition of eroded materials into a water source

AGENTS OF SILTING

- Flowing water
- Strong wind
- Moving animals

SILT

- These are eroded materials deposited into a water source

EXAMPLES OF SILT

- Soil/mud
- Cow dung
- Grass
- Rubbish

CAUSES OF SILTING

- Soil erosion
- Cultivating along riverbanks and lake shores
- Allowing animals to drink in water sources
- Clearing vegetation on riverbanks and lake shores

EFFECTS (DANGERS) OF SILTING

- It leads to water pollution
- It reduces the depth of a water body (it makes a water body shallow)
- It leads to death of some marine animals
- It destroys the habitats for marine animals

How does silting lead to floods?

- By reducing the capacity/depth of water sources

How does silting lead to death of aquatic (marine) animals?

- Silt suffocates marine animals

CONTROL OF SILTING

- Planting short grass around water sources
- Putting silt traps around water bodies
- Avoid cultivating along river banks and lake shores
- Using a dredging machine to remove silt from water bodies

BEST WISHES

PARAMOUNT SCIENCE NOTES

PRIMARY SEVEN

TERM TWO

TOPIC ONE: MACHINES

FRICTION

- Friction is the force that opposes motion of an object
- ✓ It occurs in all the states of matter

FACTORS THAT DETERMINE FRICTION

- Weight of an object
- Nature (texture) of an object

PROPERTIES OF FRICTION

- There is more friction on rough surfaces than on smooth surfaces
- Friction increases with increase in weight
- Friction always produces heat

CAUSES OF FRICTION

- Roughness of surfaces
- Molecular adhesion (attractive forces between surfaces in contact)
- Deformations of the objects

TYPES OF FRICTION

- Static friction
- Dynamic friction
- Viscosity

1. STATIC FRICTION

- This is the type of friction that occurs between objects at rest (stationary objects)

Examples of objects with static friction

- A pen resting on a table
- A stone resting on ground
- A boy sitting on a desk

Why do objects with static friction possess potential energy?

- They are at rest

2. DYNAMIC (KINETIC) FRICTION

This is the type of friction that occurs in moving objects (objects in motion)

Examples of dynamic (kinetic) friction

- Sliding friction
- Rolling friction

Examples of objects with kinetic (dynamic) friction

- A book sliding over a table
- A tyre of moving car on the road
- A ball rolling on ground

Why do objects with dynamic friction possess kinetic energy?

- They are in motion

3. VISCOSITY FRICTION (FLUID FRICTION)

- This is the type of friction that occurs in liquids and gases
- ✓ It is found in all fluids (liquids and gases)
- ✓ A fluid is a substance that can flow easily

Examples of objects with viscosity (fluid friction)

- A fish swimming in water
- A bird flying in air

MERITS/ADVANTAGES/IMPORTANCE OF FRICTION

Why is friction regarded as a useful force?

- It helps us in lighting match sticks
- It helps us in getting static electricity
- It helps us in sharpening tools
- It helps us in braking vehicles
- It helps us in climbing trees
- It helps us in writing on papers
- It helps us in grinding grains and seeds
- It helps us in washing clothes
- It helps us in us walking

Name the force that enabled early man to discover fire.

- Friction

WAYS OF INCREASING FRICTION

- By putting treads on tyres and shoes
- By putting spikes on sports shoes
- By putting grips on bicycle handles and car steering wheels
- By putting tarmac on road surfaces
- By putting gravel/small stones on road surfaces
- By increasing the weight of moving objects
- By making smooth surfaces rough

Things used to increase friction (materials that make surfaces rough)

- Treads
- Spikes
- Grips
- Gravel/small stones
- Tarmac

Why should friction be increased on roads?

- To prevent vehicles from sliding
- To make braking of vehicles easy

How do road engineers increase friction on the roads?

- By putting murram/gravel/small stones on road surfaces
- By putting tarmac on road surfaces

How do vehicle drivers increase friction on the roads?

- By driving vehicles with treads on their tyres (cars with new tyres)
- By putting much weight in their vehicles

Why it is dangerous to drive a car without treads on its tyre?

- It can slide easily
- It cannot brake (stop) easily
- It can get punctures easily

Why should friction be increased on car steering wheels?

- To prevent hands of the driver from sliding off

State the importance of grips on bicycle handles and car steering wheels.

- To increase friction

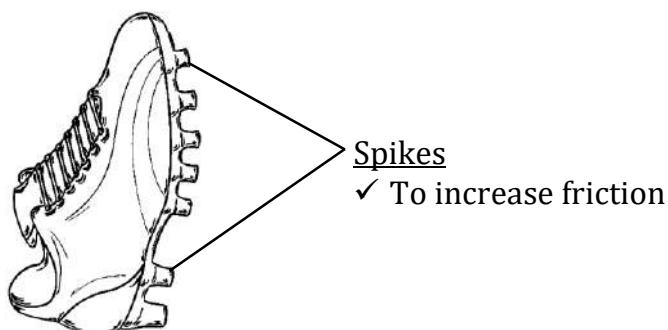
How is friction increased on motorcycle handles?

- By putting grips on motorcycle handles

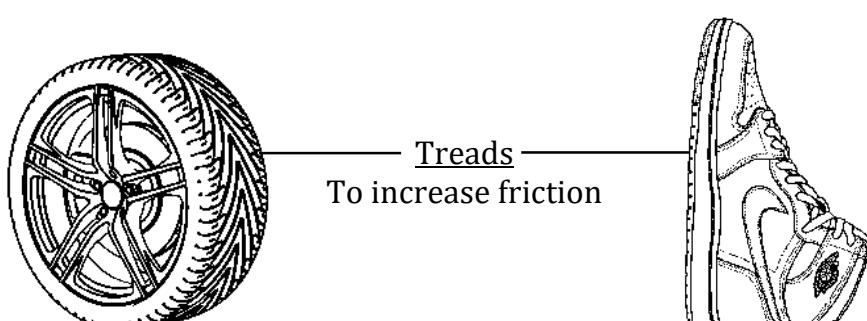
Of what importance are the rough surfaces in palms of hands and soles of feet?

- To increase friction

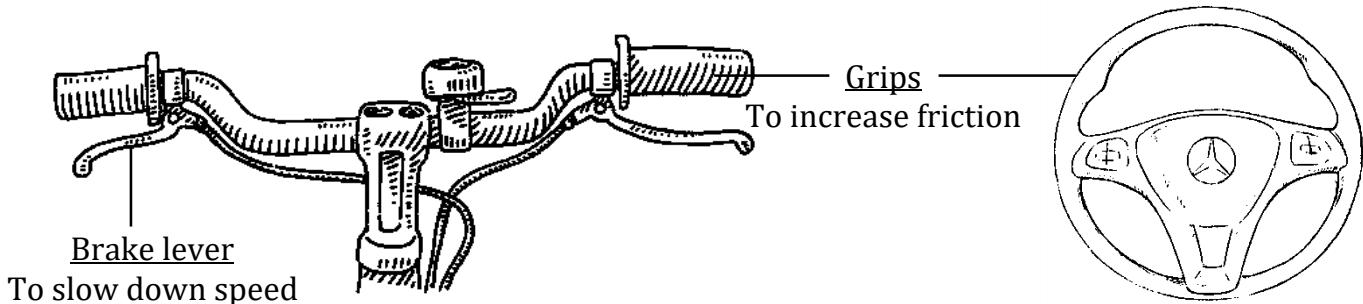
DIAGRAMS SHOWING THINGS THAT INCREASE FRICTION
SPIKES ON SPORTS SHOE



TREADS ON CAR TYRE AND SCHOOL SHOE



GRIPS ON CAR STEERING WHEEL AND BICYCLE HANDLES



How do spikes on football shoes, treads on tyres and gravel put on road surfaces increase friction?

- They make surfaces rough

DEMERITS/DISADVANTAGES OF FRICTION

Why is friction regarded as a nuisance force?

- It causes unnecessary heat in machines
- It causes unnecessary noise in machines
- It reduces efficiency of machines
- It causes wear and tear of machines
- It delays work
- It makes us use a lot of effort to move machines

WAYS (METHODS) OF REDUCING FRICTION

- By lubricating (oiling or greasing)
- By using rollers
- By using ball bearings
- By polishing or varnishing surfaces
- By streamlining objects
- By making rough surfaces smooth

Things used to reduce friction

- Oil
- Lubricants
- Grease
- Rollers
- Ball bearings
- Polish
- Varnish

How does varnishing and polishing reduce friction?

- By making the surfaces smooth

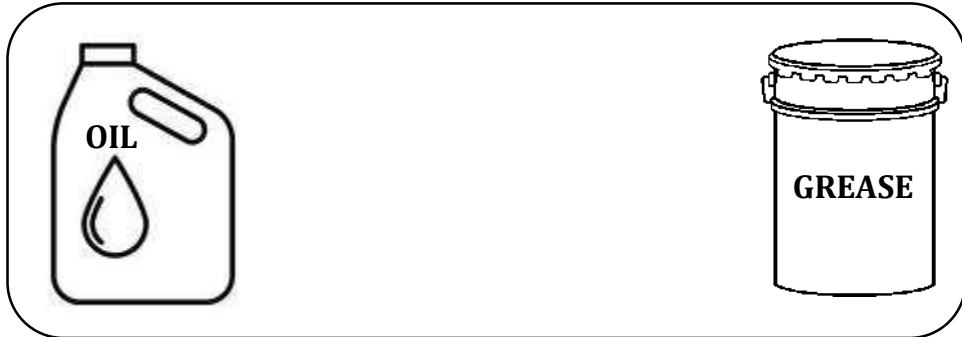
LUBRICANTS

- These are organic substances that reduce friction

Examples of lubricants

- Oil
- Grease

DIAGRAMS SHOWING LUBRICANTS



How do lubricants (oil and grease) reduce friction?

- They make surfaces (moving parts) smooth or slippery

Ways of lubrication

- Oiling
- Greasing

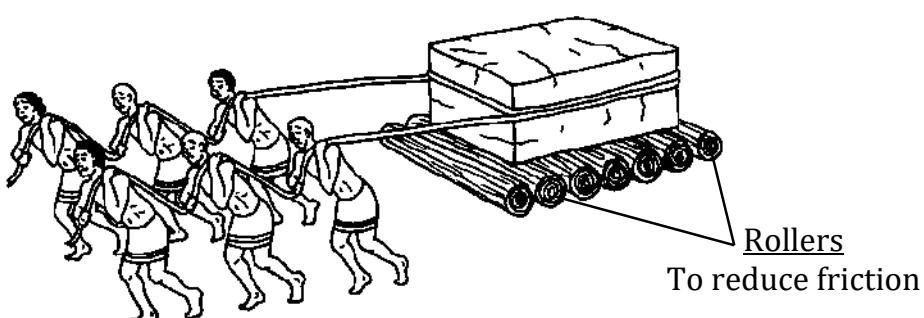
Besides reducing friction, give other reason why moving parts (e.g. door hinges) should be lubricated?

- To prevent rusting

Why is it bad to lubricate brake pads of bicycles?

- It reduces friction hence making braking of bicycle difficult.

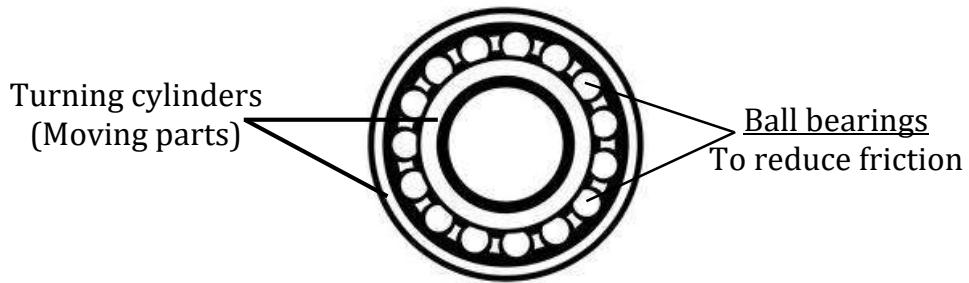
A DIAGRAM SHOWING ROLLERS



How do rollers reduce friction?

- They reduce the area of contact between moving parts

A DIAGRAM SHOWING BALL BEARINGS



How do ball bearings reduce friction?

- They keep the moving parts separate

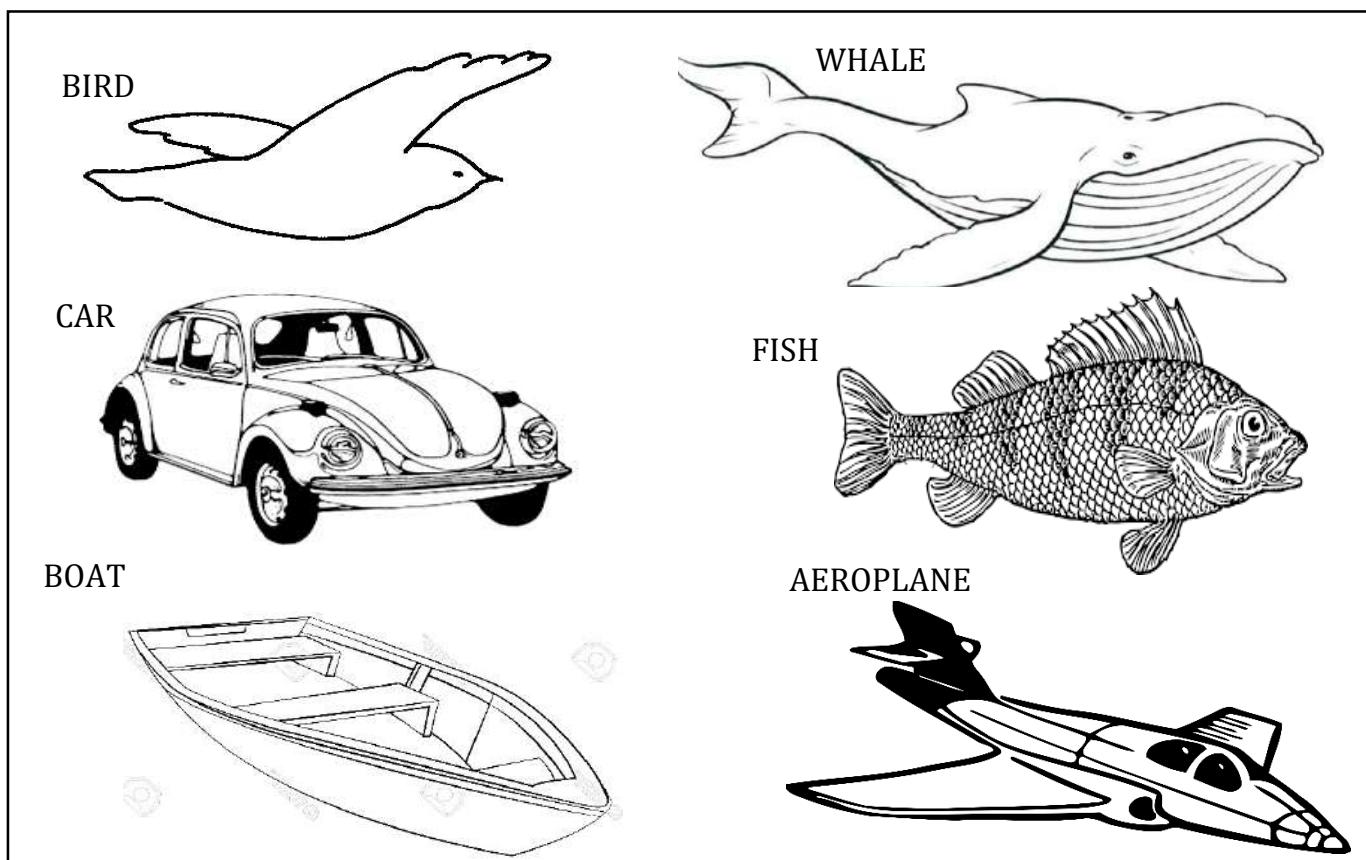
EXAMPLES OF STREAMLINED NON- LIVING OBJECTS

- | | | |
|-------------|----------|---------------|
| ▪ Aeroplane | ▪ Car | ▪ Boat |
| ▪ Ship | ▪ Rocket | ▪ Jet fighter |

Examples of streamlined animals

- | | |
|--------|---------|
| ▪ Fish | ▪ Bat |
| ▪ Bird | ▪ Whale |

DIAGRAMS SHOWING STREAMLINED ORGANISMS AND NON-LIVING OBJECTS



How does streamlining reduce friction?

- It reduces resistance to the flow of liquids and gases

Identify the type of friction minimized by streamlining objects

- Viscosity

HOW ARE THE FOLLOWING ABLE TO REDUCE FRICTION NATURALLY?

Birds, bats, fish and sea mammals

- They have streamlined bodies

Joints

- They have synovial fluid
- They have cartilage

Why should friction be reduced in moving parts of machines?

- To prevent unnecessary noise in machines
- To prevent unnecessary heat in machines
- To increase efficiency of a machine
- To prevent tear and wear of machines
- To make movement easy (to increase speed of movement)

INERTIA

- This is the tendency of an object to resist change in its state of motion
- ✓ It is determined by **mass**

Why do passengers seated in a car bend?

- i) Backward when the driver starts it suddenly:
 - **Due to inertia at rest**
- ii) Forward when the driver stops (brakes) it suddenly:
 - **Due to inertia in motion**

MACHINES

- A machine is a device (tool) that makes work easier
- A machine is a device (tool) that simplifies work

ADVANTAGES OF USING MACHINES

How do machines simplify work?

- Some machines multiply effort (reduce the effort needed to do work)
- Some machines change the direction of forces
- Some machines increase the speed of doing work
- Some machines change energy from one form to another

DISADVANTAGES OF USING MACHINES

- Some machines are expensive to buy and manage
- Some machines can cause accidents
- Some machines can cause laziness

TYPES (GROUPS) OF MACHINES

- Complex machines
- Simple machines

COMPLEX MACHINES

These are machines with many parts and difficult to use

- They need special training to use

Examples of complex machines

- Tractor
- Sewing machine: It consists of a pulley and a wedge
- Computer
- Car
- Aeroplane
- Tractor

Why is a tractor called a complex machine?

- It is made up of many parts and difficult to use

SIMPLE MACHINES

- These are machines with few parts and easy to use
- ✓ They do not need special training to use

Examples of simple machines

- | | | |
|---------|----------|---------------|
| ▪ Knife | ▪ Axe | ▪ Borehole |
| ▪ Panga | ▪ Ladder | ▪ Nut cracker |
| ▪ Hoe | ▪ Broom | ▪ Scissors |

Why is an axe called a simple machine?

- It is made up of few parts and easy to use

TYPES (GROUPS OR CLASSES) OF SIMPLE MACHINES

- | | |
|--|---|
| <ul style="list-style-type: none"> ▪ Levers ▪ Inclined planes (slopes) ▪ Wedges | <ul style="list-style-type: none"> ▪ Screws ▪ Pulleys ▪ Wheel and axle |
|--|---|

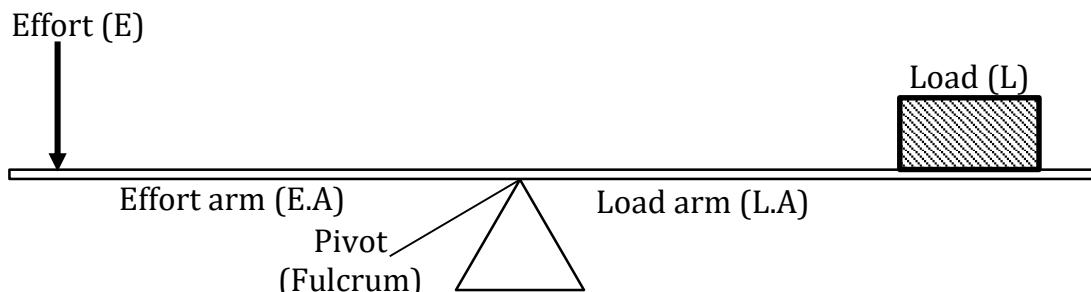
LEVERS

- A lever is a rigid bar that turns at a fixed point called pivot

Parts of a lever

- Load
- Effort
- Pivot (Fulcrum)

A DIAGRAM SHOWING A LEVER



PART OF A LEVER	DESCRIPTION
1. Effort (E)	▪ This is the force applied to move the load
2. Load (L)/Resistance	▪ This is the force (weight) to be moved
3. Pivot (P)/Fulcrum (F)	▪ This is a fixed turning point of a lever
4. Effort arm (EA)/Effort distance	▪ This is the distance from effort to the fulcrum (pivot)
5. Load arm (LA)/Load distance	▪ This is the distance from load to the fulcrum (pivot)

When does the lever work best?

- When the effort arm is longer than the load arm

CLASSES OF LEVERS

- First class lever
- Second class lever
- Third class lever

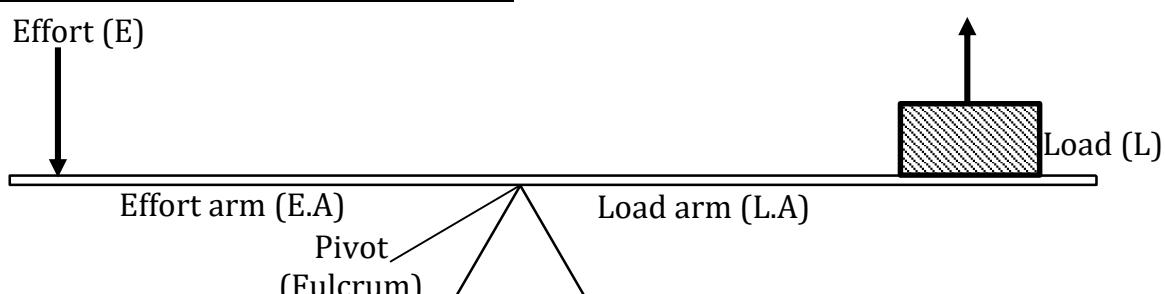
What factor determines the class of lever?

- The position of load, effort and pivot

FIRST CLASS LEVERS (EPL)

- This is the class of lever where the pivot is between the load and effort

AN ILLUSTRATION OF FIRST CLASS LEVER



- The load and effort move in opposite directions
- The longer the effort arm, the smaller the effort applied

EXAMPLES MACHINES IN THE FIRST CLASS LEVER

- | | | |
|---|--|--|
| <ul style="list-style-type: none"> ▪ See-saw ▪ Beam balance ▪ Scissors ▪ Pliers | <ul style="list-style-type: none"> ▪ Crowbar ▪ Pincers ▪ Lid opener ▪ Shears | <ul style="list-style-type: none"> ▪ Claw hammer ▪ Borehole ▪ Secateurs |
|---|--|--|

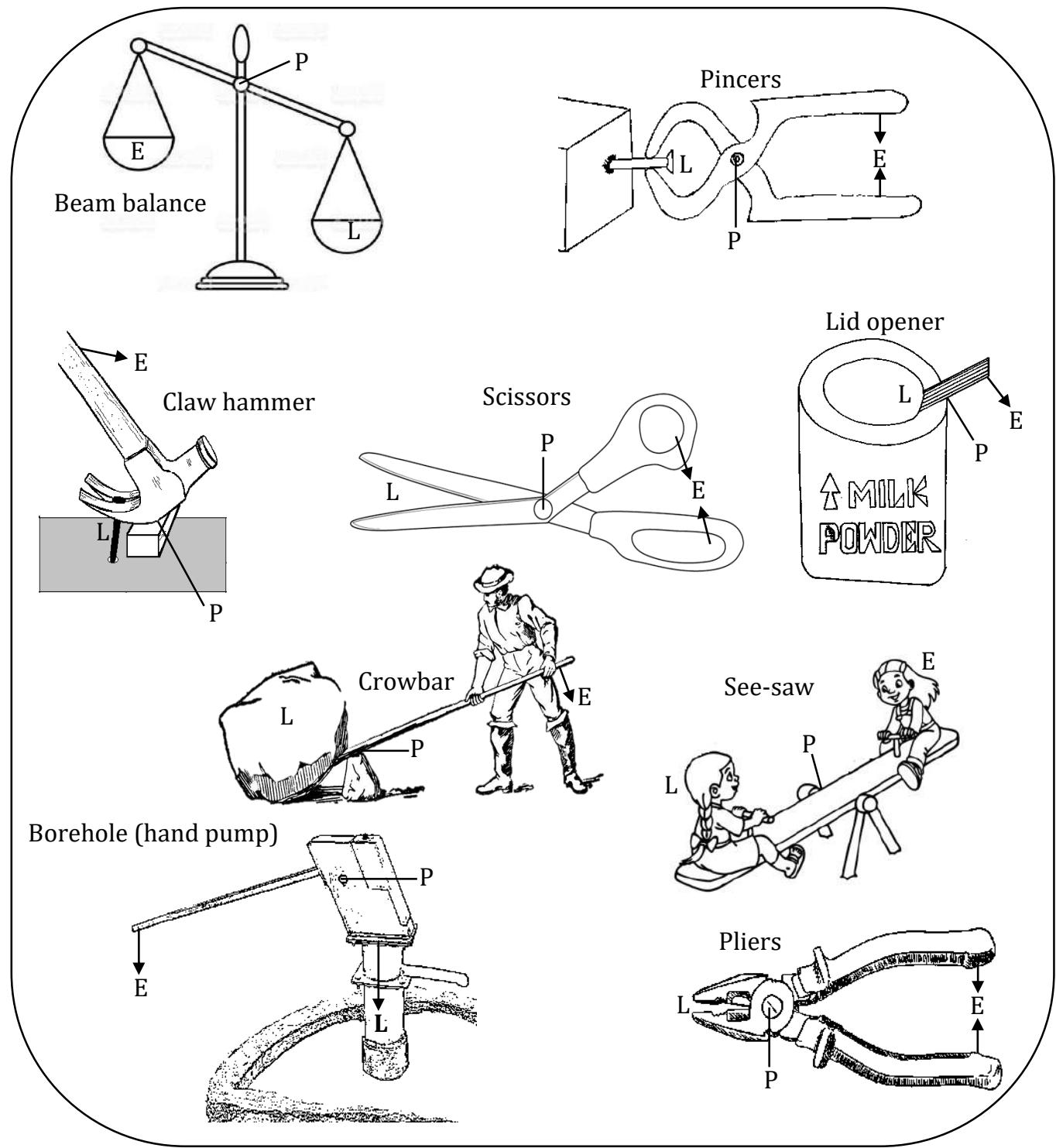
How do first class levers simplify work? (Advantages of using first class levers)

- They reduce the effort needed to do work (They use less effort)

How do first class levers reduce the effort needed to do work?

- By increasing effort arm (by making effort arm longer than load arm)

DIAGRAMS SHOWING FIRST CLASS LEVER MACHINES



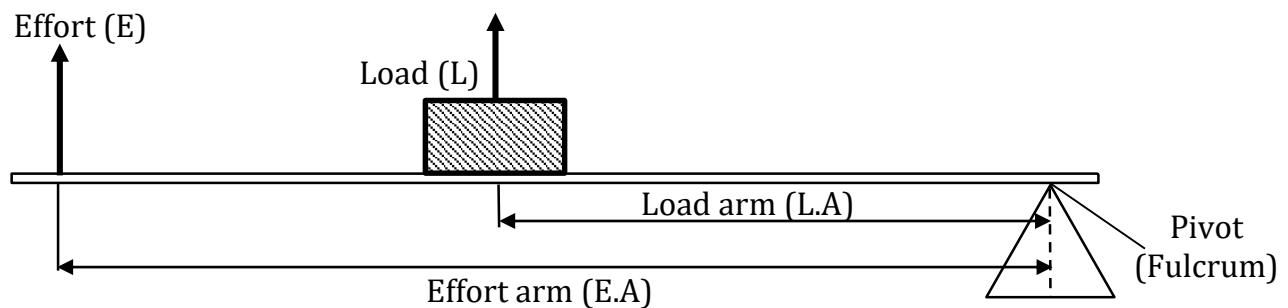
Uses of first class levers in our daily life

- A see-saw helps in playing balancing games
- A beam balance helps in measuring mass of items
- A claw hammer helps in removing iron nails from wood
- A lid opener helps in opening tins of paint
- A borehole helps in pumping water from underground
- A pair of scissors is used for cutting bandage when giving first aid
- Secateurs help in pruning
- Shears help in shearing (removing fleece/wool from sheep)

SECOND CLASS LEVERS (PLE)

- This is the class of lever where the load is between the pivot and effort

AN ILLUSTRATION OF SECOND CLASS LEVER



- The load and effort move in the same direction
- The effort arm is longer than the load arm hence using less effort

Examples of second class levers (class two levers)

- | | | |
|---------------|-----------------|-----------|
| ▪ Wheelbarrow | ▪ Bottle opener | ▪ Spanner |
| ▪ Nut cracker | ▪ Paper cutter | |
| ▪ Human foot | ▪ Door | |

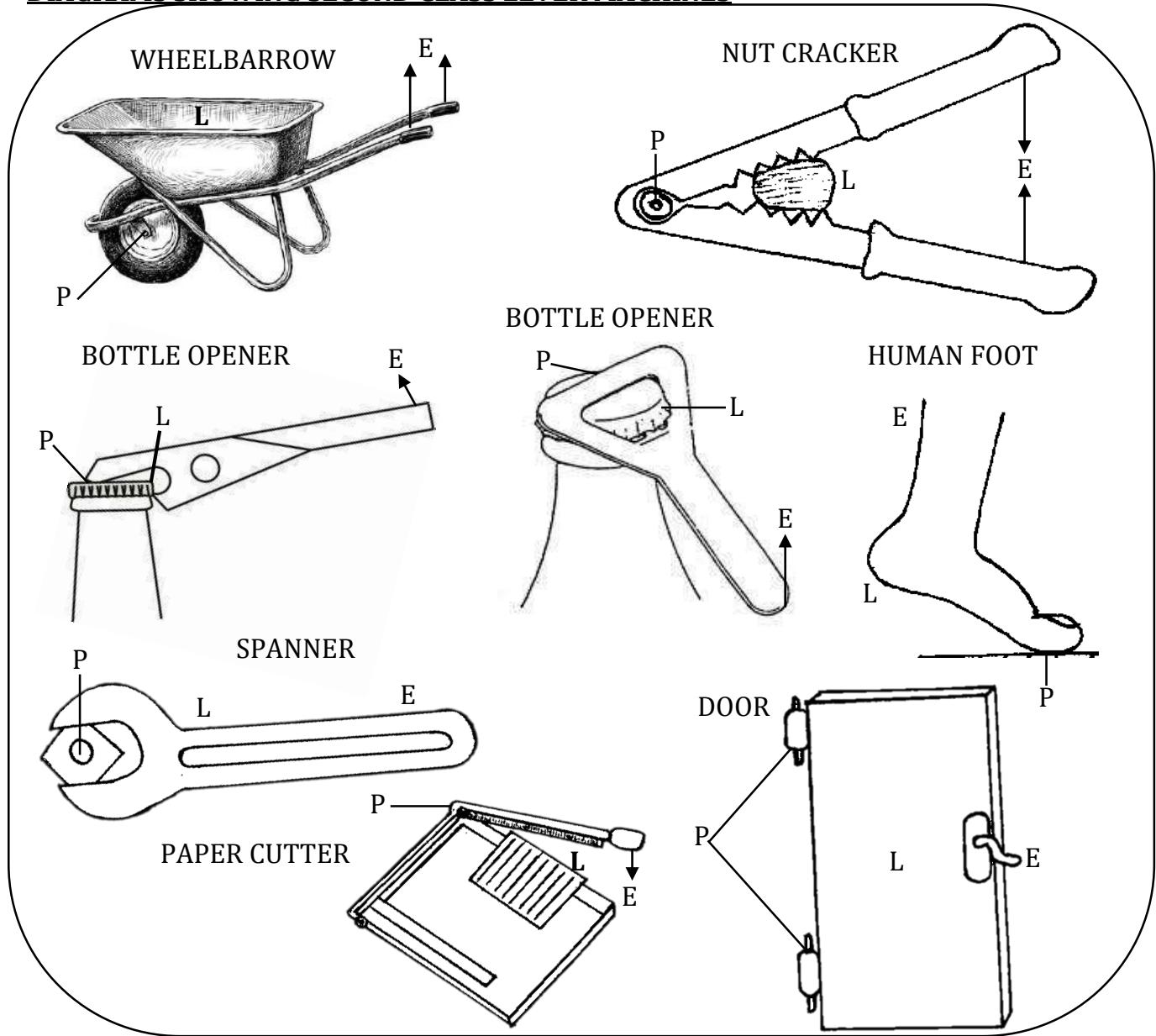
How do second class levers simplify work? (Advantages of using second class levers)

- They reduce the effort needed to do work (They use less effort)

How do second class levers reduce the effort needed to do work?

- By increasing effort arm (By making effort arm longer than load arm)

DIAGRAMS SHOWING SECOND CLASS LEVER MACHINES



USES OF SECOND CLASS LEVERS IN OUR DAILY LIFE

- A wheelbarrow is used to transport manure to the garden
- A nut cracker is used to break hard shelled seeds
- A bottle opener is used to open soda bottles
- A paper cutter is used to cut papers
- A door is used to promote privacy in buildings
- A spanner is used fasten or loosen nuts and bolts

Why are first and second class levers regarded as force multipliers?

- They reduce the effort needed to do work

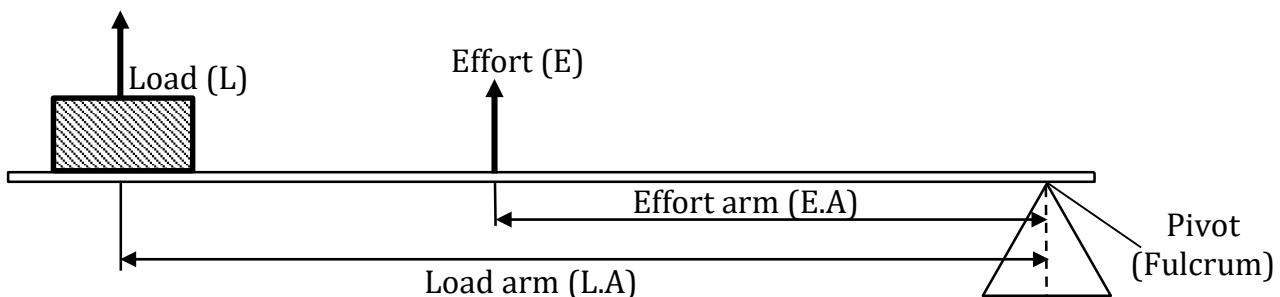
Why are scissors, pliers, pincers, shears, secateurs and nut crackers called double levers?

- They have two rigid bars with one pivot

THIRD CLASS LEVER (PEL)

- This is the class of lever where the effort is between the load and pivot

An illustration of a third class lever



- ✓ The load arm is always longer than the effort arm

EXAMPLES OF THIRD CLASS LEVERS MACHINES

- Fishing rod
- Broom
- Artificial arm
- Kitchen tongs (sugar tongs)
- Tweezers
- Human arm
- Cricket bat
- Chopstick
- Spade
- Shovel
- Hoe

How do third class levers simplify work? (Advantages of using third class levers)

- They increase the speed of doing work

How do third class levers simplify work? (Advantages of using third class levers)

- By reducing the effort arm (distance moved by effort)

Why third class lever regarded as distance multiplier?

- It reduces the effort arm (effort distance) and increases load distance

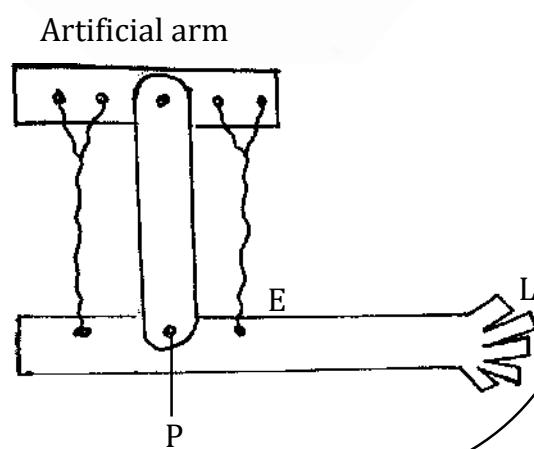
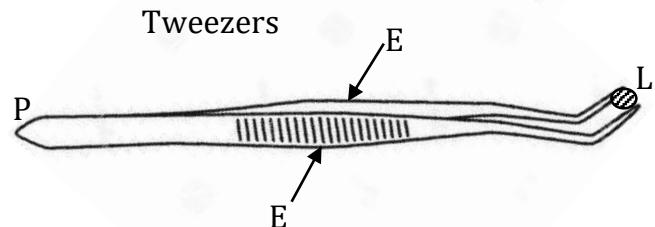
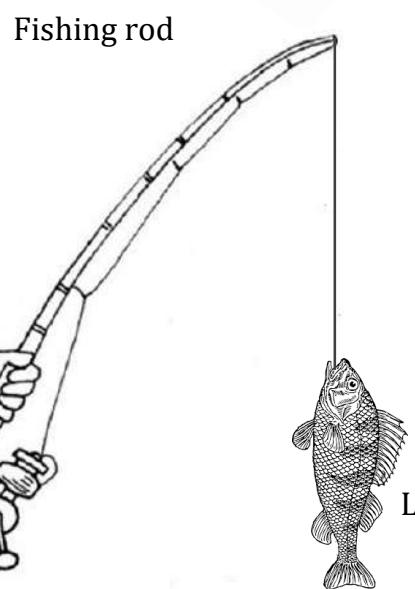
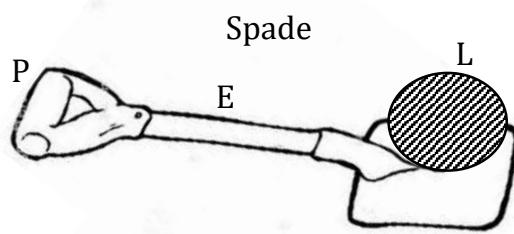
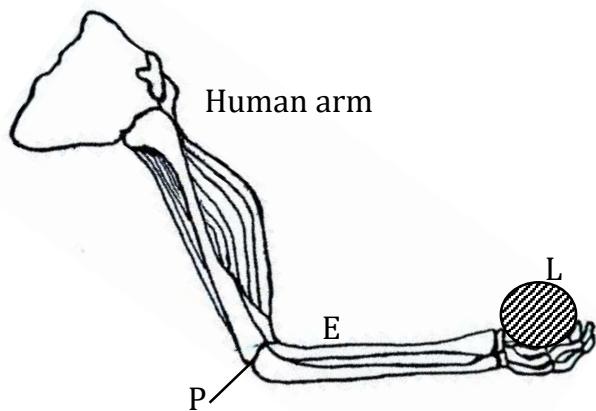
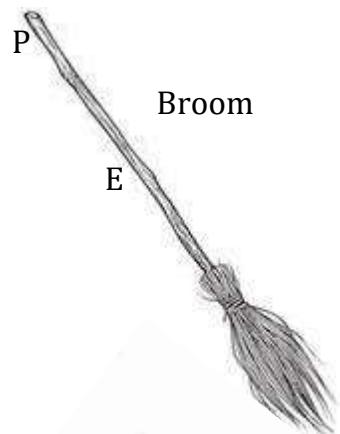
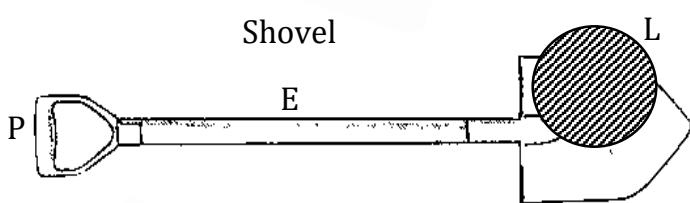
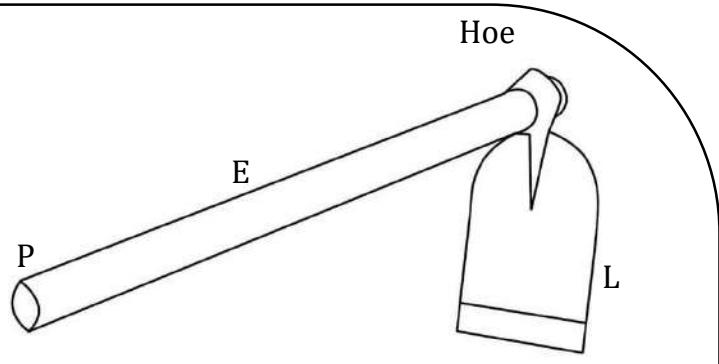
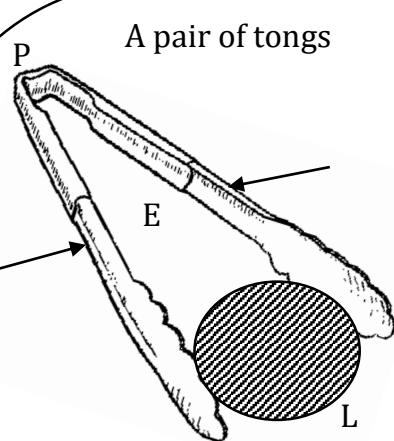
Why third class lever regarded as speed multiplier?

- It reduces the effort distance and increases load distance to increase the speed of doing work

Disadvantage of using third class levers

- They use much effort to do work

DIAGRAMS SHOWING THIRD CLASS LEVER MACHINES



USES OF THIRD CLASS LEVERS IN OUR DAILY LIFE

- A fishing rod is used for harvesting fish from water bodies
- A broom is used for sweeping rubbish
- Artificial arm is used to replace the removed arm
- Kitchen tongs is used for lifting hot charcoal
- Tweezers help in removing insect stings from the skin
- A spade is used for loading manure
- A shovel is used for removing loose soil
- A hoe is used for digging

MOMENTS

- **A moment** is the turning effect of a force
- It is measured in **Newton metre (NM)**
- A force acting downwards on left of the pivot turns the lever in anticlockwise direction
- A force acting downwards on right of the pivot turns the lever in clockwise direction

PRINCIPLES OF MOMENTS (LAWS OF LEVERS)

- The sum of clockwise moments is equal to the sum of anticlockwise moments for a lever to balance
- The product of effort and effort arm is equal to the product of load and the load arm for a lever to balance

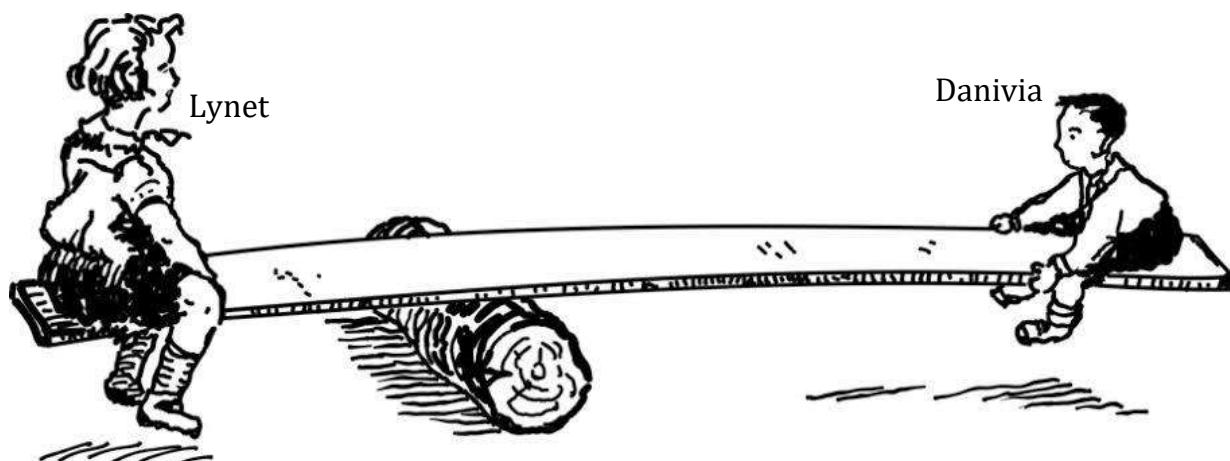
$$\text{Effort} \times \text{Effort arm} = \text{Load} \times \text{Load arm}$$

When is a lever said to be balancing (to be in equilibrium)?

- When the product of effort and effort arm is equal to the product of load and load arm

NOTE:

1. If a lever is to balance, the heavier body sits near the pivot.



Study the diagram above and answer questions about it.

i) **Who is heavier?**

- Lynet

ii) **Give a reason for your answer above.**

- Lynet is nearer the pivot than Danivia

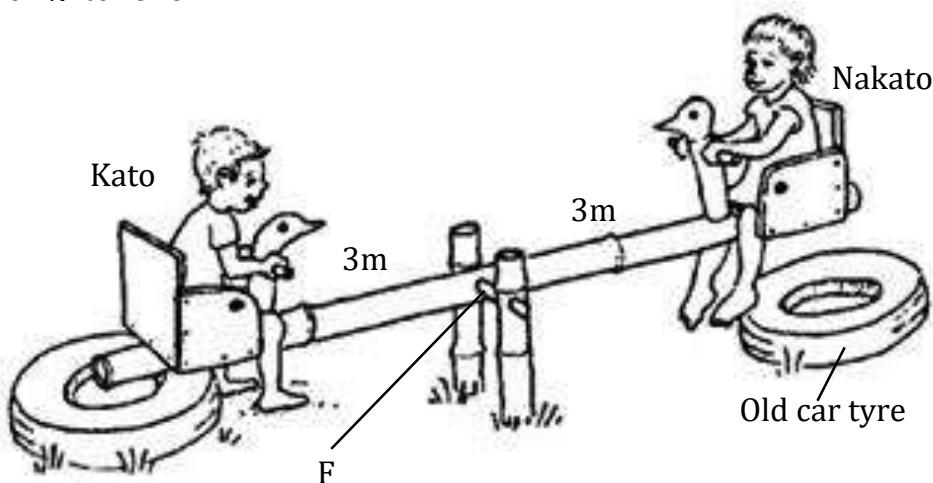
iii) **Who is lighter?**

- Danivia

iv) **Give a reason for your answer above.**

- Danivia is farther from the pivot than Lynet

2. If two bodies are at the same distance on opposite sides of the pivot, the heavier body lifts up the lighter one.



Study the diagram of a seesaw shown above and answer questions that follow.

i) **Of the twins on the seesaw above, who is heavier?**

- Kato

ii) **Give a reason for your answer above.**

- Kato has lifted up Nakato

iii) **What should Kato do in order to balance with Nakato?**

- Kato should sit nearer the pivot than Nakato

iv) **What should Nakato do in order to balance with Kato?**

- Nakato should sit farther from the pivot than Kato

v) **Name the part marked F**

- Pivot / Fulcrum

vi) **State the importance of the old car tyres put at the ends of a seesaw?**

- Old car tyres act as shock absorbers / To absorb shock

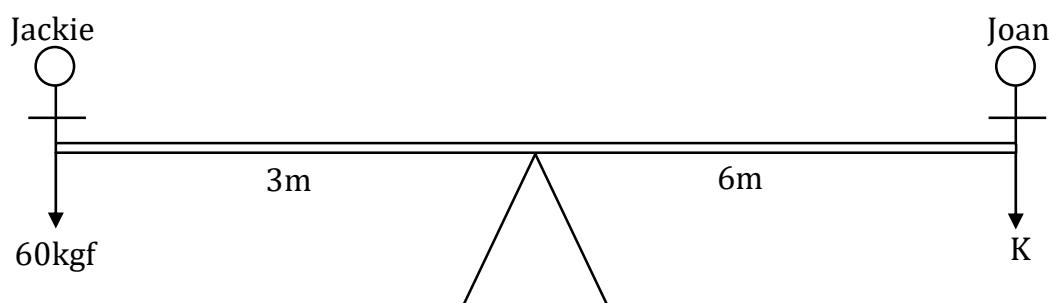
CALCULATIONS ON MOMENTS

EXAMPLE I

Jackie weighs 60kgf and sits 3 metres away from the fulcrum of the seesaw. Joan sits on the opposite side 6 metres away from the fulcrum and both girls balance.

Find Joan's weight

Sketch



✓ Let Joan's weight be K

Apply the law of levers

$$L \times LA = E \times EA$$

$$(6 \times K) = 60 \times 3$$

$$6K = 180$$

$$\underline{6K} = \underline{180}$$

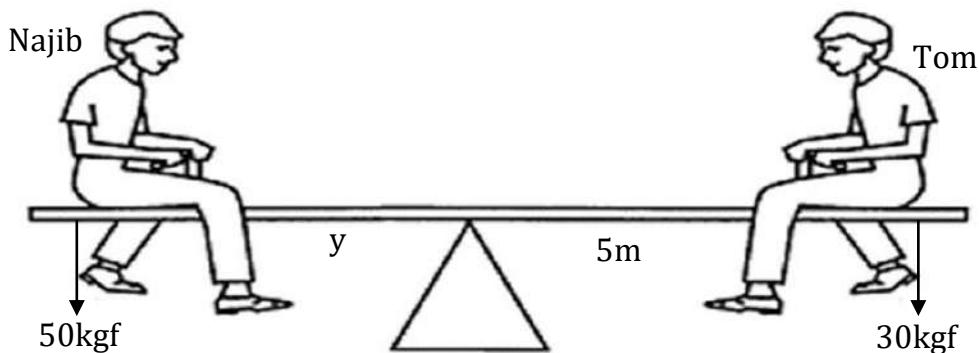
$$6 = 6$$

$$K = 30\text{Kgf}$$

EXAMPLE II

Najib weighs 50kgf and is seated at a distance of y m from the pivot of a seesaw. Tom on other side is seated at a distance of 5m from the pivot weighs 30kgf. If the lever balances

- i) Draw a sketch to show the position of Najib and Tom.



- ✓ Let Mukasa's distance from the pivot be y

- ii) Find Najib's distance from the pivot.

Apply the law of levers

$$\begin{array}{lcl} L \times LA & = & E \times EA \\ (50 \times y) & = & 30 \times 5 \\ 50y & = & 150 \\ \underline{50y} & = & \underline{150} \\ 50 & & 50 \\ y & = & 3m \end{array}$$

- iii) How far is Najib from Tom?

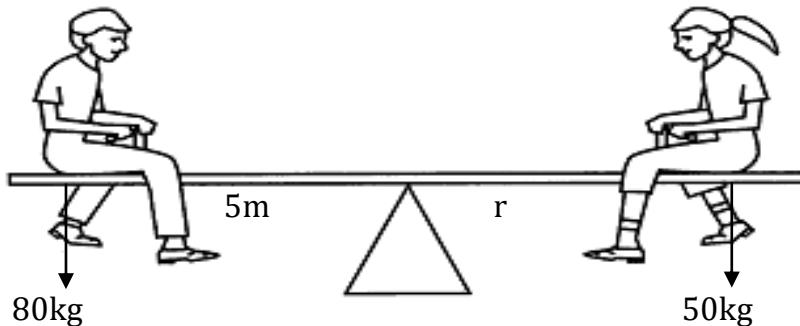
$$3m + 5m = 8m$$

EXAMPLE III

A man weighs 80kg and sits 5m away from the pivot of a seesaw.

- i) Where will his wife who weighs 50kg sit in order for them to balance?

Sketch



- ✓ Let wife's distance from the pivot be r

Apply the law of levers

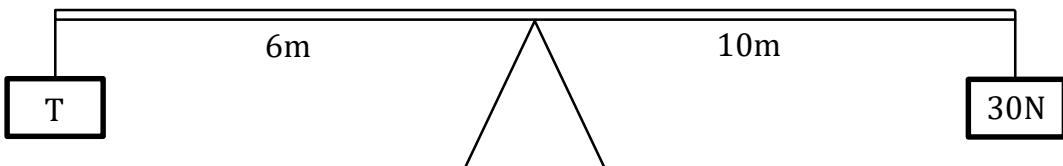
$$\begin{array}{lcl} E \times EA & = & L \times LA \\ (50 \times r) & = & 80 \times 5 \\ 50r & = & 400 \\ \underline{50r} & = & \underline{400} \\ 50 & & 50 \\ r & = & 8m \end{array}$$

ii) How far is the man from the wife?

$$8m + 5m = 11m$$

Example IV

Find the value of T in the figure below



Apply the law of levers

$$E \times EA = L \times LA$$

$$(T \times 6) = 10 \times 3$$

$$6T = 30$$

$$\underline{6T} = \underline{30}$$

$$6 = 6$$

$$T = 5N$$

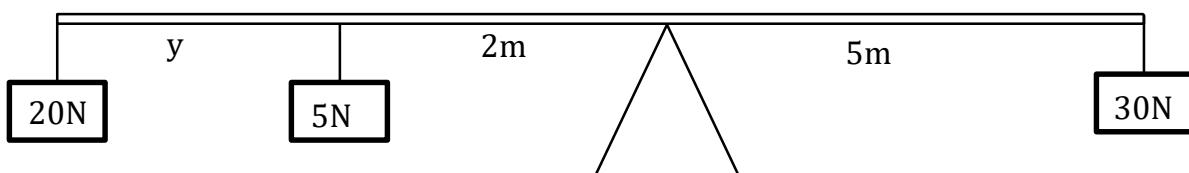
Activity

1. Wasswa weighs 80kgf and sits 3 m from the pivot of the see saw. Where will Kato who weighs 60kgf sit in order for them to balance?
2. Dan weighs 72kg sits 6metres from the pivot of a seesaw. Diana who weighs 36kk sits on the opposite side of the seesaw and they balance.
 - i) Draw a sketch to show the position of Dan and Diana
 - ii) How far is Diana from the pivot?
3. A man weighs 90kgf and sits 3m away from the fulcrum while his son weighing 30kgf sits in order to balance the man.
 - i) Draw a sketch to represent the above information
 - ii) How far is the man from the boy?
4. A man weighs 60kgf and sits 1.5 m from the turning point of the see saw. How far from the turning point will the boy whose weight is 30kgf sit in order to balance the man?

MORE CALCULATIONS ON MOMENTS

EXAMPLE I

In a lever below, calculate the value of y if two sides are to balance



Apply the law of levers

$$E \times EA = L \times LA$$

$$20(y + 2) + (5 \times 2) = 30 \times 5$$

$$20y + 40 + 10 = 150$$

$$20y + 50 = 150$$

$$20y + 50 - 50 = 150 - 50$$

$$20y = 100$$

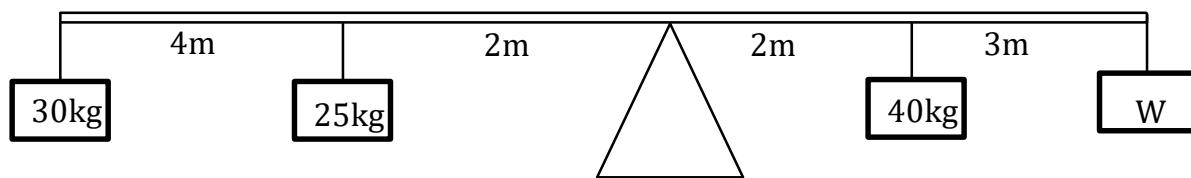
$$\underline{20y} = \underline{100}$$

$$20 = 20$$

$$y = 5m$$

EXAMPLE II

Find the W in kg



Apply the law of levers

$$\begin{array}{rcl}
 E \times EA & = & L \times LA \\
 W(3 + 2) + (40 \times 2) & = & 30(4 + 2) + (25 \times 2) \\
 3W + 2W + 80 & = & 120 + 60 + 50 \\
 5W + 80 & = & 230 \\
 5W + 80 - 80 & = & 230 - 80 \\
 5W & = & 150 \\
 \underline{5W} & = & \underline{150} \\
 5 & & 5 \\
 W & = & 30\text{kg}
 \end{array}$$

TERMS USED WITH MACHINES

Mass

- This is the amount (quantity) of matter in an object
- ✓ The **basic unit** of mass is grams (**g**) and the **standard unit** is kilograms (**Kg**)

Weight

- This is the force of gravity acting on an object.
- ✓ It is measured in **Newton (N)**

FACTORS AFFECTING WEIGHT OF AN OBJECT

- Force of gravity
- Nature of an object
- Size of an object

Why do objects weigh less on moon than on earth?

- The moon's gravity is less than the earth's gravity
- There is less gravity on moon than on earth

DIFFERENCES BETWEEN MASS AND WEIGHT

- Mass is measured in kilograms while weight is measured in Newtons
- Mass is constant while weight changes
- Mass is a scalar quantity while weight is a vector quantity
- Mass can never be zero while weight can be zero
- Mass is the amount of matter in an object while weight is the force of gravity acting on an object

BUOYANCY (UPTHRUST)

- This is the upward force acting on an object put in a fluid (liquid or gas)

Why do objects weigh less when put (immersed) in water or other fluids?

- Due to upthrust (buoyancy)

How is buoyancy important to sailors?

- It enables their boats to float on water

Examples of objects that float due to upthrust (buoyancy)

- Boat
- Ferry
- Ship

SURFACE TENSION

- This is the force of attraction between molecules on the surface layer of the liquid

Application of surface tension

- It enables small insects to walk on water
- It enables small pins to float on water

Why do small sinking objects e.g. pins and small insects/water striders tend to float on water?

- Due to surface tension

COHESION

- This is the force of attraction between molecules of the same kind
- ✓ Cohesion is greatest in solids and weakest in gases

Why do solids have greatest cohesion?

- Solids have compact molecules / molecules in solids are closely packed together

Why do gases have no cohesion?

- Molecules in gases are farthest apart

Why do liquids flow?

- They have weak cohesion

ADHESION

- This is the force of attraction between molecules of different kind

Name the force that enables water droplets to stick on a glass surface.

- Adhesion

DISTANCE

This is the space between two points

- The basic unit of distance is **metre (m)** and the standard unit is **kilometre (km)**

FORCE

This is pull or push on an object

- It is measured in **Newton (N)**

$$1\text{kg} = 10\text{N}$$

$$1\text{kgf} = 1\text{N}$$

Note

Force = Mass x gravity

$$F = M \times g$$

WORK

- This is the product of force and displacement

OR

- This is the product of force and distance moved in a specific direction
- Work done is measured in **joules (J)**

When is work said to be done?

- When an object moves along the direction of applied force

When is it said that there is no work done?

- When force is applied and an object does not move
- When the force is perpendicular to the motion of an object

CALCULATIONS ON WORK DONE

Work done = force x distance

$$W.d = F \times d$$

Example I

Calculate the work done to push a wheelbarrow with an effort of 10N through a distance of 5m.

$$W = F \times d$$

$$W = 10 \times 5$$

$$= 50J$$

Example II

A block was moved using an effort of 7kg through a distance of 5m. Calculate the work done

$$1\text{kg} = 10\text{N}$$

$$70\text{ kg} = 7 \times 10\text{N}$$

$$= 70\text{N}$$

$$W = F \times d$$

$$W = 70 \times 5$$

$$= 350J$$

Example III

Calculate the work done by a man who used 4N to push a wheel barrow through a distance of 2.5m

$$W = F \times d$$

$$W = 4 \times 2.5$$

$$= \underline{\underline{4 \times 25}}$$

$$\begin{array}{r} 10 \\ \times 25 \\ \hline \end{array}$$

$$= \underline{\underline{100}}$$

$$\begin{array}{r} 10 \\ \times 25 \\ \hline 100 \end{array}$$

$$= \underline{\underline{10}}J$$

Activity:

1. Calculate the measure of work done to put a sack of rice on a truck 3m above the ground using an effort of 50kg
2. An effort of 75N was applied to lift up a brick through a distance of 60m. Calculate the work done

MECHANICAL ADVANTAGE (M.A)

- This is the ratio of load to effort

OR

- This is the number of times a machine simplifies a given work.

$$M.A = \frac{\text{Load (L)}}{\text{Effort (E)}}$$

NOTE

- M.A has no units **because** it is a ratio of forces
- Less effort is used when M.A is greater than one
- Much effort is used when MA is less than one

Name the force that affects mechanical advantage of a machine

- Friction

Much friction reduces mechanical advantage and less friction increases mechanical advantage

CALCULATIONS ON MECHANICAL ADVANTAGE (MA)

An effort of 40N is applied to a lever to overcome a load of 200N. Calculate the MA of the machine.

$$\begin{aligned} \text{MA} &= \frac{L}{E} \\ \text{MA} &= \frac{200\text{N}}{40\text{N}} \\ &= 5 \end{aligned}$$

What does the answer above mean?

- A machine simplifies the given work four times

Activity

1. Calculate the mechanical advantage (MA) if the cook uses a wheel barrow to push a 100kgf of maize flour with an effort of 25kgf.
2. Find the effort needed to lift a load of 300N if the MA is 3

Velocity Ratio (V.R)

- This is the ratio of effort arm to load arm

OR

- This is the ratio of effort distance to load distance

$$V.R = \frac{\text{Effort distance}}{\text{Load distance}}$$

CALCULATIONS ON VELOCITY RATIO

1. A crowbar moved a load of 800N to a height of 2m. If an effort of 200N was applied at a distance of 8m,
 - i) Calculate the MA
 - ii) Find the VR
2. A load of 100N was moved through a distance of 10m. If an effort of 2200N was applied at a distance of 50m from the fulcrum on the opposite side.
 - i) Calculate the mechanical Advantage
 - ii) Find the velocity ratio of the machine

EFFICIENCY OF A MACHINE (E)

- This is the ratio of the work output to work input of a machine expressed as a percentage

WORK OUTPUT

- This is the product of load and load distance
- This is the work done on the load by the machine

WORK INPUT

- This is the product of effort and effort distance
- This is the work done by the effort on the machine

$$E = \frac{L \times L.D}{E \times E.D} \times 100\%$$

REASONS WHY THE EFFICIENCY OF A MACHINE IS ALWAYS LESS THAN 100%

- Due to friction
- Due to gravity
- Due to rusting

WAYS OF IMPROVING THE EFFICIENCY OF A MACHINE

- By lubricating (oiling or greasing) to reduce friction
- By replacing/repairing worn out parts of a machine

Example

By using a machine, an effort of 30N was moved through a distance of 15m to raise a load of 120N to a height of 3m. Calculate the efficiency of the machine

$$\begin{aligned}
 \text{Efficiency} &= \frac{\text{Load} \times \text{Load distance}}{\text{Effort} \times \text{Effort distance}} \times 100\% \\
 &= \frac{120\text{N} \times 3\text{m}}{30\text{N} \times 15\text{m}} \times 100\% \\
 &= \frac{4}{5} \times 100\% \\
 &= 80\%
 \end{aligned}$$

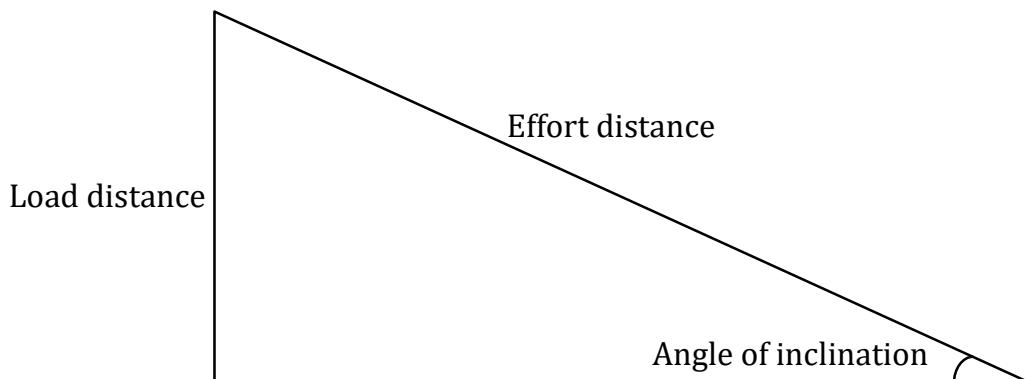
POWER

- This is the rate of doing work
- ✓ It is measured in **watts (w)** or **kilowatts (kw)**

INCLINED PLANES (SLOPES)

- These are slanting surfaces that join a lower level to a higher level
- These are simple machines with a slanting surface
- ✓ They are called inclined **because** they have a slanting surface and planes **because** they are flat

AN ILLUSTRATION SHOWING AN INCLINED PLANE (SLOPE)



- The vertical height **is the load distance (load arm)**
- The slanting surface **is the effort distance (effort arm)**

How do inclined planes/slopes simplify work? (Advantages of using inclined planes)

- They reduce the effort needed to raise heavy loads to higher levels

How do inclined planes/slopes reduce the effort needed to do work?

- By increasing the effort distance

How do inclined planes/slopes reduce the effort needed to do work?

- By increasing the effort distance

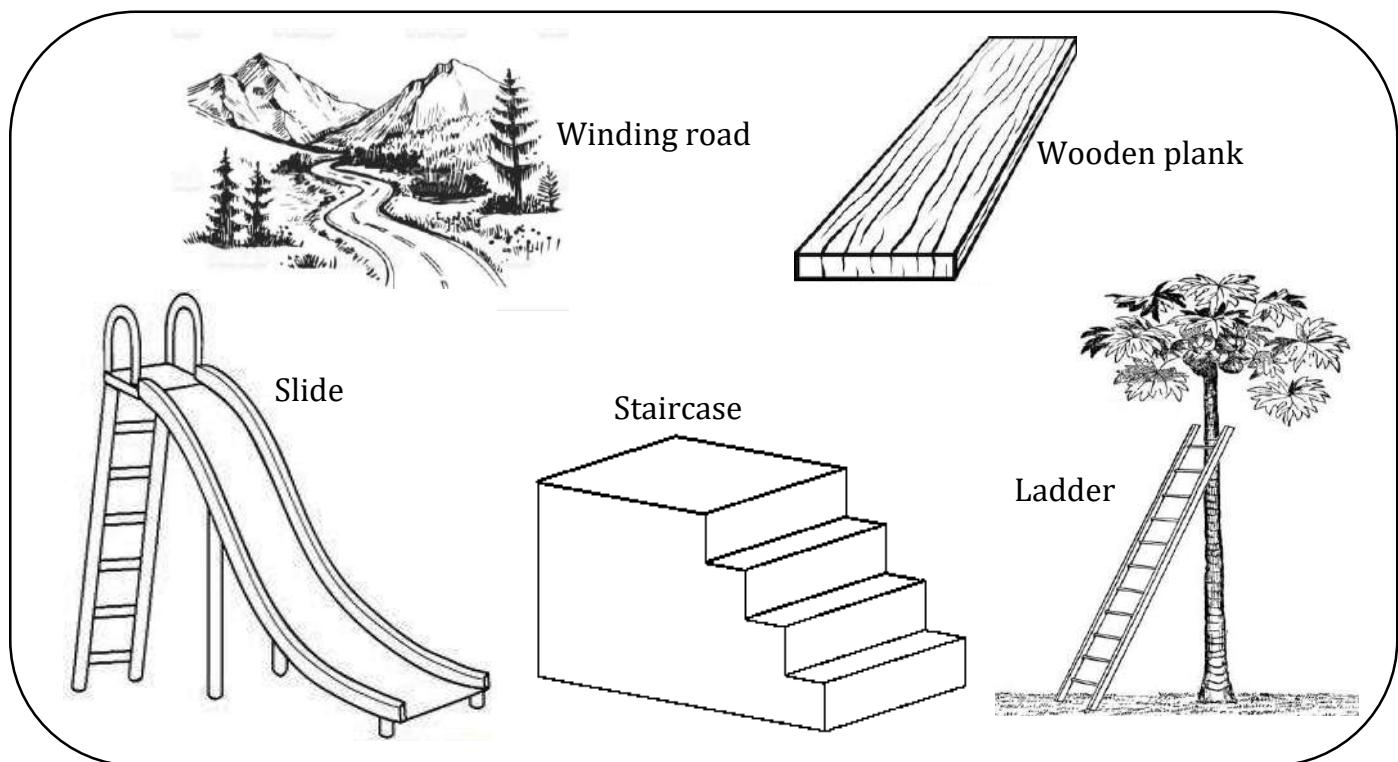
EXAMPLES OF INCLINED PLANES

- Staircase : this is a stepped slope
- Winding road (road going uphill)
- Ramp/Wheelchair ramp
- Ladder
- Slide
- Wooden plank (plank of wood)

USES OF INCLINED PLANES IN OUR DAILY LIFE

- A ladder helps in climbing trees
- Staircases help in climbing tall buildings
- A winding road helps in climbing steep hills
- A slide is used for playing sliding games
- A wooden plank helps in loading heavy goods on trucks

DIAGRAMS SHOWING SLOPES (INCLINED PLANES)



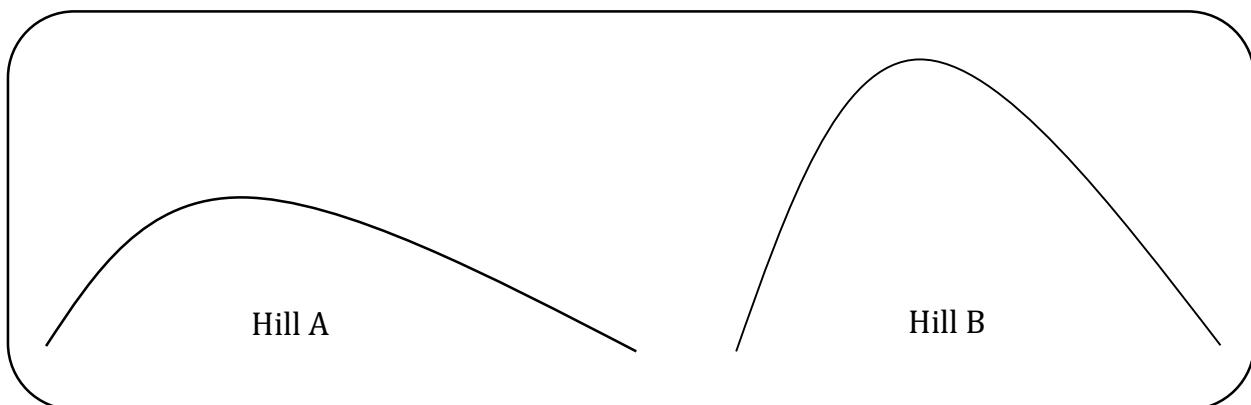
Why is it easier to climb up stairs than to use a ladder?

- Less effort is used to climb up stairs than on a ladder

How can inclined planes/slopes be improved?

- By making the slanting surface longer (increasing the effort distance)
- By reducing the angle of inclination

Study the diagrams below and answer the questions that follow.



On which hill will less effort be used in climbing?

- Hill A

Give a reason for your answer above

- Hill A has a longer slanting surface than hill B

Why does a person use much effort to climb hill B?

- Hill B has a steep slanting surface

Identify the inclined plane that can be used to reduce the effort needed in climbing hill B

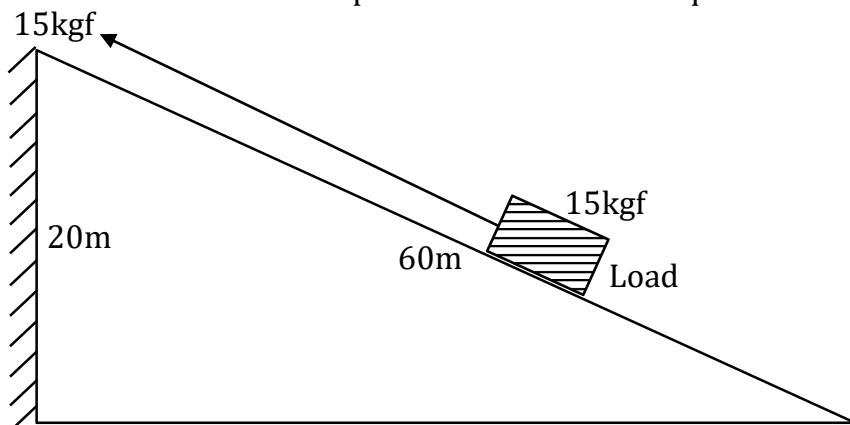
- Winding road

CALCULATING THE MECHANICAL ADVANTAGE OF SLOPES (INCLINED PLANE)

$$MA = \frac{L}{E} \quad \text{OR} \quad MA = \frac{ED}{LD}$$

EXAMPLE I

The diagram below shows an inclined plane. Use it to answer questions.



Calculate the work done on the load and Mechanical advantage

$$\text{Work done} = \text{force} \times \text{distance}$$

$$= 15 \times 2$$

$$= 30 \text{ Joules}$$

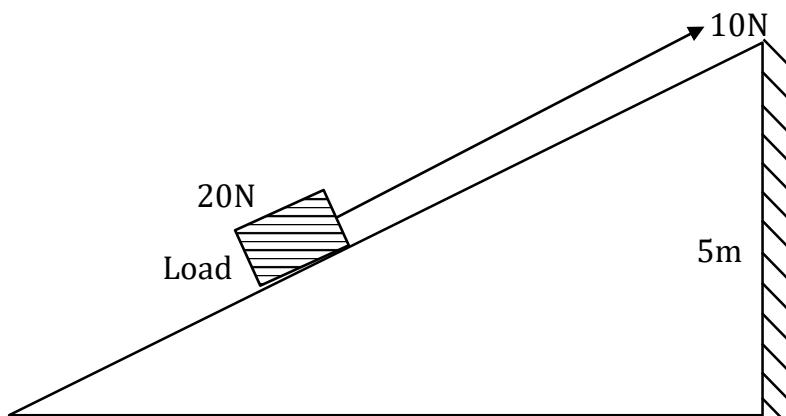
$$MA = \frac{ED}{LD}$$

$$= \frac{6m}{2m}$$

$$= 3$$

EXAMPLE II

Below is a slope. Use it to answer questions.



Calculate the mechanical advantage

$$MA = \frac{L}{E}$$

$$= \frac{20N}{10N}$$

$$= 2$$

Find the distance moved by effort

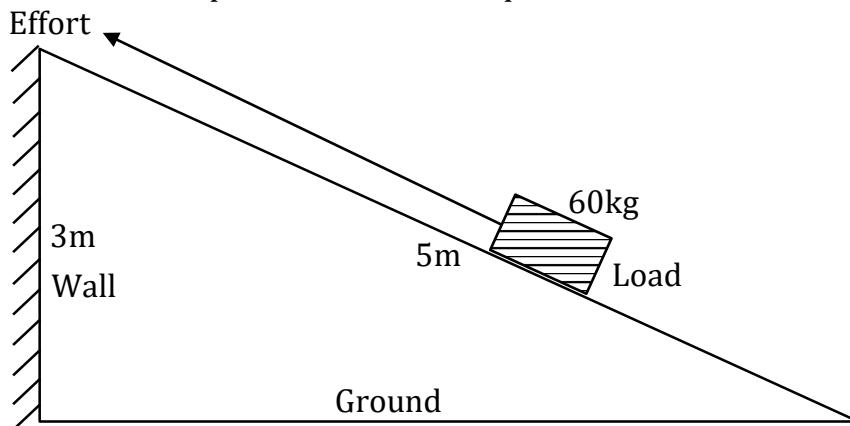
$$MA = \frac{ED}{LD}$$

$$5m \times 2 = \frac{ED}{5m} \times 5m$$

$$10m = ED$$

Example III

The diagram below shows a slope. Use it to answer questions



If an effort of 30kg was used to raise the load from the ground to a higher level,

- Calculate the mechanical advantage
- Find the efficiency of the machine

WEDGES

- These are tools with a sharp edge that gets gradually wider

Why are wedges sometimes called double inclined planes?

- They have two slanting surfaces

EXAMPLES OF WEDGES

- | | | |
|----------|--------------|----------------|
| ▪ Axe | ▪ Razorblade | ▪ Wooden wedge |
| ▪ Panga | ▪ Bullet | ▪ Safety pin |
| ▪ Spear | ▪ Knife | ▪ Hoe |
| ▪ Sword | ▪ Nail | |
| ▪ Needle | ▪ Chisel | |

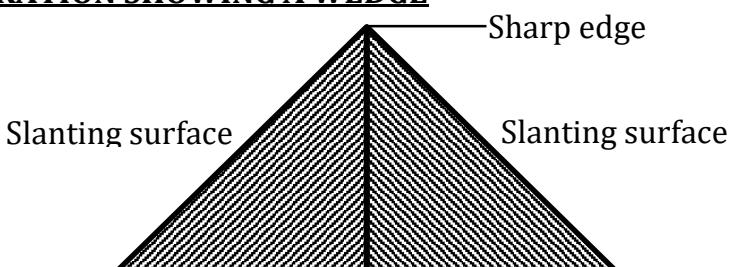
APPLICATIONS (USES) OF WEDGES

- Some wedges are used for splitting/chopping wood
- Some wedges are used for cutting
- Some wedges are used for sewing
- Some wedges are used for digging
- Some wedges are used for peeling
- Some wedges are used for piercing

Activities done using wedges

- | | |
|----------------------|----------------|
| ▪ Sewing | ▪ Peeling food |
| ▪ Cutting | ▪ Digging |
| ▪ Splitting firewood | |

AN ILLUSTRATION SHOWING A WEDGE



How do wedges simplify work?

- They have a sharp edge which makes the crack bigger.

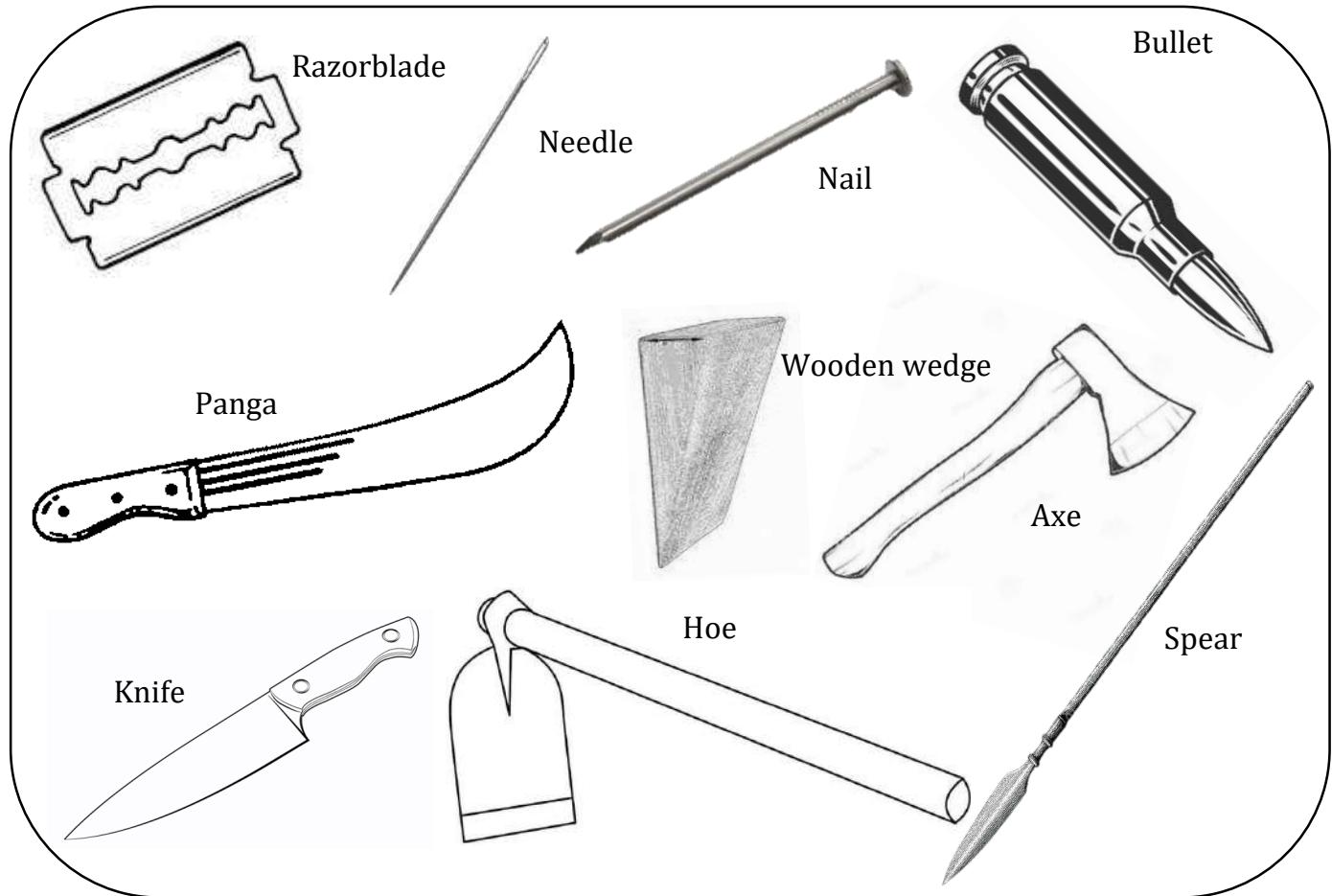
How can wedges be improved?

- By sharpening them

FACTORS THAT AFFECT THE EFFICIENCY OF WEDGES

- | | | |
|-----------|------------|-------------|
| ▪ Rusting | ▪ Friction | ▪ Sharpness |
|-----------|------------|-------------|

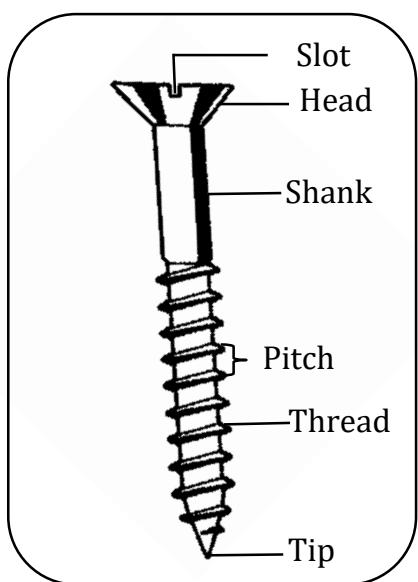
DRAWINGS SHOWING WEDGES



SCREWS

- A screw is an inclined plane wound round a bar/rod

PARTS OF THE SCREW



Threads (screw threads)

- They hold the screw nail into the material where it is driven

Pitch

- This is the distance between two consecutive threads

Head

- It has a groove/slot where the screw driver is fitted

Slot

- It is where the screw driver is fitted

Shank (rod)

- This is the smooth part above the threads but below the head

Tip

- This is the part of the screw nail that enters the material first

NOTE

A screw with many threads moves longer distance so;

- Less effort is needed to overcome the load

A screw with few threads moves a shorter distance so;

- Much effort is needed to overcome the load

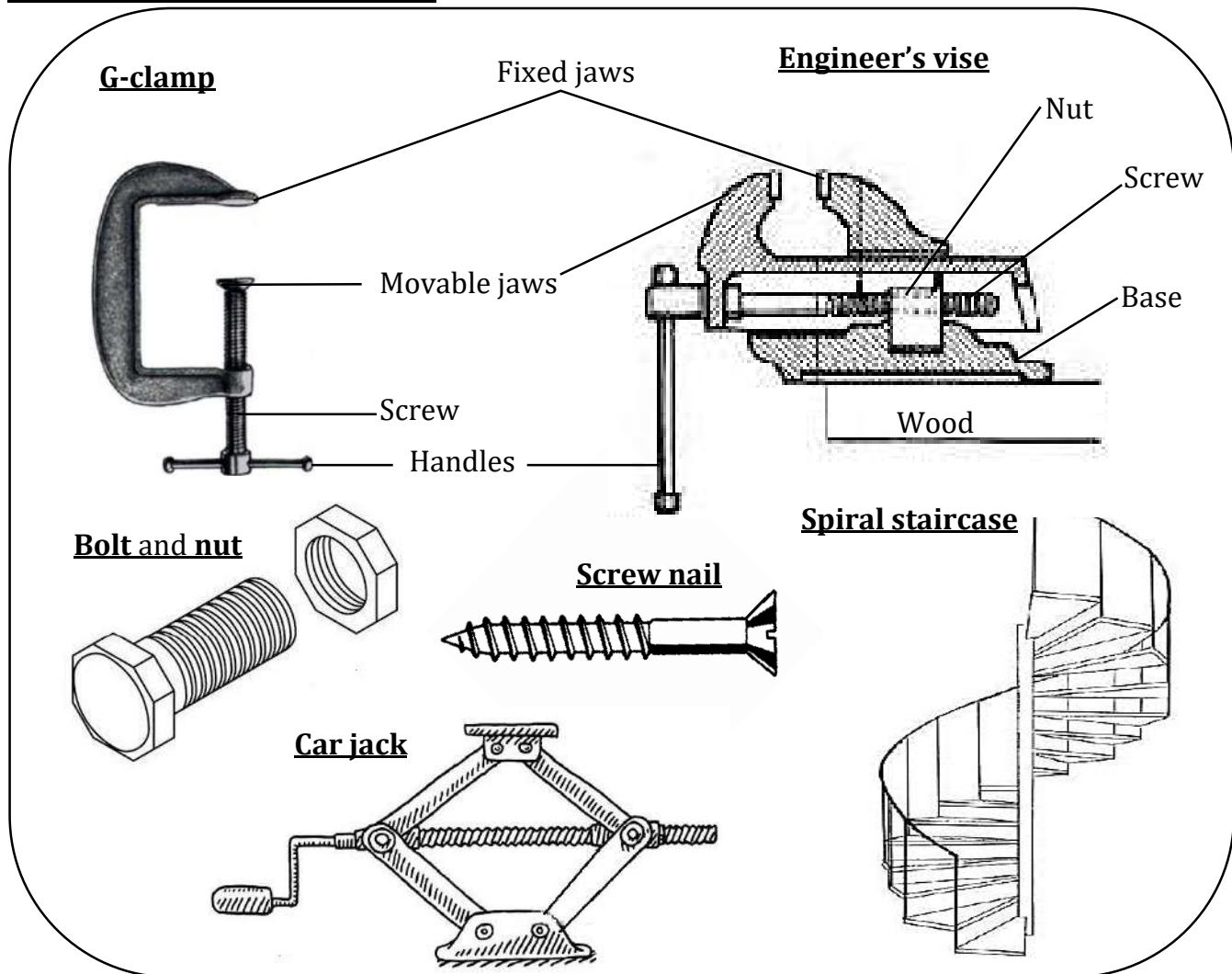
EXAMPLES OF MACHINES THAT USE SCREWS

- Bolt and nut
- Screw cap
- Car jack
- Screw nail
- Spiral staircase
- Engineer's vise
- G-clamp
- Drilling machine

FACTORS THAT AFFECT PROPER WORKING OF SCREWS

- Rusting
- Friction

DRAWINGS SHOWING SCREWS



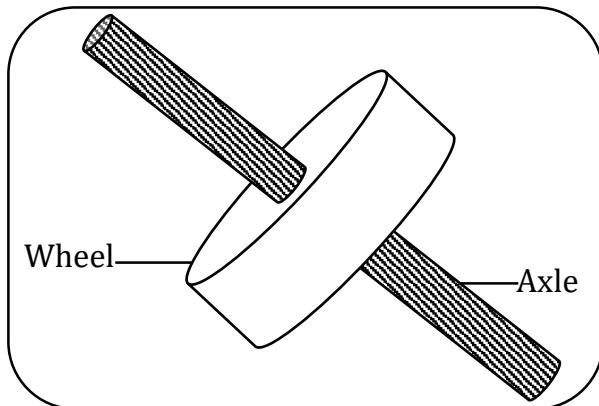
USES OF SCREWS

- Car jack is used to lift vehicles
- Screw nails are used to fasten(hold) wood or metals together
- Drilling machine is used to drill holes in wood or metals
- Screw caps are used to tighten bottle tops
- Spiral staircase make movement upstairs easier
- Engineer's vise is used to hold metals when filing or cutting
- Bolts and nuts are used to fasten metals together

WHEELS AND AXLE

- These are simple machines composed of two rotating wheels fixed together
- ✓ **A wheel** is a circular rim rotating on axle (shaft)
- ✓ **An axle** is a rod on which a wheel rotates
- ✓ A strong thread or chain is tightly around the axle
- ✓ A belt (chain) coming out of the wheel leads to the **Effort** and the one that comes out of the axle leads to the **Load**

AN ILLUSTRATION OF A WHEEL AND AXLE



- ✓ The radius of the wheel must be greater than the radius of the axle to use less effort

EXAMPLES OF WHEELS AND AXLE MACHINES

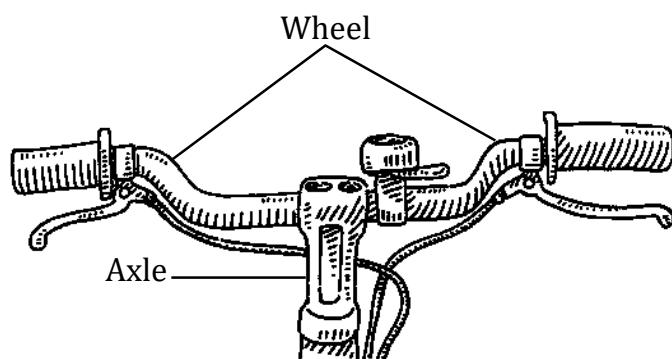
- Car steering wheel
- Doorknob
- Bicycle handles
- Bicycle pedal wheels
- Egg beater
- Windlass (winch)
- Brace
- Sewing machine
- Screw driver
- Windmill

APPLICATION (USES) OF WHEELS AND AXLE IN DAILY LIFE

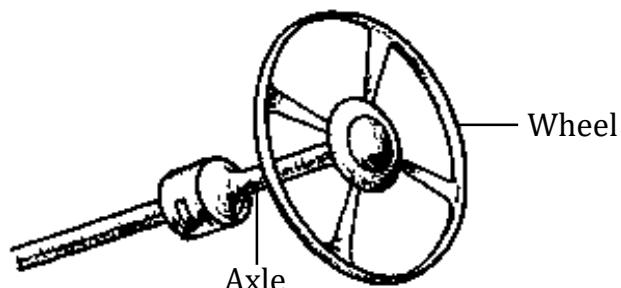
- Egg beater is used to prepare eggs for frying
- Windlass is used to draw water from deep wells
- Doorknob is used to open doors
- Steering wheel is used to turn cars
- Bicycle pedal wheels are used to ride bicycles
- Door knobs used to open doors
- Brace is used to drill holes in wooden materials
- Screw drivers are used to turn screw nails

DRAWINGS SHOWING WHEELS AND AXE MACHINES

HANDLES OF A BICYCLE

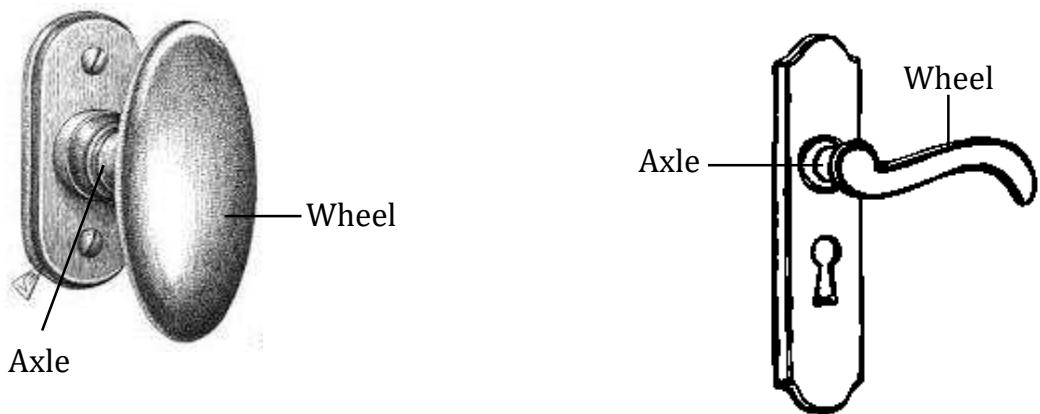


CAR STEERING WHEEL

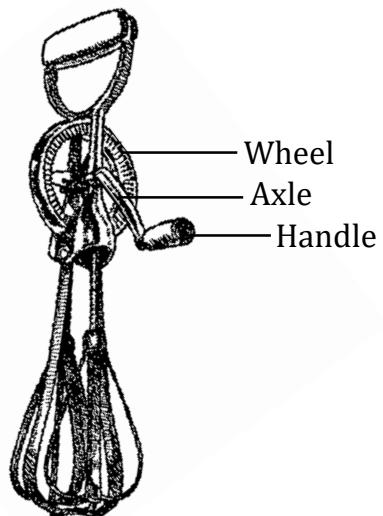


- ✓ The longer the steering wheel, the easier the turning of the wheel

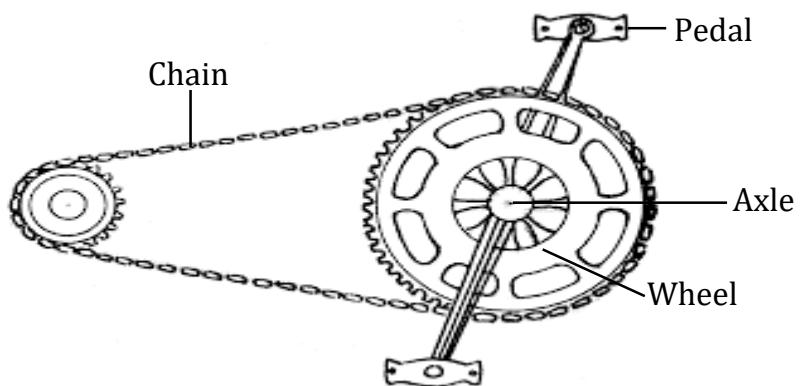
DOORKNOB



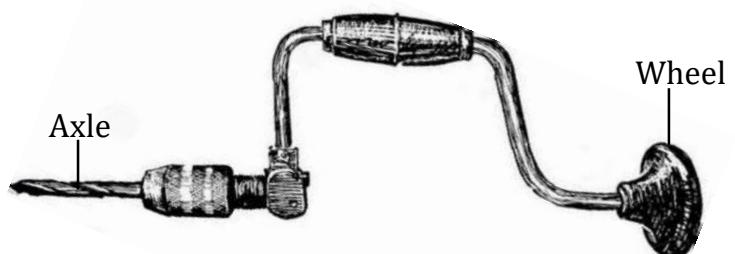
EGG BEATER



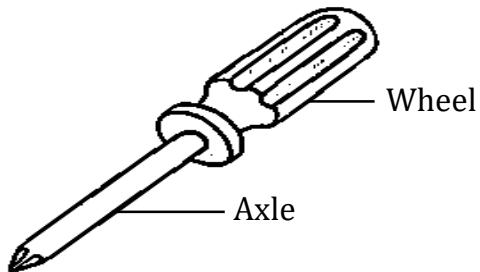
PEDAL WHEELS OF A BICYCLE



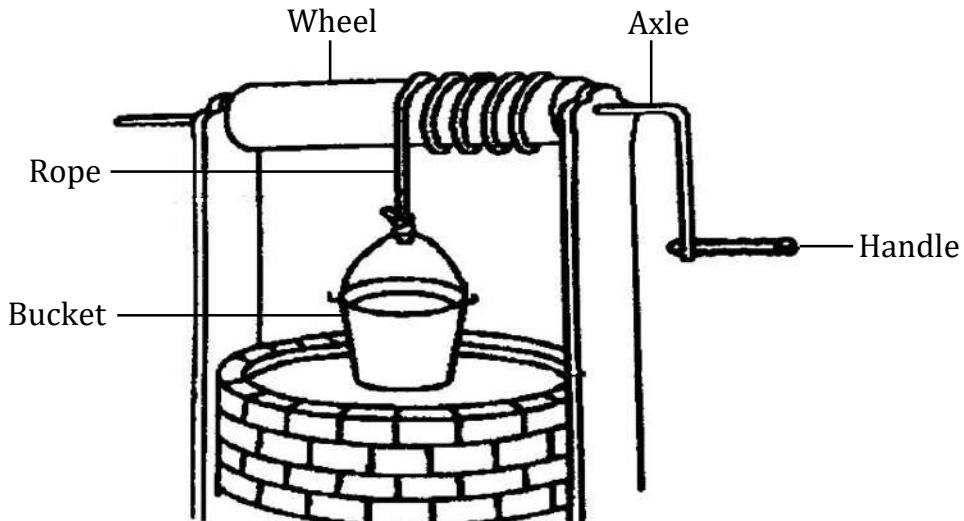
BRACE



SCREW DRIVER



WINDLASS



NOTE

- The handle of the windlass is turned in clockwise direction to move the bucket upwards

How can one turn the handle to make the bucket move downwards?

- In the anti-clockwise direction

On which principle does a windlass work?

- It works on the principle of wheels and axle

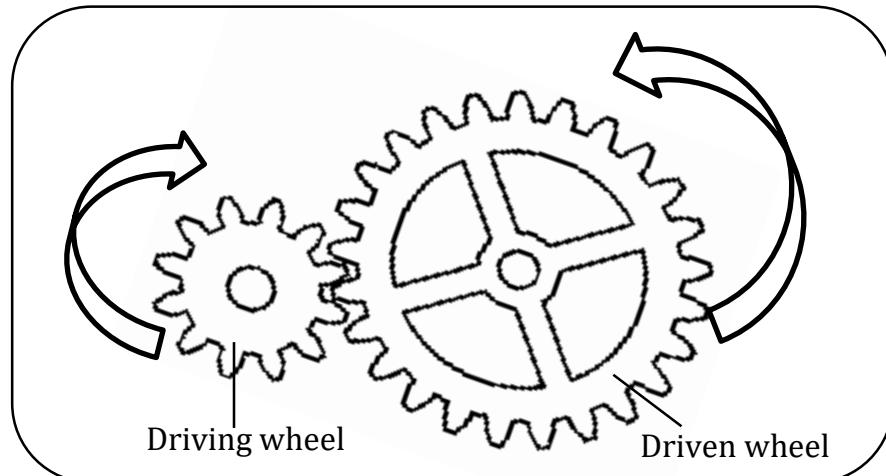
GEAR WHEELS AND BELT DRIVES

Gear wheel:

- This is a wheel with a toothed rim
- This is a wheel with teeth on edges around it
- ✓ It is sometimes called **cogwheel** or **toothed wheel**

ILLUSTRATIONS SHOWING COGWHEELS (GEARS)

i) COG WHEELS A AND B MOVE IN OPPOSITE DIRECTIONS



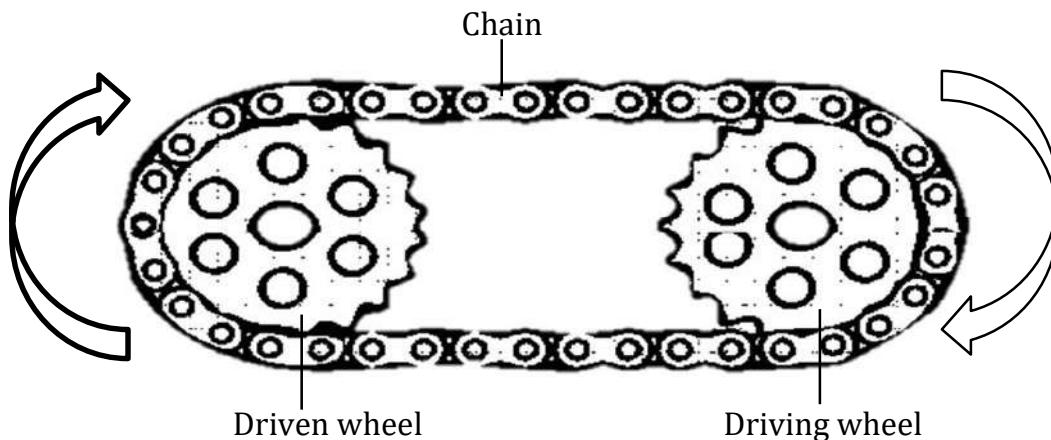
- If cogwheels are fixed, their teeth interlock and they move in opposite directions

CALCULATION ON GEARS

If the driving wheel has 12 teeth and a driven wheel has 48 teeth, how many revolutions will be made by a driving wheel in a complete turn (one revolution) of a driven wheel?

$$\begin{aligned}\text{No. of revolutions} &= \frac{\text{No. of teeth on driven wheel}}{\text{No. of teeth on driving wheel}} \\ &= \frac{48}{12} \\ &= 4 \text{ revolutions}\end{aligned}$$

ii) COGWHEELS A AND B MOVE IN THE SAME DIRECTION



- If cogwheels are connected with chains (belts), they move in the same direction

EXAMPLES OF MACHINES THAT USE GEAR WHEELS

- Motor cycles
- Bicycles
- Bulldozers
- Gear boxes
- Watches

ADVANTAGES OF USING GEAR WHEELS

- They multiply effort(reduce the effort applied)
- They increase the speed of rotation
- They change the direction of rotation/movement
- They can be used to slow the speed of rotation

BELT DRIVE:

- This is a mechanism where the movement of a flexible belt transmits power from one pulley shaft to another.
- Pulleys connected and driven by a belt move in the same direction

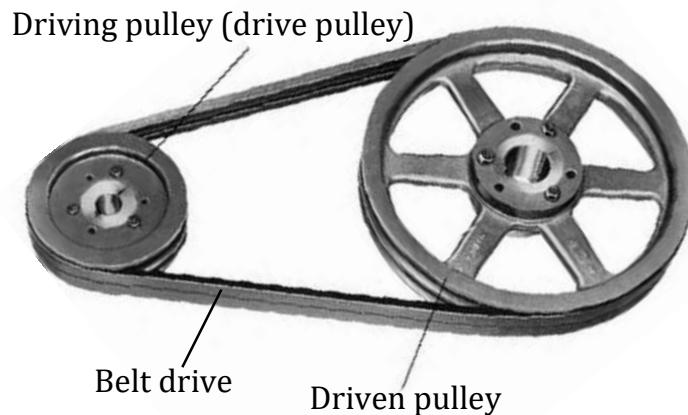
APPLICATIONS OF BELT DRIVE:

- It is used to transfer (transmit) power from one pulley to another.
- It is used in the mill industry.
- It is used in conveyor.
- It is used in washing machine.
- It is used in exhaust fan system.

MATERIALS USED TO MAKE BELT DRIVE:

- | | |
|-----------|-----------|
| ▪ Leather | ▪ Plastic |
| ▪ Rubber | ▪ Balata |
| ▪ Cotton | |

AN ILLUSTRATION SHOWING PULLEYS DRIVEN BY BELT DRIVE



EXAMPLES OF MACHINES THAT USE BELT DRIVE

- Sewing machine
- Grain mill
- Sawmill
- Printing press
- Treadmill
- Belt conveyor / conveyor belt system
- Alternator
- Washing machine
- Generator
- Car radiator fans
- Water pump
- Air compressor

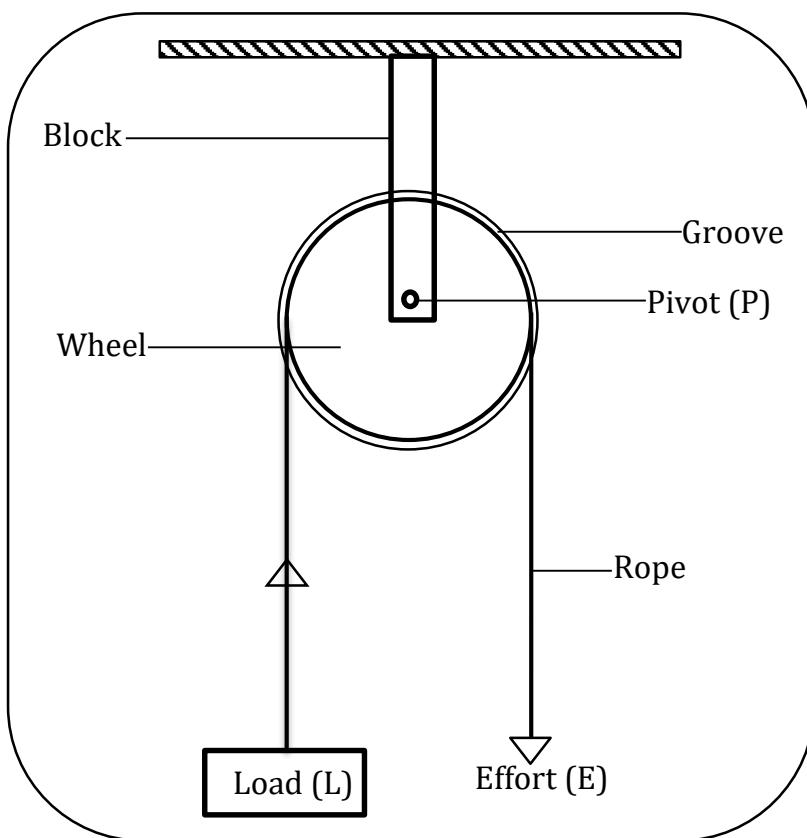
USES OF BELT CONVEYOR

- They are used in bottling industries to transport soda bottles in bottling lines
- They are used in escalators to transport people from one floor to another
- They are used to transport materials from one level to another

PULLEYS:

- A pulley is a wheel with a grooved rim

PARTS OF A PULLEY



Functions of the parts of a pulley

Block

- It holds (supports) the pulley

Grooved rim

- It prevents the rope from slipping (sliding) off

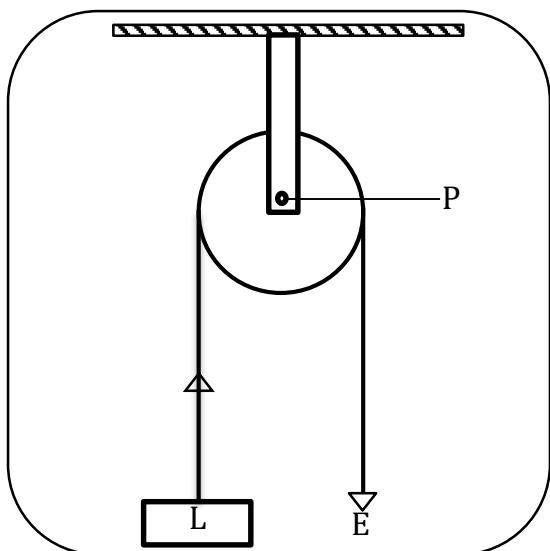
Rope/chain

- It holds the load
- It is where the effort is applied

TYPES OF PULLEYS

- Single fixed pulley
- Single movable pulley
- Block and tackle pulleys (fixed movable pulley)

SINGLE FIXED PULLEY



In a single fixed pulley:

- The block is fixed and only the wheel moves
- It changes the direction of forces
- The load and effort move in opposite direction
- The load and effort move the same distance
- It acts as a first class lever
- Work is done faster
- The effort applied is equal to the load
- The mechanical advantage is always one (1)

$$\begin{aligned} \text{MA} &= \frac{L}{E} & \text{but; } L = E \\ &= \frac{E}{E} \\ \text{M.A.} &= 1 \end{aligned}$$

How does a single fixed pulley simplify work?

- By changing the direction of force

How does changing the direction of forces simplify work?

- It is easier to raise the load by pulling downwards

Why is the M.A of a single fixed pulley always one?

- The load is equal to effort

Why is the load equal to effort applied in a single fixed pulley?

- The load and effort move the same distance

Advantage of using single fixed pulley

- It changes the direction of forces

Disadvantage of using single fixed pulley

- It does not reduce the effort needed to do work

Examples of single fixed pulley

- Flagpole
- Window blind
- Ski lift

CALCULATIONS ON SINGLE FIXED PULLEYS

Example I

Find the force applied to lift a load of 50kgf using a single fixed pulley

$$\text{MA} = \frac{\text{Load}}{\text{Effort}}$$

$$1 = \frac{50\text{kgf}}{E}$$

$$E = 50\text{kgf}$$

Example II

Find the effort applied to pull a load of 85N using a single fixed pulley.

$$MA = \frac{L}{E} \quad \text{but; } MA = 1$$

$$L = 85N$$

$$1 = \frac{85N}{E}$$

$$E \times 1 = \frac{85}{E}$$

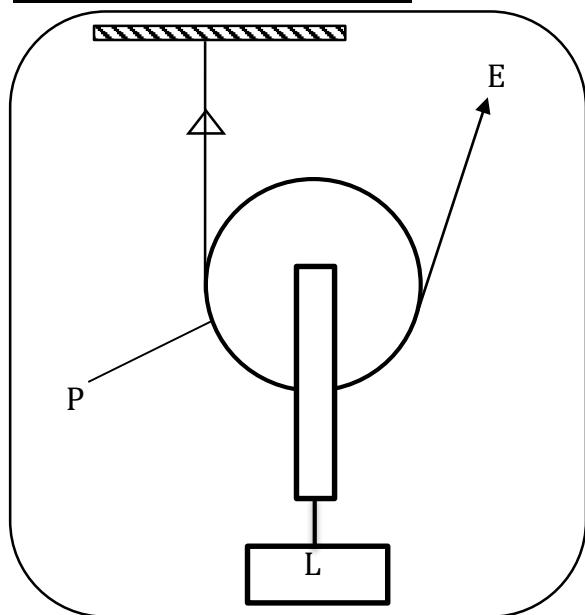
$$E = 85N$$

The force needed to lift the load is the same as the load.

Activity

1. An effort of 10kgf was applied on a single fixed pulley to raise a load to a height of 60m
 - i) Find the value of load to be raised
 - ii) Calculate the distance moved by effort
2. If a load of 30kg is to be lifted through a distance of 10m using a single fixed pulley
 - i) Find the value of effort needed for lifting the load
 - ii) Calculate the distance moved by effort

SINGLE MOVABLE PULLEY



In a single movable pulley:

- The whole pulley block moves along the rope
- It does not change the direction of force
- The load and effort move in the same direction
- The effort distance is twice the load distance
- It acts as a second class lever
- Work is done slower
- The effort applied is a half the load
- The mechanical advantage (M.A) is two (2)

$$MA = \frac{L}{E} \quad \text{but; } L = 2E$$

$$= \frac{2E}{E}$$

$$MA = 2$$

How does a single movable pulley simplify work?

- It uses less effort
- It reduces the effort by a half the load

Why does a single movable pulley use less effort?

- The effort distance is longer than the load distance

Why is the M.A of a single movable pulley always two (2)?

- The load is twice the effort
- The effort is a half the load

Advantage of using single movable pulley

- It reduces the effort needed to raise the load (it uses less effort)

Disadvantage of using single fixed pulley

- It does not change the direction of forces

EXAMPLES OF SINGLE MOVABLE PULLEYS

- Construction crane
- Modern elevator
- Weight lifting machines at gyms

CALCULATIONS ON SINGLE MOVABLE PULLEYS

EXAMPLE I

What force will be needed to raise a load of 50kgf using a single movable pulley?

$$\begin{aligned} M.A &= \frac{L}{E} \\ 2 &= \frac{50\text{kgf}}{E} \\ E \times 2 &= \frac{50\text{kgf}}{E} \times E \\ 2E &= 50\text{kgf} \\ \underline{2E} &= \underline{50\text{kgf}} \\ 2 &= 2 \\ E &= 25\text{kgf} \end{aligned}$$

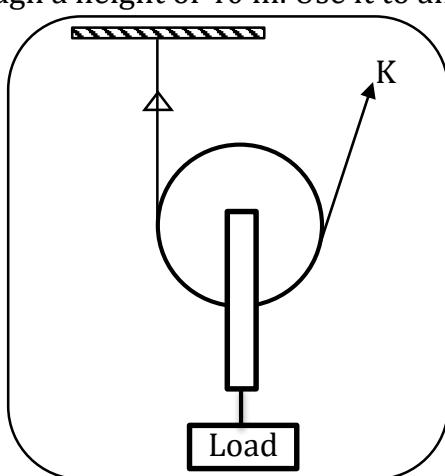
EXAMPLE II

If a single movable pulley is used to lift a load of 90N, find the value of effort.

$$\begin{aligned} M.A &= \frac{L}{E} \\ 2 &= \frac{90\text{N}}{E} \\ E \times 2 &= \frac{90\text{N}}{E} \times E \\ 2E &= 90\text{N} \\ \underline{2E} &= \underline{90\text{N}} \\ 2 &= 2 \\ E &= 45\text{N} \end{aligned}$$

EXAMPLE III

The diagram below shows a single movable pulley system on which an effort of 70kg was used to raise a load through a height of 40 m. Use it to answer questions.



a) Calculate distance moved by effort

$$\begin{aligned} M.A &= \frac{ED}{LD} \\ 40\text{m} \times 2 &= \frac{ED}{40\text{m}} \times 40\text{m} \\ 80\text{m} &= ED \end{aligned}$$

b) What does letter K represent?

- Effort

ACTIVITY

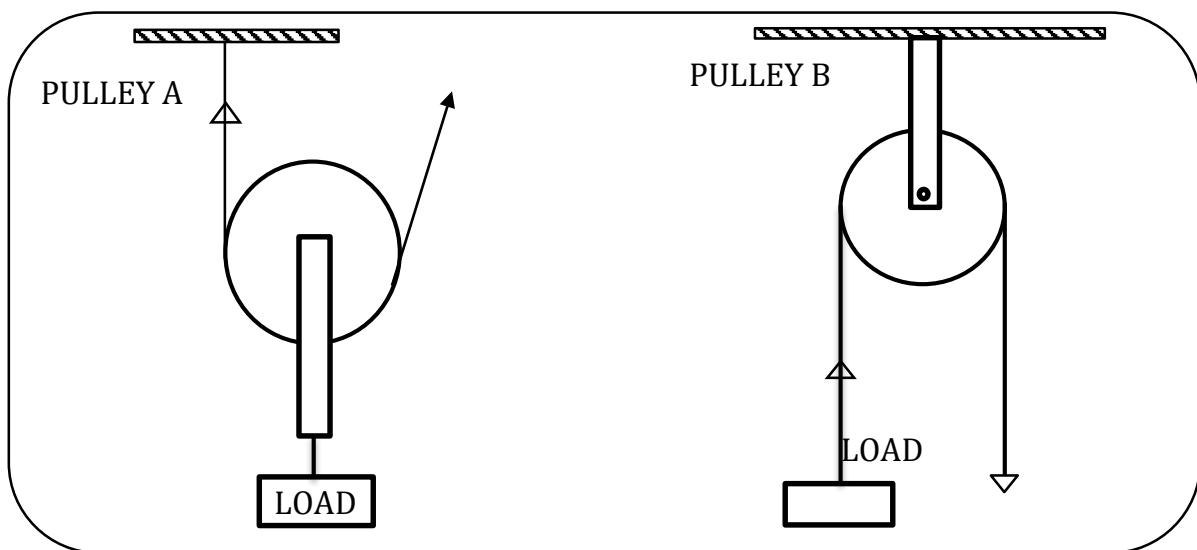
1. Calculate the effort needed to lift a load of 600N up the building using a single movable pulley
2. If the load is raised through a height of 50m using a single movable pulley, find the distance moved by the effort
3. A man used 40N to pull a load of 80N
 - a) What type of pulley did he use?
 - b) Give a reason for your answer
4. a) How much effort is needed to lift a load of 50kgf using a movable pulley system?
c) Besides friction, name other force you overcome when using a single movable pulley

DIFFERENCES BETWEEN FIXED PULLEYS AND MOVABLE PULLEYS

FIXED PULLEY	MOVABLE PULLEY
It changes direction of forces	It does not change the direction of forces
The effort is equal to the load	The effort is half the load
Work is done faster	Work is done slower
It has mechanical advantage of one	It has mechanical advantage of two
It has velocity ratio of one	It has velocity ratio of two

ACTIVITY

The diagrams below show types of pulley systems used to raise similar load (W). Use them to answer questions that follow

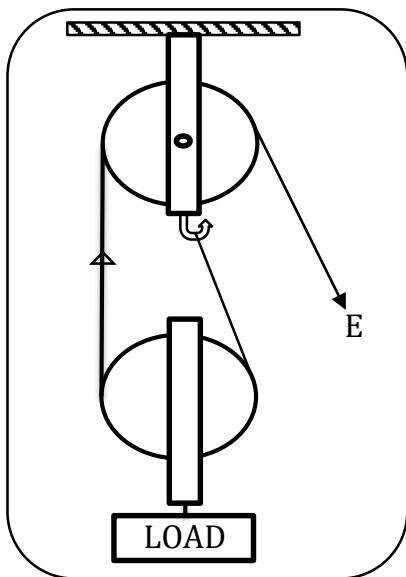


- a) Identify the type of pulley system shown in each diagram
- b) In which of the two pulley systems is less effort needed to raise the load
- c) Give a reason to support your answer in (b) above
- d) How can the pulley system in diagram B be useful at school?
- e) If the load of 200N is raised from the ground to a roof of 5m high using arrangement B,
f) Calculate the work done
- g) Find the effort needed to raise the load
- h) f) Give one comparison between pulley system A and pulley system B
- i) g) Why a pulley system is sometimes regarded as a lever machine?

BLOCK AND TACKLE PULLEY (FIXED MOVABLE PULLEY/DOUBLE PULLEY SYSTEM)

- This is a combination of a fixed pulley and a movable pulley both supported by one block

A DIAGRAM SHOWING A BLOCK AND TACKLE PULLEY



NOTE:

- The more movable pulleys used, the less effort needed to raise the load

ADVANTAGES OF USING BLOCK AND TACKLE PULLEY

- It changes the direction of force
- It reduces the effort needed to do work

WHAT DETERMINES THE MECHANICAL ADVANTAGE OF BLOCK AND TACKLE PULLEY?

- The number of wheels (pulleys) in the block
- The number of supporting ropes lifting the load

EXAMPLES OF DEVICES WHICH USE PULLEYS

- Cranes
- Flagpoles
- Elevators/house lifts
- Scaffolds
- Breakdown vehicles (tow trucks)

APPLICATIONS (USES) OF PULLEYS IN OUR DAILY LIFE

- They are used to raise (hoist) flags on flagpoles
- They are used in cranes to lift heavy loads
- They are used to draw curtains in curtain boxes
- They are used in elevators / house lifts
- They are used on tow trucks to pull stranded vehicles
- They are used in scaffolds by painters
- They are used to fetch water from deep wells

EXCRETORY SYSTEM

BODY SYSTEMS

- A system is a group of organs that perform a specific function
- An organ is a group of tissues that perform a specific function
- A tissue is a group of cells that perform a specific function
- A cell is the smallest unit of an organism (this is the basic unit of life)

Examples of body systems

- | | |
|---|--|
| <ul style="list-style-type: none">▪ Digestive system▪ Reproductive system▪ Muscular system▪ Skeletal system▪ Nervous system | <ul style="list-style-type: none">▪ Circulatory system▪ Respiratory system▪ Endocrine system▪ Lymphatic system▪ Excretory system |
|---|--|

EXCRETORY SYSTEM

- This is a body system that removes metabolic waste products from the body

What is excretion?

- This is the process of removing metabolic waste products from the body

State two importance of excretion

- It prevents body poisoning
- It maintains the pH of body fluids

Mention three metabolic processes that form excretory products

- | | |
|---|---|
| <ul style="list-style-type: none">▪ Respiration▪ Deamination | <ul style="list-style-type: none">▪ Synthesis of proteins |
|---|---|

Organs of the excretory system (examples of excretory organs)

- | | |
|---|---|
| <ul style="list-style-type: none">▪ The skin▪ The kidney | <ul style="list-style-type: none">▪ The lungs▪ Liver |
|---|---|

EXCRETORY ORGANS AND THEIR EXCRETORY PRODUCTS

EXCRETORY ORGAN	EXCRETORY (WASTE) PRODUCTS
Skin	<u>Sweat</u> <ul style="list-style-type: none">▪ Excess salts▪ Excess water▪ Urea▪ Lactic acid
Kidney	<u>Urine</u> <ul style="list-style-type: none">▪ Excess salts▪ Excess water▪ Urea▪ Uric acid
Liver	Bile pigments Cholesterol
Lungs	Carbon dioxide Water vapour

Why is faeces not regarded as an excretory product?

- It is not formed by a metabolic process

THE KIDNEYS

- These are two reddish brown bean shaped organs in the abdominal cavity
- They are found on either side of the spine **at the back of the abdomen**
- They are enclosed in a transparent membrane called **renal capsule**

Name the part of the skeleton that protects the kidneys.

- Pelvis (hip bone)

FUNCTIONS OF THE KIDNEYS

- They filter blood (remove urine from the body)
- They balance salt and water level in the body/balance body's fluids/for osmoregulation
- They produce a hormone to regulate blood pressure e.g. renin

Waste products by the kidney (components of urine)

- Urea
- Uric acid
- Excess salts
- Excess water

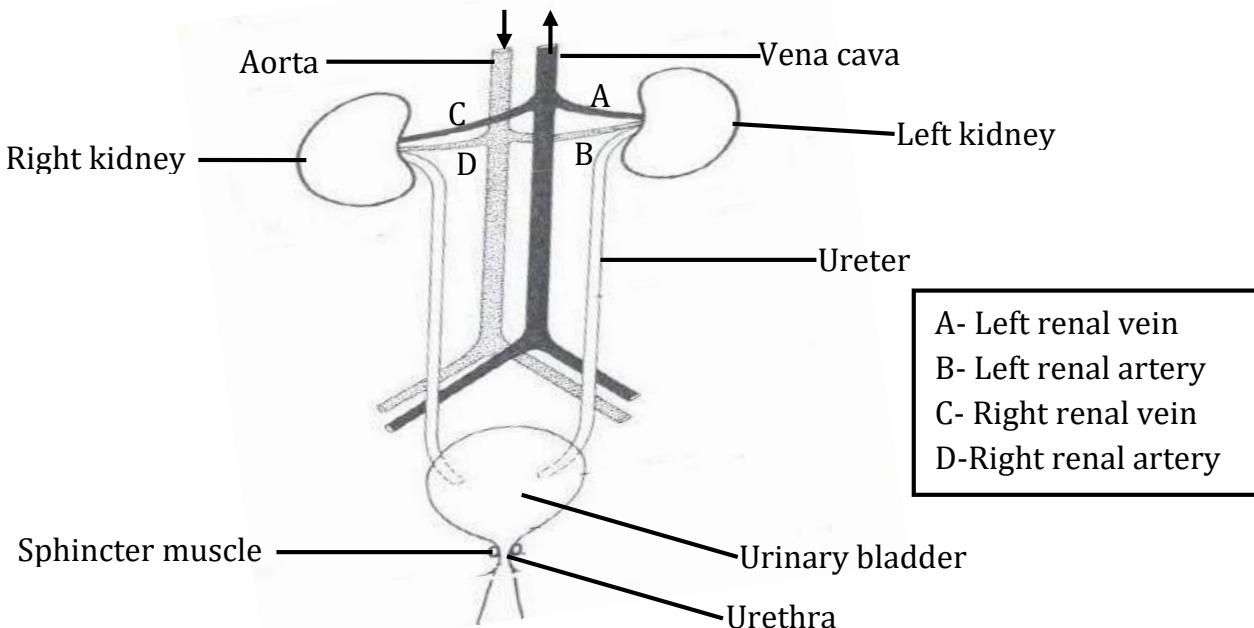
Name the nitrogenous compounds in urine/filtered by kidneys from blood

- Urea
- Uric acid

Name the two kidneys found in human beings

- Left kidney
- Right kidney

A diagram showing the position of the kidneys in the urinary system



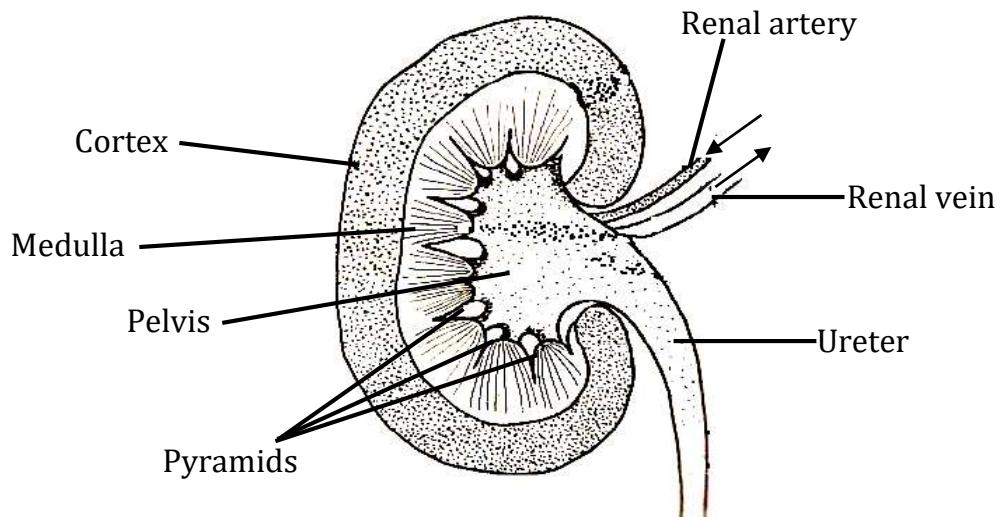
NOTE

- **Urinary system** is a body system that removes urine from the body
- It consists of the kidneys, ureters, urinary bladder and urethra
- **The kidneys** are the major organs of the urinary system

Why is the right kidney at a lower level than the left kidney?

- The right kidney is below the liver which is the largest body organ while the left kidney is below the spleen

THE STRUCTURE OF THE KIDNEY



Functions of each part of the kidney and urinary system

Renal artery

- It carries oxygenated blood from the aorta to the kidneys

Renal vein

- It carries deoxygenated blood from the kidney to the vena cava

Note

- ✓ Blood in renal vein is filtered while blood in renal artery is not filtered

Cortex (renal cortex)

- It is where blood is filtered

How is the cortex adapted to its function?

- It has nephrons to filter blood
- It has a dense network of capillaries (glomerulus)

Name the main process that occurs in the cortex of the kidney

- Filtration of blood (ultrafiltration)

Medulla

- It is where **selective reabsorption** of useful materials occurs

OR

- It reabsorbs water and mineral salts that are still needed by the body

Examples of useful materials reabsorbed by the medulla of the kidney

- | | |
|-----------------|---------------|
| ▪ Water | ▪ Glucose |
| ▪ Mineral salts | ▪ Amino acids |
- ✓ A lot of water is reabsorbed when blood volume is low
 - ✓ Little water is reabsorbed when blood volume becomes normal

Ureter

- It passes urine from the kidney to the urinary bladder

Urinary bladder

- It stores urine before it is passed out of the body

Sphincter muscle

- It opens or closes the urinary bladder

Urethra

- It passes urine out of the body

Pyramids

- They pass urine from the medulla to the pelvis

Pelvis (renal pelvis)

- It collects urine before it goes to the urinary bladder

PROCESSES INVOLVED IN URINE FORMATION

- Ultrafiltration (Filtration)
- Selective reabsorption (Reabsorption)
- Tubular secretion (Secretion)

URINATION (MICTURITION)

- This is the removal of urine from the body

Factors that affect the amount of urine passed out of the body

- Fluid intake
- Temperature

Why do people urinate frequently on cold days?

- There is little or no sweating hence the kidneys pass out excess water as urine

Why do people pass out little urine on hot days?

- There is much sweating hence less work for the kidneys

Why do people pass out a lot of urine when they drink plenty of fluids?

- For the kidneys to balance the water level in the body

Name the blood vessel that carries purified blood from the kidney.

- Renal vein

Why is selective reabsorption important after filtration?

- It prevents loss of useful materials which are still needed by the body

Why do children below three years of age always urinate on the bed?

- Their urinary bladders are not developed enough to store urine for the whole night

What is meant by the term kidney dialysis?

- This is the process of removing urine from the blood of people with kidney failure

DISEASES OF THE KIDNEY

- | | |
|-----------------|-----------------|
| ▪ Kidney stones | ▪ Nephritis |
| ▪ Bilharziasis | ▪ Kidney cancer |

KIDNEY STONES

- These are hard deposits of salts that form inside the kidneys

Causes of kidney stones

- | | |
|----------------------------|-----------|
| ▪ Dehydration | ▪ Obesity |
| ▪ Eating too much raw salt | |

Signs of kidney stones

- | | |
|----------------|----------------------|
| ▪ Bloody urine | ▪ Frequent urination |
| ▪ Smelly urine | |

Symptoms of kidney stones

- | | |
|-----------------------------|---------------------|
| ▪ Pain in the lower abdomen | ▪ Painful urination |
|-----------------------------|---------------------|

BILHARZIASIS

- It is caused by germs called **schistosomes (blood flukes)**
- It is spread by a vector called **fresh water snails**
- It spreads through drinking, swimming or bathing in contaminated water

Signs of bilharziasis

- Bloody urine
- Swollen abdomen

Nephritis

- It leads to inflammation of the kidney

DISORDER OF THE KIDNEYS

- Kidney failure

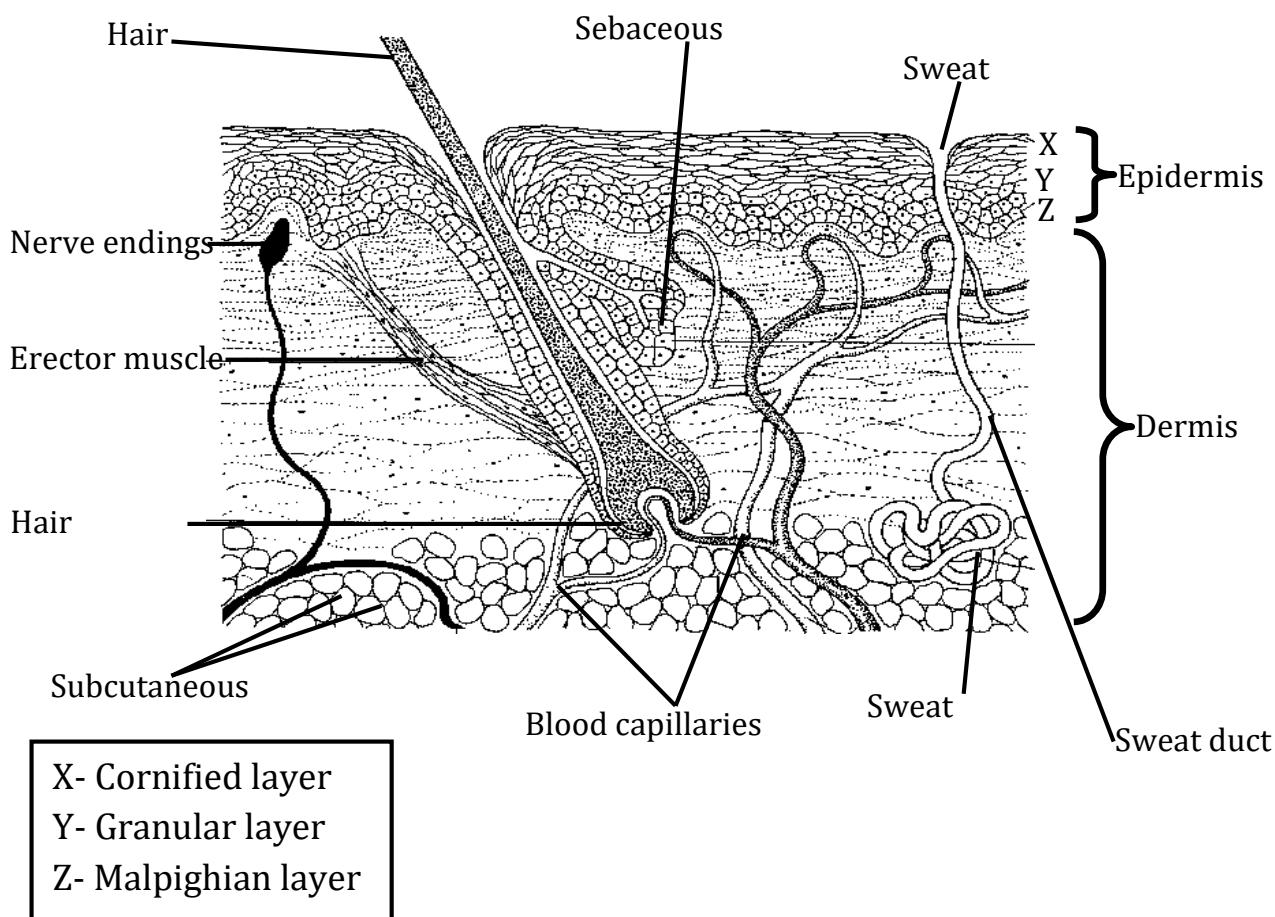
Ways of promoting proper working of the kidneys and the urinary system

- Feed on a balanced diet
- Do regular body exercises
- Drink plenty of safe water
- Do not hold back urine for a long time
- Avoid taking a lot of alcohol
- Avoid eating too much raw (uncooked) salt
- Avoid heavy blows at the lower back of the abdomen
- Have regular medical checkups

THE SKIN (INTEGUMENT)

- This is the outer protective organ of the human body
- It is the largest organ on human body
- The skin is an integumentary organ

STRUCTURE OF THE HUMAN SKIN



Name the two main layers (regions) of the skin

- Epidermis
- Dermis (corium)

THE EPIDERMIS

- This is the outermost (upper) layer of the skin
- It has no nerves and blood vessels

Importance of epidermis region of the skin

- It protects the inner layer from damage
- It prevents germs and dirt from entering the body

Name the layers that make up the epidermis

- Cornified layer
- Granular layer
- Malpighian layer

1. Cornified layer

- It is the outermost layer of the epidermis
- It is made up of dead cells

Functions of the cornified layer

- It protects the inner parts from damage
- It prevents germs from entering the body
- It prevents water loss by evaporation

Why is the cornified layer very thick on palms of hand and soles of feet?

- To increase friction

2. Granular layer

- It is made up of living cells that gradually die to form the cornified layer

Function of the granular layer

- It is responsible for gradual development of the cornified layer

3. Malpighian layer

- It is made up of actively growing cells which divide by **mitosis** to form new epidermis
- It contains a protein called **keratin**
- It contains a dark pigment called **melanin**

Uses of melanin

- It determines the skin colour
- It acts as a screen to sunshine (it protects the skin from ultraviolet sun rays)

Explain the term albinism (albinoism)

- This is the congenital lack of melanin in the skin, eyes and hair

Who is an albino?

- This is a person with congenital lack of melanin

State the uses of keratin

- It makes the skin tough and flexible
- It produces fingernails and toenails

THE DERMIS (CORIUM)

- This is the innermost (lower) layer of the skin
- The dermis is thicker than the epidermis

PARTS OF THE DERMIS LAYER OF THE SKIN

- | | |
|------------------|---------------------------------|
| ▪ sweat glands | ▪ sebaceous glands (oil glands) |
| ▪ sweat duct | ▪ blood capillaries |
| ▪ hair follicle | ▪ nerve endings |
| ▪ erector muscle | ▪ subcutaneous fats (fat cells) |

FUNCTIONS OF EACH PART OF THE HUMAN SKIN

Blood capillaries

- They supply food and oxygen to the cells
- They help in temperature regulation
- They remove excretory waste produced in the cells

Sweat glands (sudoriferous gland)

- They produce sweat

Components of sweat

- | | |
|----------------|---------------|
| ▪ Excess salts | ▪ Urea |
| ▪ Water | ▪ Lactic acid |

Sweat duct

- They are passages of sweat from the sweat glands to the sweat pores
- They lead sweat to the skin surface

Sweat pores

- They let sweat out of the body

Hair follicle (hair root)

- It is where the hair grows from

Hair

- It regulates body temperature
- **Hair shaft** is the part of hair above the skin

How does hair on the skin regulate temperature on cold days?

- The hair stands on the skin to trap air which prevents heat loss

How does hair on the skin regulate temperature on hot days?

- The hairs lie flat on the skin surface to allow heat loss

List down three parts of the human body where hair does not develop

- | | |
|----------------------|------------|
| ▪ Soles of the feet | ▪ The lips |
| ▪ Palms of the hands | |

Of what importance are the fingernails and toenails?

- They protect the tips of fingers and toes

Hair erector muscle

- It enables the hair to rise or lie flat on the skin

How does the erector muscle enable the hair to rise or fall on the skin surface?

- By contracting and relaxing

Sebaceous glands (oil glands)

- To produce sebum

Sebum

- This is the oily substance produced by sebaceous gland

Importance of sebum

- It prevents the skin from drying up (desiccation) / It keeps the skin soft and moist
- It keeps the skin waterproof

Subcutaneous fat (fat cells)

- It stores fats which prevent heat loss
- It protects the muscles and bones from the effects of falls
- It acts as energy store for the body

Nerve endings

- They transmit impulses for heat, touch, pressure, pain and cold to the brain
- They enable the skin to feel

FUNCTIONS OF THE SKIN

- It excretes sweat (removes sweat from the body)
- It regulates body temperature
- It stores fats
- It makes vitamin D with help of sunlight
- It protects the inner parts of the body
- It acts as a waterproof to our bodies
- For feeling (It helps the body to be sensitive to touch, heat and cold)
- It reduces harmful effects of UV (ultra violet) radiation

Qn. How is the skin adapted to its function of feeling?

- It has sensory nerves

BODY TEMPERATURE REGULATION BY THE SKIN

a) HOW DOES THE SKIN REGULATE HUMAN BODY TEMPERATURE ON HOT DAYS?

- Through vasodilation
- Through sweating (perspiration)/sweat glands produce more sweat
- The hairs lie flat (fall) on the skin surface to allow heat loss

(Through relaxing of hair erector muscles to make the hair lie flat on the skin surface)

Vasodilation

- This is the widening of blood vessels at the skin surface
- It occurs when smooth muscles of blood vessels relax

How does vasodilation cool the human body?

- More blood flow at the skin surface to allow heat loss

State the importance of sweating to the human body

- It cools the human body

How does sweating cool the human body on a hot day?

- Evaporation of sweat causes heat loss

How is sweating similar to transpiration?

- Both cool the organisms/regulate body temperature

Why does a dog move while its tongue is out (how is panting important to a dog)?

- To cool its body/to regulate the body temperature

Mention the practices people use to regulate their body temperature on hot days

- | | |
|-------------------------|------------------------------|
| ▪ Using umbrellas | ▪ Moving under the shade |
| ▪ Taking cold drinks | ▪ Turning on an electric fan |
| ▪ Wearing light clothes | |

Ways through which organisms cool themselves (regulate their body temperature)

ORGANISMS	HOW THEY COOL THEMSELVES
Dogs	▪ by panting
Plants	▪ though transpiration

Humans and horses	▪ by sweating
Elephants	▪ by flapping their big ears
Owls and doves	▪ by gular fluttering
Pigs and hippos	▪ by bathing in cool mud
Crocodiles	▪ by opening their mouth

b) HOW DOES THE SKIN REGULATE HUMAN BODY TEMPERATURE ON COLD DAYS?

- Through vasoconstriction
- Sweat glands produce little or no sweat
- Through shivering
- The hair stands on the skin to trap air which prevents heat loss

(Through contracting of hair erector muscles to make the hair stand on the skin surface)

Vasoconstriction

- This is the narrowing of blood vessels at the skin surface
- It occurs when the smooth muscles of blood vessels contract

How does vasoconstriction keep the human body warm on cold days?

- Little blood flows at the skin surface to prevent heat loss

How does shivering keep the body warm on cold days?

- Muscles contract rapidly to produce heat

What causes goose pimples on cold days?

- Contraction of erector muscles

Mention the practices people use to regulate their body temperature on cold days

- | | |
|----------------------------|------------------------|
| ▪ Taking hot drinks | ▪ Sitting near fire |
| ▪ Putting on thick clothes | ▪ Doing body exercises |

Ways through which water is lost from the body (causes of dehydration)

- | | |
|--------------------|---------------------------|
| ▪ Severe diarrhoea | ▪ Severe sweating |
| ▪ Severe vomiting | ▪ Severe burns and scalds |

DISEASES WHICH AFFECT THE SKIN

Bacterial skin diseases

- Leprosy
- Impetigo
- Boils
- Cellulitis

Fungal skin diseases (mycosis/tinea infections)

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

Viral skin diseases

- Chicken pox (Varicella)
- Measles (Rubeola)
- German measles (Rubella)
- Smallpox (Variola)

Deficiency skin diseases

- Pellagra (caused by lack of vitamin B₃)
- Scurvy (caused by lack of vitamin C)

Other skin diseases

- **Scabies** (caused by itch mites)
- **Skin cancer:** (caused by over use of bleaching vaseline)
- Eczema

DISORDERS OF THE SKIN

- Burns
- Scalds
- Bruises
- Dandruff
- Pimples
- Vitiligo
- Acne
- Cuts and wounds
- Corns
- Blisters
- Skin allergy
- Herpes zoster

Note

- **A bruise** is a swelling on a skin caused by internal bleeding due to strong hit
- **Vitiligo** is a condition when the skin losses its pigment cells

Give two ways in which wounds heal?

- By regeneration
- By fibrosis

WAYS OF CARING FOR HUMAN SKIN

- Regular bathing with clean water and soap
- Dry your body with a clean towel after bathing
- Feed on a balanced diet
- Avoid skin bleaching vaseline and body cream
- Cover wounds and cuts with clean bandages
- Perform regular body exercises
- Protect the skin from direct sunshine
- Keep your fingernails short and clean
- Put on clean and dry underwear and stockings
- Do not share clothes with people having skin infections
- Avoid playing with sharp objects
- Put antiseptics on wounds to prevent infections

How is the skin similar to kidneys in terms of functions?

- Both remove metabolic wastes from the body

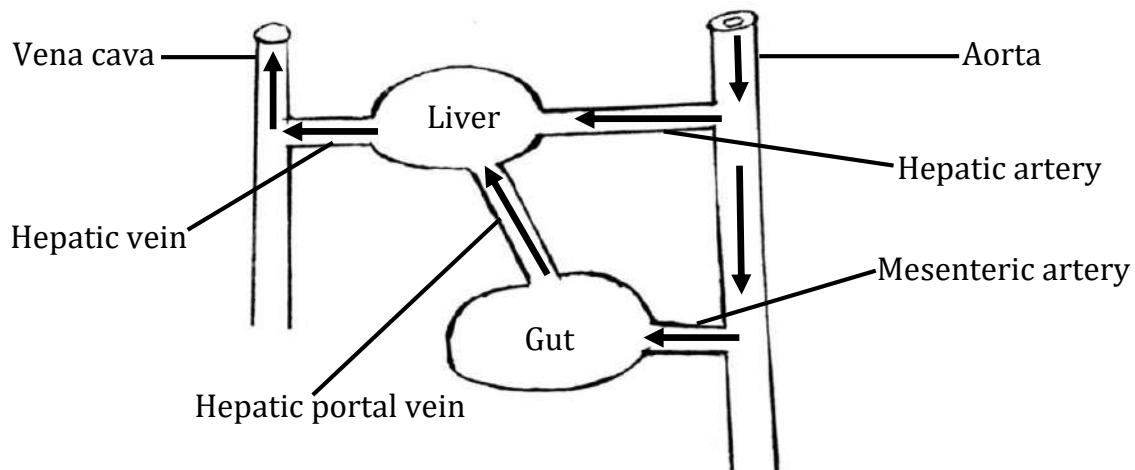
THE LIVER

- This is a large reddish brown organ below the diaphragm.
- It is found in the abdominal cavity
- The liver is the largest organ in the human body
- The liver is the most important organ in the body
- The liver has two lobes; **the right lobe and the left lobe**
- The two lobes are separated by the gall bladder
- The gall bladder **stores bile**

Why is the liver regarded as the most important body organ?

- It performs many functions compared to other body organs

POSITION OF THE LIVER



Mesenteric artery

- It carries oxygenated blood from the aorta to the digestive tract (gut)

Hepatic artery

- It carries oxygenated blood from the aorta to the liver

Hepatic vein

- It carries deoxygenated blood from the liver to the vena cava

Hepatic portal vein

- It carries blood with digested food from the gut (digestive tract) to the liver

Why does blood from the ileum go to the liver before circulation?

- To be detoxified (for the liver to remove toxic substances)
- For the liver to store excess nutrients

FUNCTIONS OF THE LIVER

- It produces bile juice (bile)
- It excretes bile pigments
- It helps in deamination

Deamination: is the process by which the liver converts excess amino acids into urea

- It regulates blood sugar level

How? By storing excess glucose

- It produces heat
- It detoxicates blood
- It stores some vitamins and mineral salts
- It makes plasma proteins; like fibrinogen
- It produces cholesterol

Why is a liver called an excretory organ?

- It removes bile pigments from the body

How are bile pigments formed?

- By the breakdown of dead red blood cells

Why does a dead body (corpse) feel cold?

- The liver which produces heat has stopped working

Why is a liver called a storage organ?

- It stores some vitamins, mineral salts and glucose

Note

- Vitamins stored by the liver include: **Vitamins A, D, E and K**
- Mineral salts stored by the liver include: **iron, copper and potassium**

BILE JUICE

- This is a digestive juice which has no enzymes
- It is produced by the liver and stored in the gall bladder

Importance of bile juice

- To breakdown (emulsify) fats in the duodenum
- To neutralize acidic chyme from the stomach
- To provide alkaline conditions for proper working of enzymes in duodenum

IMPORTANCE OF GALL BLADDER

- To store and concentrate bile
- To control the flow of bile into the duodenum

DETOXICATION (DETOXIFICATION)

- This is the process by which the liver removes toxic substances from blood

Name three toxic (harmful) substances removed from blood by the liver

- Alcohol
- Urea
- Expired drugs

FUNCTIONS OF PANCREAS

- It produces pancreatic enzymes
- It produces insulin hormone

FUNCTIONS OF INSULIN HORMONE

- It stimulates the liver to regulate blood sugar level
- It stimulates glucose uptake by the body cells to produce energy

Name the metabolic disease caused by lack of insulin in the body

- Diabetes

Give any two causes of diabetes

- Lack of insulin
- Insulin resistance
- Obesity

Insulin resistance is when the liver cells don't respond well to insulin

Mention two signs of diabetes

- Frequent urination
- Dark skin patches
- Slow healing of cuts and wounds

Symptoms of diabetes

- Severe thirst
- Severe hunger
- Tiredness
- Blurred vision

DISEASES OF THE LIVER

- Liver cirrhosis (caused by too much drinking of alcohol)
- Hepatitis A and B
- Liver cancer
- Liver abscess (these are boils which form pus in the liver)

HEPATITIS B

- It is caused by a virus called **hepatitis B virus (HBV)**
- It affects the liver

How does hepatitis B spread?

- Through playing unprotected sex with infected person
- Through sharing contaminated needles with an infected person
- Through body contact with infected body fluids

Signs of hepatitis B

- Dark urine
- Vomiting
- Jaundice (the skin and sclera turn yellow)

Prevention and control of hepatitis B

- Immunize using Hep B vaccine
- Use condoms during sex
- Avoid sharing needles with an infected person
- Use latex gloves during fisting or fingering

CARE FOR THE LIVER

- Avoid taking a lot alcohol
- Always drink safe water
- Avoid drug abuse
- Make regular body exercises
- Feed on balanced diet

THE LUNGS

- These are two spongy and elastic pink organs in the **chest cavity**
- The lungs are protected by the part of human skeleton called **rib cage**
- The lungs are both excretory and respiratory organs

Why are lungs regarded as excretory organs?

- They remove carbon dioxide and water vapour from the body

Why are lungs regarded as respiratory organs?

- They supply the body with oxygen for respiration

Name the two lungs in the human body

- Left lung
- Right lung

Why do lungs feel spongy?

- They have many alveoli (air sacs) inside them

Why are lungs elastic?

- For easy expansion and contraction during breathing

Name the membrane that encloses the lungs

- Pleural membrane

State the importance of the pleural membranes (pleura) on the lungs

- It produces pleural fluid

State the importance of the pleural fluid

- It reduces friction between the lungs and ribs

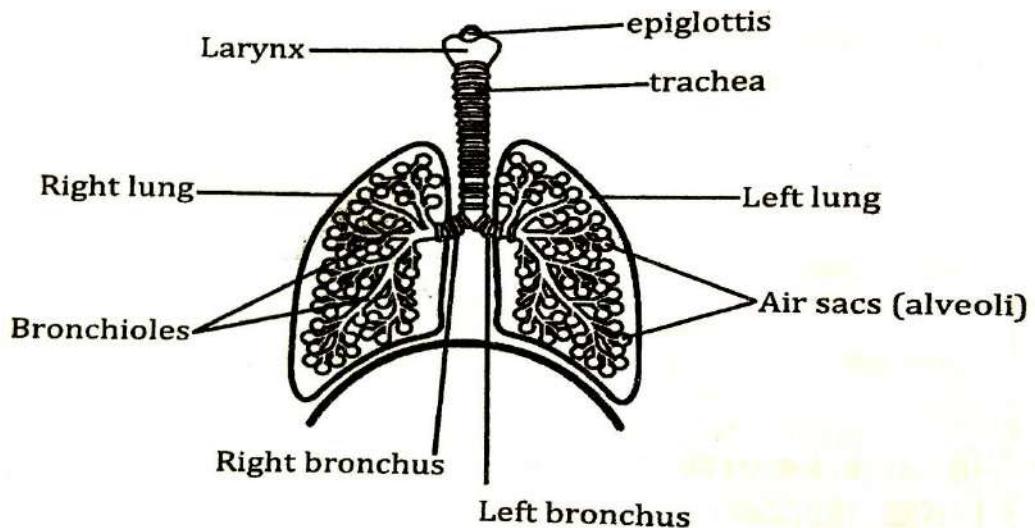
Of what importance is the pleural cavity?

- It holds the pleural fluid

What do we call the muscles that hold together the ribs in one position?

- Intercostal muscles

THE STRUCTURE OF THE LUNGS (RESPIRATORY SYSTEM)



FUNCTIONS OF LUNGS

- They remove carbon dioxide and water vapour from the body
- They supply the body with oxygen for respiration
- They are used for breathing

How are lungs adapted to their functions?

- They are spongy and elastic
- They have very many alveoli
- They contain very many blood vessels
- They have a moist surface
- They are covered in thin membranes

NOSE

- It is an olfactory organ (sense organ for smell)

Importance of the nose

- For smelling
- It cleans, warms and moistens inhaled air

Why is the temperature in the nose slightly higher than that of other body parts?

- To warm the inhaled air before it reaches the lungs

CONTENTS OF THE NOSE AND THEIR IMPORTANCE

1. Mucus (snot)

- To trap germs and dust
- To moisten air
- To prevent the nose from drying up

2. Cilia

- To filter air /to trap dust and germs

Of what function are cilia and mucus in the nose?

- To trap dust and germs (to clean the air)

Mention three things that happen to inhaled air in the nose

- Air is cleaned (filtered)
- Air is warmed
- Air is moistened

What warms the inhaled air in the nose?

- Blood in the vascular membrane

Why is it not advisable to breathe through the mouth?

- There is no cilia to filter air
- Air is not warmed and it can chill the lungs

Why do people sometimes breathe through the mouth?

- Due to nasal congestion
- Due to deviated nasal septum
- Due to nose bleeding

DISORDERS OF THE NOSE

- Nose bleeding
- Nasal congestion (accumulation of mucus in the nose)

Diseases of the nose

- Sinus infection (Sinusitis)
- Nasal polyp
- Hay fever

CARE FOR THE NOSE

- Wash the nose with clean water and soap.
- Do not share handkerchiefs
- Use a clean piece of cloth to clean the nose
- Avoid rough games that can harm the nose
- Do not allow mucus to flow and reach the lips

Why should we cover the nose while sneezing?

- To prevent spread of droplet infections

THROAT (PHARYNX)

This is a common passage for food and air

- It carries air to the wind pipe and food to the gullet.

EPIGLOTTIS

- It prevents food from entering the wind pipe during swallowing (it prevents choking)

How does the epiglottis prevent choking?

- By closing the wind pipe during swallowing

LARYNX (VOICE BOX)

- It has vocal cords which vibrate to produce sound

THE TRACHEA (WIND PIPE)

- It is the passage of air from the nose to the lungs.

Why is the trachea made up of rings of cartilage?

- To keep it open all the time.

State what would happen to the trachea in absence of the rings of cartilages if the air pressure inside is low.

- The trachea would collapse (close) and lead to suffocation

NOTE

- The trachea contains cilia **to trap dust and germs**
- The trachea divides into two **bronchi** (left bronchus and right bronchus)
- The bronchi subdivide into **bronchioles**
- The bronchioles end into tiny air sacs called **alveoli**

ALVEOLI (AIR SACS)

- It is where gaseous exchange occurs
- Gaseous exchange in the alveoli occurs by **diffusion**

In which human body organ does gaseous exchange take place?

- In the lungs

Where in the lungs does gaseous exchange take place?

- In the alveoli (air sacs)

By what process does oxygen in the alveoli enter red blood cells and carbon dioxide leave blood?

- Diffusion

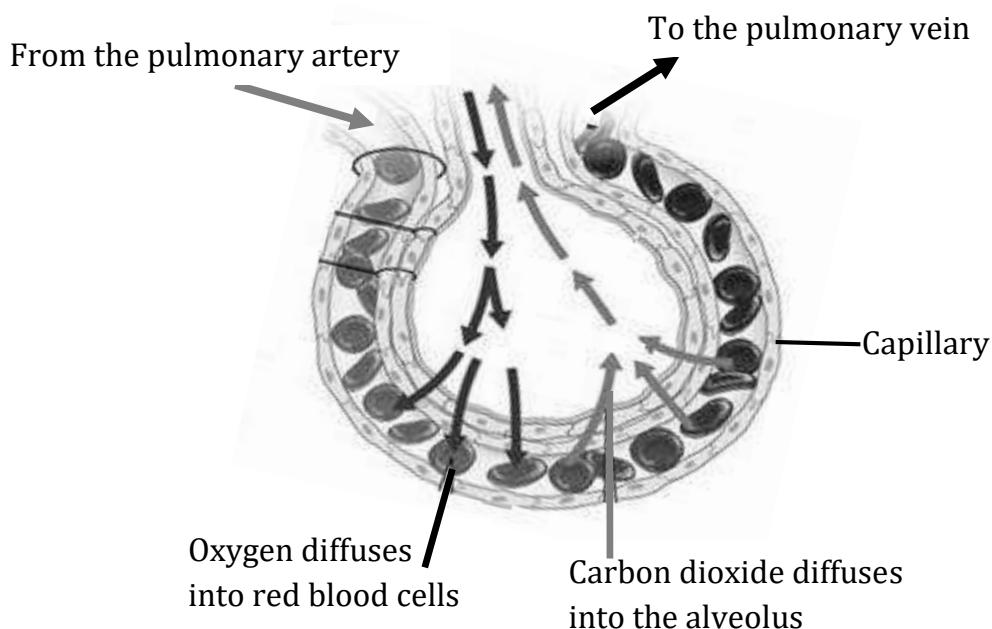
What is meant by the term diffusion?

- This is the movement of molecules from an area of high concentration to an area of low concentration

What is meant by the term gaseous exchange?

- This is the process by which blood releases carbon dioxide and gains oxygen

THE STRUCTURE OF THE ALVEOLUS



What do the arrows represent in the above diagram?

- They represent gaseous exchange.

ADAPTATIONS OF ALVEOLI (AIR SACS) TO THEIR FUNCTION

- They have thin walls

For easy diffusion of gases

- They have a lot of blood capillaries

To supply them with food nutrients

- They have a moist surface

For easy diffusion of gases

- They are numerous (very many in number)

To increase the surface area for gaseous exchange

DIAPHRAGM

This is a dome-shaped muscle that separates the chest cavity and abdominal cavity

- It helps in breathing

INTERCOSTAL MUSCLES

- They hold the ribs in position.

BREATHING (VENTILATION OF THE LUNGS)

- This is the movement of air in and out of the lungs

Give two importance of breathing

- It provides oxygen to the body for respiration
- It removes carbon dioxide and water vapour from the body

What is tidal air?

- This is the amount air that moves in and out of the lungs during a normal breath

TYPES (PHASES/MECHANISMS) OF BREATHING

- Breathing in (inhalation/inspiration)
- Breathing out (exhalation/expiration)

1. BREATHING IN (INHALATION OR INSPIRATION)

- This is the movement of air into the lungs

Events/things that occur during inhalation

- Intercostal muscles contract
- Ribs go upwards and outwards
- Diaphragm contracts/flattens/moves downwards
- Volume of the chest cavity increases
- The lungs expand

Why do lungs expand during inhalation?

- To create space for the air entering
- They are filled with air

Which property of air enable lungs to expand during inhalation?

- Air occupies space

Why does the diaphragm go downwards during inhalation?

- To provide space for expansion of the lungs

Why do ribs go upwards and outwards during inhalation?

- To provide space for the expansion of the lungs

State the importance of inhalation/breathing in

- It provides oxygen to the body for respiration

Correct order showing the mechanism of inhalation

- Diaphragm and intercostal muscles contract
- Volume of chest cavity increases (size of the chest and lungs increases)
- Air pressure inside decreases
- Air rushes into the lungs

Why is inhalation said to be an active process?

- It involves muscle contraction that requires energy

2. BREATHING OUT (EXHALATION OR EXPIRATION)

- This is the movement of air out of the lungs.

Events/things that occur during exhalation

- Intercostal muscles relax.
- Ribs go downwards and inwards
- Diaphragm relaxes and becomes dome-shaped (move upwards)
- Volume of the chest decreases
- The lungs contract (go to their original size)

Why do lungs contract during exhalation?

- To force out air

Which property of air enable lungs to contract during exhalation?

- Air can be compressed

State the importance of exhalation/breathing out

- It removes carbon dioxide and water vapour from the body

CORRECT ORDER SHOWING THE MECHANISM OF EXHALATION

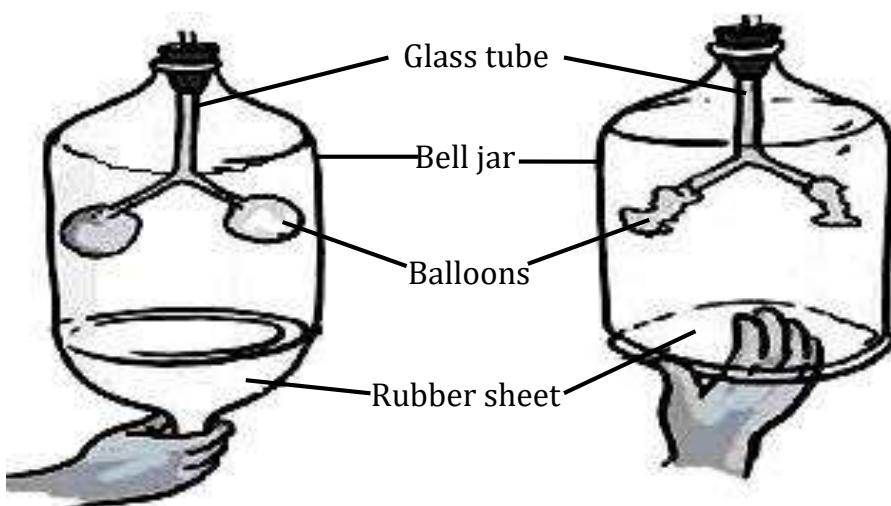
- Diaphragm and intercostal muscles relax
- Volume of chest cavity decreases (size of the chest and lungs decreases)
- Air pressure inside increases
- Air moves out of the lungs

Why is exhalation regarded as a passive process?

- It does not involve muscle contraction

A MODEL SHOWING THE MECHANISMS OF BREATHING

- Cut off the bottom of a plastic bottle
- Cover and tie the open end with a rubber sheet
- Tie two empty balloons to a Y – shaped (straw) glass tube
- Insert the straw into the bottle through its cork



Which body system is illustrated above?

- Respiratory system

What do the following parts represent?

- Glass tube (straw) ----- trachea
- Balloons----- lungs
- Bell jar (plastic bottle) ----- chest cavity
- Polythene bag (rubber sheet)----- diaphragm

What happens to the balloons when the rubber sheet is pulled outwards/downwards?

- The balloons expand

What happens to the balloons when the rubber sheet is pushed inwards?

- The balloons contract

COMPOSITION OF AIR BREATHED IN AND OUT

Type of air	Inspired air	Expired air
Oxygen O ₂	21%	16%
Carbon dioxide CO ₂	0.03%	4%
Nitrogen N ₂	78%	78%
Water vapour	Less	More
Rare gases	0.97%	0.97%

QUESTIONS:

Why do we breathe out less oxygen?

- It is used in the body during respiration

Why is there more carbon dioxide and water vapour in exhaled air?

- They are produced in the body during respiration.

Why is the percentage of nitrogen and rare gases the same in both inhaled air and exhaled air?

- They are neither produced nor used in the body

Why does a person breathe heavily after a vigorous exercise?

- To pay the oxygen debt.

Why does a person breathe heavily during a vigorous exercise?

- To supply the body with more oxygen for respiration

RESPIRATION

- This is the oxidation of food (glucose) in the living body cells to produce energy
- It is a **chemical change**
- It takes place in the **living cells** (living body cells)

How is respiration an important process among living things?

- It enables them to get energy

AN EQUATION SHOWING RESPIRATION



Raw materials for respiration

- Glucose (food)
- Oxygen

Products of respiration

- Energy → main/useful product
- Carbon dioxide
- Water vapour } byproducts/waste products

Explain the meaning of the term oxidation.

- This is the process by which oxygen combines with a substance

TYPES OF RESPIRATION

AEROBIC RESPIRATION

- This is the type of respiration that uses oxygen

ANAEROBIC RESPIRATION

- This is the type of respiration that does not use oxygen

Mention three human respiratory organs

- Nose
- Lungs (they are the main respiratory organs)
- Trachea (wind pipe)

DISORDERS OF THE RESPIRATORY SYSTEM

- Hiccups
- Sneezing
- Choking: it is caused by blockage of the wind pipe by a foreign object
- Yawning
- Coughing: it is caused by irritation of wind pipe by the dust

Hiccups

- These are involuntary contractions of the diaphragm

Causes of hiccups

- | | |
|----------------------------|----------------------------------|
| ▪ Taking carbonated drinks | ▪ Swallowing air along with food |
| ▪ Taking too much alcohol | ▪ Overeating |
| ▪ Sudden excitement | |

DISEASES OF THE RESPIRATORY SYSTEM (RESPIRATORY DISEASES)

1. COMMUNICABLE (INFECTIOUS) RESPIRATORY DISEASES

- | | |
|------------------------------|--------------------|
| ▪ Tuberculosis (TB) | ▪ Influenza (Flu) |
| ▪ Diphtheria | ▪ Common cold |
| ▪ Whooping cough (Pertussis) | ▪ Acute bronchitis |
| ▪ Pneumonia | ▪ COVID-19 |

2. NON-COMMUNICABLE (NON-INFECTIOUS) RESPIRATORY DISEASES

- | | |
|---------------|---|
| ▪ Lung cancer | ▪ Chronic bronchitis |
| ▪ Asthma | ▪ Asbestosis: it is caused by too much exposure to asbestos |
| ▪ Emphysema | |

List down three respiratory diseases caused by tobacco smoking

- Lung cancer
- Emphysema
- Chronic bronchitis

Name two respiratory diseases worsened by tobacco smoking

- Asthma
- Tuberculosis

ASTHMA

- It is a hereditary disease of the respiratory system

Sign of asthma

- Difficulty in breathing on cold days
- Wheezing

How does asthma make breathing difficult?

- It blocks the bronchioles

Why is asthma called a hereditary disease?

- It is genetically transmitted from parents to offspring

LUNG CANCER

- It is a respiratory disease
- It is caused by exposure to tobacco smoke and radon gas

Signs of lung cancer

- | | |
|---------------------------|---------------|
| ▪ Coughing up -blood | ▪ Wheezing |
| ▪ Difficulty in breathing | ▪ Weight loss |

Symptom of lung cancer

- Chest pain

Name the poisonous gas in tobacco smoke

- Carbon monoxide

Name the carcinogen (substance that causes lung cancer) in tobacco smoke

- Tar

Name the addictive drug in tobacco

- Nicotine

Give two effects of nicotine to human health

- It narrows/constricts blood vessels
- It increases blood pressure

Why is lung cancer called a death sentence?

- It has no cure

How does regular tobacco smoking cause lung cancer?

- It causes abnormal growth of lung cells

TUBERCULOSIS

- It is a bacterial airborne disease (droplet infection)
- It attacks the respiratory and skeletal system
- It mainly affects the lungs and the backbone (spine)

Name the germ (bacterium) which causes tuberculosis

- Mycobacterium tuberculosis

How does tuberculosis spread?

- Through inhaling contaminated air
- Through drinking unboiled milk from tubercular cows

Signs and symptoms of tuberculosis

- Chronic cough
- A lot of sweating at night
- Loss of body weight

Prevention and control of tuberculosis

- Immunize babies using BCG vaccine
- Isolate and treat the sick people
- Drink boiled or pasteurized milk

PNEUMONIA

- It is a respiratory disease
- It mainly affects the lungs
- It can be caused by bacteria or viruses

Signs of pneumonia

- Difficulty in breathing
- Wheezing
- Stuffy nose

How does pneumonia make breathing difficult?

- It causes inflammation of the alveoli

Name the vaccine that protects infants against pneumonia

- PCV (Pneumococcal conjugate vaccine)

CARE FOR THE RESPIRATORY SYSTEM

- Perform regular body exercise
- Eat meals containing low animals fats
- Avoid cigarette smoking
- Feed on a balanced diet
- Take infants for immunization
- Always keep the nose away from dust

TOPIC: LIGHT ENERGY

ENERGY

- This is the ability to do work

Examples of forms of energy

- | | | |
|----------------|---------------------|----------------|
| ▪ Light energy | ▪ Heat energy | ▪ Solar energy |
| ▪ Sound energy | ▪ Chemical energy | ▪ Magnetism |
| ▪ Electricity | ▪ Mechanical energy | |

Optics

- This is the study of light

LIGHT ENERGY

- This is the form of energy that enables our eyes to see objects.
- This is the form of energy that stimulates sense of sight
- This is the form of energy produced by luminous objects

Why is light called a form of energy?

- It does work

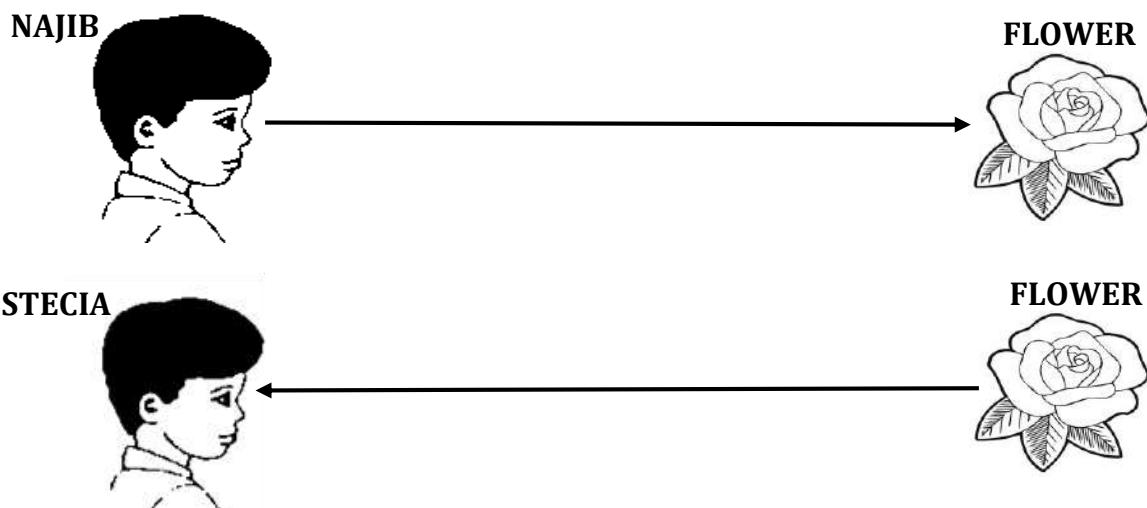
Importance (uses) of light/work done by light

- Light enables us to see objects
- Light enables us to use optical instruments
- Sunlight enables plants to make their own food
- Sunlight enables eggs of reptiles, amphibians and fish to hatch.
- Sunlight helps human skin to make vitamin D
- Sunlight is used to generate solar electricity
- Ultraviolet (UV) light is used in water treatment to kill germs
- Light is used in photography

How are we able to see objects?

- We are able to see objects when they reflect light into our eyes.

Study the diagrams below



Who is able to see the flower?

- Stecia

Give a reason for your answer

- The flower reflects light into her eyes

Why is Najib unable to see the flower?

- The flower does not reflect light into his eyes

Ways through which objects give out light

- Some objects emit light on their own
- Some objects reflect light from other sources

SOURCES OF LIGHT

- A source of light is an object which produces light.

Groups (types) of sources of light

- Natural sources of light
- Artificial sources of light

Natural sources of light

- These are sources of light that exist by nature

Examples of natural sources of light

- Sun: it is the main natural light source
- Stars
- Lightning
- Erupting volcanoes
- Glow-worms
- Fireflies
- Jellyfish
- Dragonfish
- Sea star

Artificial sources of light

- These are manmade objects that produce light

Examples of artificial sources of light

- Light-bulbs
- Torches
- Lamps
- Burning candles
- Fire
- Red hot charcoal
- Lanterns
- Televisions

LUMINOUS OBJECTS

- These are objects which produce their own light

They are also called **direct sources of light**

Examples of luminous objects

- Sun
- Stars
- Light bulb
- Burning candle
- Lantern
- Red hot charcoal
- Fire
- Fireflies
- Glow-worms
- Burning charcoal
- Erupting volcano
- Jellyfish
- Dragonfish
- Sea star

Groups of luminous objects

- Incandescent objects
- Luminescent objects

i) Incandescent objects

- These are objects that produce both light and heat

Examples of incandescent sources of light

- Sun
- Stars
- Electric bulbs
- Red hot charcoal
- Erupting volcanoes
- Burning candles

ii) Luminescent objects

- These are objects that emit light without heat

Examples of luminescent objects

- Glow-worms
- Fireflies
- Jellyfish
- Fluorescent lamps
- Television
- Dragonfish
- Sea star

Name any three living things that produce light/ bioluminescent organisms

- Glow-worms
- Fireflies
- Jellyfish
- Dragonfish
- Sea star

Why do some organisms glow (produce light)?

- To attract mates
- To scare away predators
- To trap their prey

NON LUMINOUS OBJECTS (ILLUMINATED OBJECTS)

- These are objects which do not produce their own light

They are also called indirect sources of light or reflectors of light

Examples of non-luminous objects

- Moon
- Mirrors
- Planets

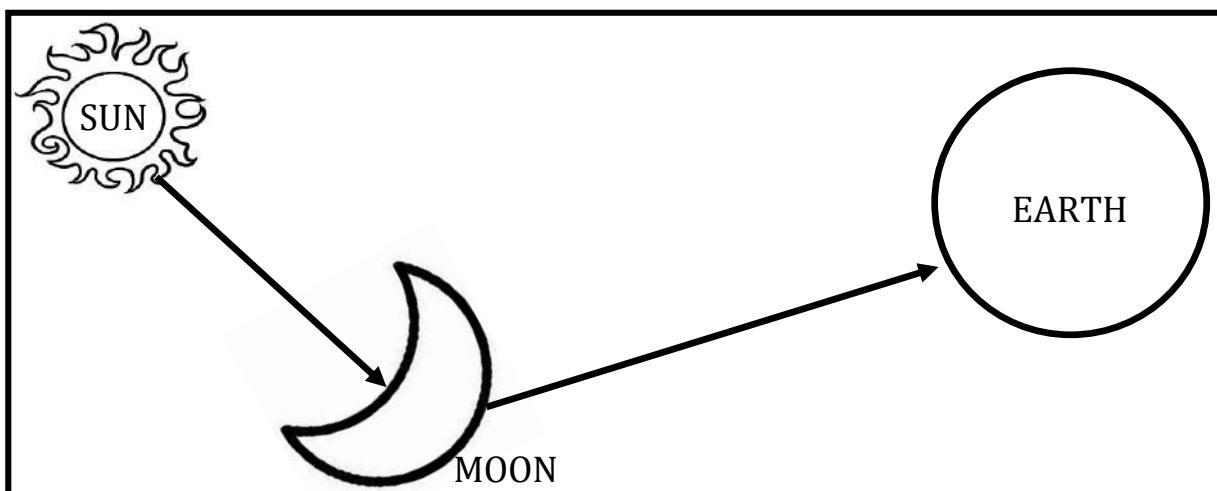
Why is the moon not called a luminous source of light?

- It does not produce its own light but reflects it from the sun

How does light from the sun reach the earth at night?

- It is reflected onto the earth by the moon

An illustration showing how the moon reflects light from the sun to the earth



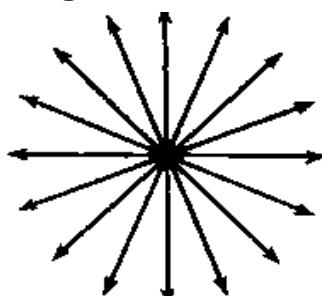
PROPERTIES OF LIGHT

- Light travels in a straight line
- Light travels in all directions from the source
- Light can be reflected
- Light can be refracted
- Light does not need a medium to travel (can travel through vacuum)

Transmission of light (how does light travel?)

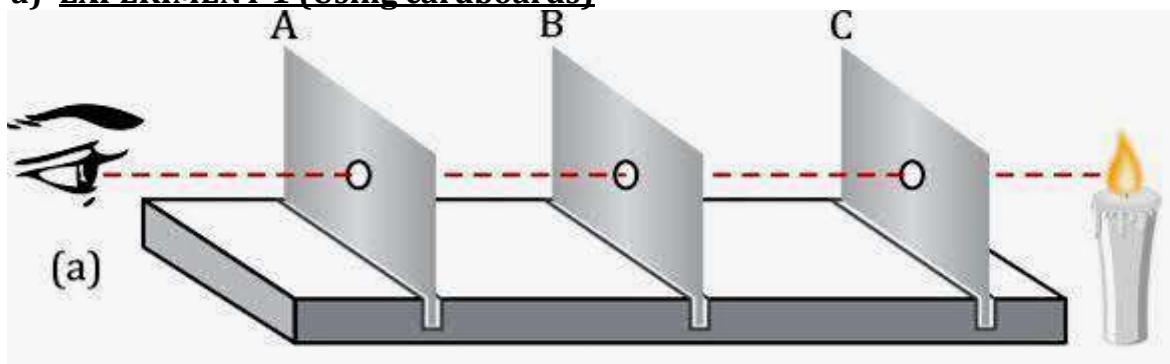
- Light travels in a straight line
- Light travels in all directions from the source

An illustration to show that light travels in all directions from the source



EXPERIMENT TO SHOW THAT LIGHT TRAVELS IN A STRAIGHT LINE

a) EXPERIMENT 1 (Using cardboards)



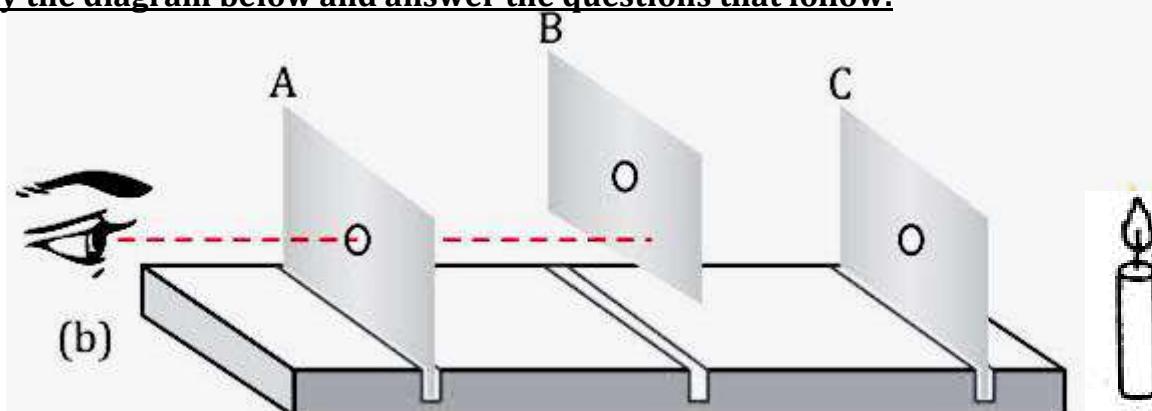
Why is the observer able to see candle light in figure (a) above?

- The holes in the cardboards are in a straight line

What does the experiment above represent?

- It shows that light travels in a straight line

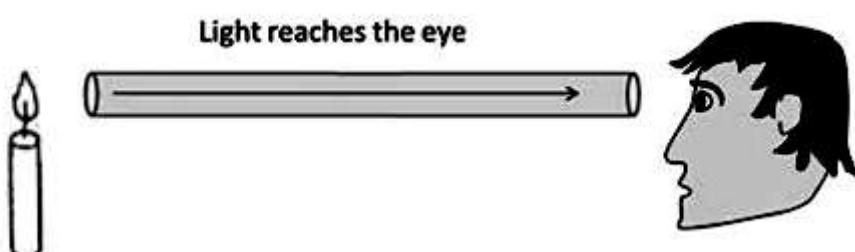
Study the diagram below and answer the questions that follow.



Why is the observer unable to see candle light in figure (b) above?

- The holes in the cardboards are not in straight line

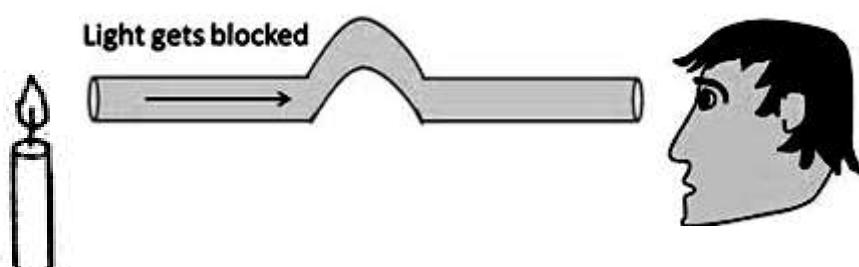
EXPERIMENT 2: (Using a straight tube/straw/pipe)



Why is the observer able to see light in the diagram above?

- The tube/pipe is straight

Use the diagram below to answer the question about it.



Why is the observer unable to see light in the diagram above?

- The tube is bent/not straight

FACTS TO PROVE THAT LIGHT TRAVELS IN A STRAIGHT LINE.

- We cannot see objects around corners because light travels in a straight line
- Shadows occur because due to obstruction of light by an opaque object
- Light from a projector travels in a straight line
- Sunlight passing through a hole in a roof travels in a straight line
- Light from rising and setting sun travels in a straight line
- Light from a torch travels in a straight line

Why can't we see around corners and barriers?

- Light travels in straight lines

How is light similar to sound and heat?

- They travel in all directions from the source
- They are forms of energy

How does light differ from sound in terms of movement?

- Light travels by rays while sound travels by waves
- Light can travel through vacuum while sound cannot travel through vacuum
- Light travels faster than sound

Why is light and heat able to travel through vacuum?

- They do not need a medium to move

Why is light able to travel through vacuum yet sound cannot?

- Light does not need a medium to move while sound needs a medium to move

RAY OF LIGHT

- This is the path of light
- This is a straight line along which light travels

An illustration of a ray of light



Why is a ray of light represented by an arrow on a straight line?

- To show direction of light

BEAM OF LIGHT

- This is a group/collection/stream of light rays.

A pencil of light

- This is a group of light rays coming or spreading out from a point
- This is a group of converging or diverging rays

Types of beams of light

- Parallel beam
- Diverging beam (divergent beam)
- Converging beam (convergent beam)

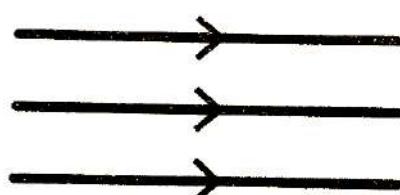
PARALLEL BEAM

- This is the type of beam where light rays do not meet

Use of parallel beam

- It enables us to see things which are directly in front of us.

An illustration of parallel beams of light



DIVERGING BEAM

- This is a type of beam where light rays spread in different directions

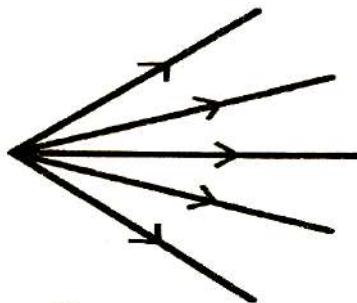
Use of diverging beam

- It enables us to see over a wider area

Devices that produce diverging beam

- | | | |
|--------------------|-----------------|------------------|
| ▪ Car headlamp | ▪ Projector | ▪ Burning candle |
| ▪ Bicycle headlamp | ▪ Electric bulb | |
| ▪ Torch | ▪ Sun | |

An illustration of diverging beams of light



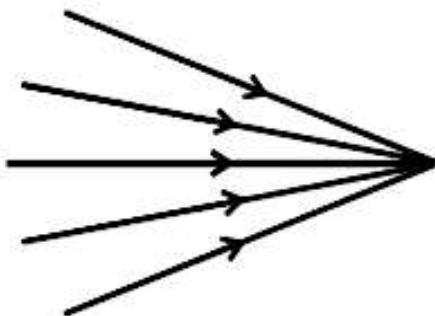
CONVERGING BEAM

- This is a type of beam where light rays meeting at a point

Use of converging beam

- It enables doctors to examine body organs which are dark e.g nose

An illustration of converging beams of light



THE SPEED OF LIGHT

- Light does not need a medium to move
- The speed of light reduces as it moves from a rarer (less dense) to denser medium
- The speed of light increases as it moves from a denser to a rarer (less dense) medium
- Light travels faster than sound in air
- The speed of light in air is 299,000,000 m/s while that of sound is 343 m/s

FACTS TO PROVE THAT LIGHT TRAVELS FASTER THAN SOUND

- Lightning is seen before thunder is heard
- Light is seen before sound is heard during fireworks
- The starter's gun flash is seen before the bang is heard at the race track
- An axe is seen striking a tree before sound is heard when cutting a tree

Why is lightning seen before thunder is heard on a rainy day?

- Light travels faster than sound

Qn. The sun is 150,000,000 Km away from the earth and light travels at a speed of 300,000 Km/s. How long does sunlight take to reach the earth?

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$T = \frac{150,000,000 \text{ km}}{300,000 \text{ km/s}}$$

$$T = 500 \text{ seconds}$$

∴ Sunlight takes 500 seconds to reach the earth

EFFECTS OF DIFFERENT OBJECTS ON LIGHT

State the things that may happen to light as it meets an object

- Light may be reflected
- Light may be refracted
- Light may be absorbed
- Light may be transmitted (allowed to pass through)

GROUPS OF OBJECTS (MATERIALS) THAT AFFECT LIGHT

- | | |
|-----------------------|------------------|
| ▪ Transparent objects | ▪ Opaque objects |
| ▪ Translucent objects | |

1. Transparent objects

- These are objects which allow all the light to pass through them.

Why are we able to see clearly through transparent objects (why can't transparent objects form shadows)?

- They allow all the light to pass through them

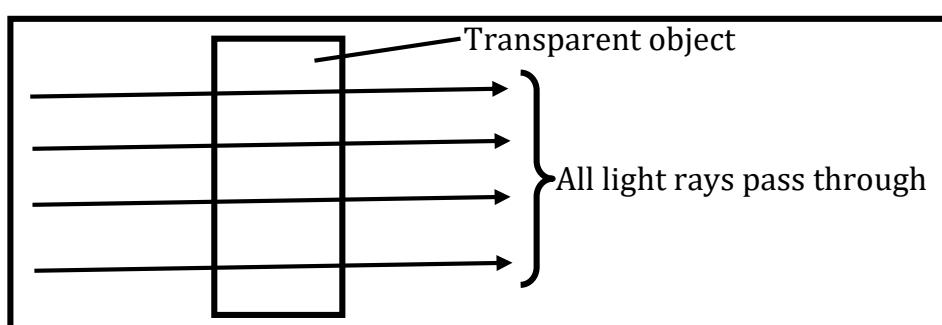
Examples of transparent objects

- | | |
|---------------|-------------|
| ▪ Clear glass | ▪ Clear air |
| ▪ Clear water | ▪ Vacuum |

What happens to light when it strikes a transparent object?

- All light pass through it

A diagram showing the effect of a transparent object on light



Uses of transparent objects

- Clear glass is used to make car windscreens
- Clear glass is used in windows on houses
- Clear glass is used in lenses
- Clear glass is used in lamps

2. Translucent objects

- These are objects which allow little (some) light to pass through them

Why are we unable to see clearly through translucent objects?

- They scatter light rays
- They allow little light to pass through them

Why does little light pass through translucent objects?

- It is due to diffusion

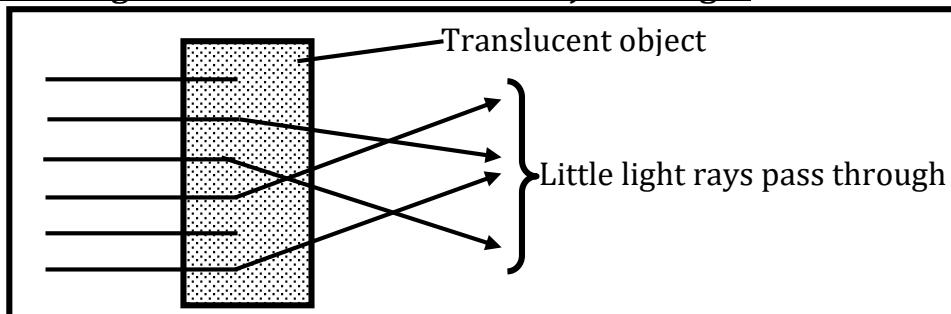
Why can a person behind a translucent material get a sunburn on a sunny day?

- Some sun rays can pass through it

Examples of translucent objects.

- | | | |
|-----------------|-----------------|--------------------|
| ▪ Frosted glass | ▪ Oiled paper | ▪ Smoky air |
| ▪ Tinted glass | ▪ Sunglasses | ▪ Cloudy water |
| ▪ Tracing paper | ▪ Stained glass | ▪ Plastic skylight |
| ▪ Wax paper | ▪ Lampshade | ▪ Thin cloth |

A diagram showing the effect of a translucent object on light



Uses of translucent materials

- Frosted glass is used in church windows
- Frosted glass is used in doors and windows of bathrooms
- Tracing paper is used in class
- Tracing paper is used as a screen in pinhole cameras
- Tinted glass is used in cars
- Tinted glass is used to make some light bulbs
- Sunglasses protect our eyes from direct sunlight
- Plastic skylights allow daylight into the house
- Wax paper is used to wrap food for cold storage

Why are doors and windows of bathrooms made with frosted glasses?

- For privacy of the user

3. Opaque objects

- These are objects which do not allow any light to pass through them

Why are we unable to see through opaque objects?

- They do not allow light to pass through them

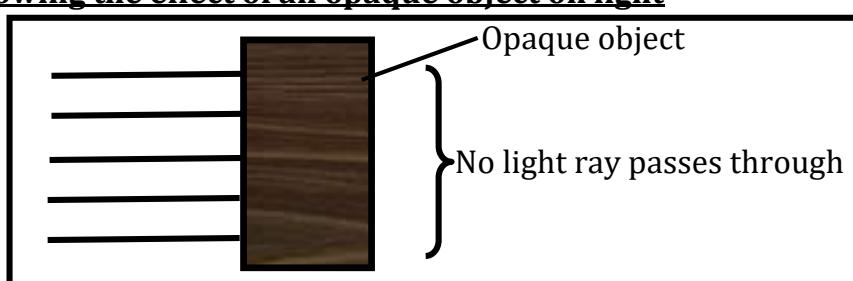
What happens when light strikes an opaque object?

- Light is blocked and a shadow is formed

Examples of opaque objects

- | | | |
|--------------|--------------|-------------------|
| ▪ Wood | ▪ Stone | ▪ Blackout fabric |
| ▪ Blackboard | ▪ Metal | |
| ▪ Human body | ▪ Brick wall | |

A diagram showing the effect of an opaque object on light



Uses of opaque objects

- They form shadows which provide shades
- Brick walls promote privacy in buildings
- Blackout fabrics keep out sunlight and heat in party tents

Name two groups of objects used to make windowpanes

- Transparent objects
- Translucent objects

SHADOWS

- This is a dark region formed when light is blocked by an opaque object

How is a shadow formed?

- When light is blocked/obstructed by an opaque object

On which principle is a shadow formed?

- Light travels in a straight line

CHARACTERISTICS OF A SHADOW

- A shadow resembles the shape of the opaque object
- A shadow is formed in opposite direction of the light source
- A shadow is dark in colour

FACTORS THAT AFFECT (DETERMINE) THE SIZE OF A SHADOW

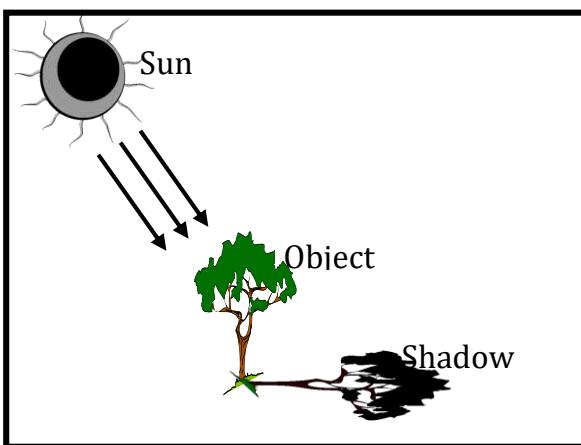
- Distance of the light source from the opaque object
- Size of the opaque object
- Size of the light source
- Position of the light source (angle at which light strikes an opaque object)

Note

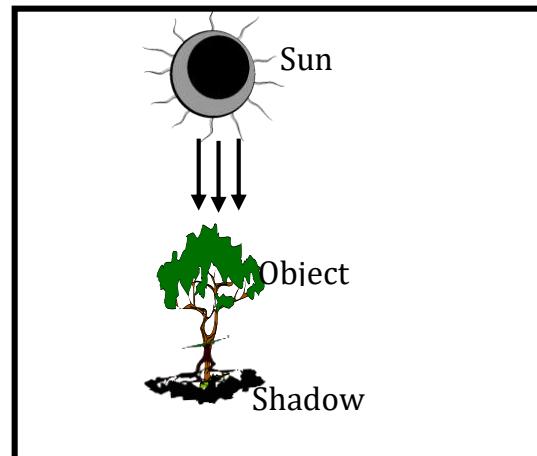
- The shadow is smaller when the light source is far and it is bigger when the light source is nearer to the opaque object

DIAGRAMS SHOWING THE SIZE OF SHADOWS FORMED BY THE SUN AT DIFFERENT POSITIONS IN THE SKY

IN THE EARLY EVENING



AT MIDDAY (NOON)



Why is the shadow shortest at noon (midday)?

- The sun is directly overhead

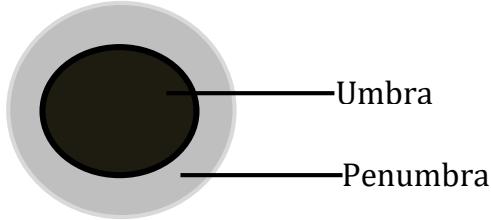
Why is the shadow longest at sunrise and sunset (in the early morning and early evening/late afternoon)?

- The sun is low on the horizon/the sun is low in the sky

TYPES/REGIONS/PARTS OF THE SHADOW

- Umbra (total shadow)
- Penumbra (partial shadow)

A DIAGRAM SHOWING PARTS/REGIONS OF A SHADOW



UMBRA

- This is the darkest part of the shadow
- This is the region of complete shadow

It is dark **because** it does not receive any light

How is an umbra formed?

- By total obstruction of light from a small source

When is an umbra shadow formed?

- When the light source is far away from an opaque object
- When light from a small source is completely blocked by an opaque object
- When light passing through a narrow opening is blocked by an opaque object

PENUMBRA

- This is the lighter part of the shadow
- This is the region of partial shadow

It is light **because** it receives some light

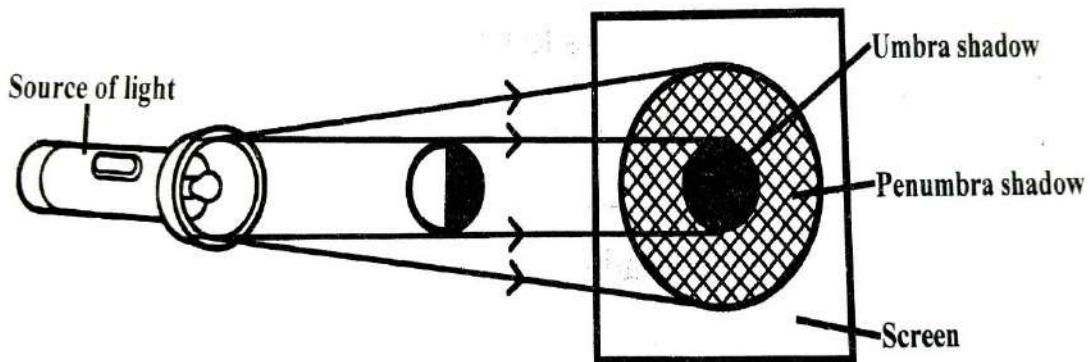
How is penumbra formed?

- By partial obstruction of light from a big source

When is penumbra formed?

- When the light source is nearer to the opaque object
- When light from a big source is blocked by an opaque object
- When light passing through a wider opening is blocked by an opaque object

A simple illustration of formation of a shadow



USES OF SHADOWS

- They provide shades
- They are used to estimate time
- They are used to tell directions
- They help people to hide

DANGERS OF SHADOWS

- They are a source of fear at night
- They are hiding places for dangerous people and animals

ECLIPSE

- This is a shadow formed when sunlight is obstructed by the moon or earth

Note:

- The sun is stationary/fixed/does not move
- The earth moves around sun
- The moon moves around the sun and earth at the same time
- **An orbit** is a curved path of an object (heavenly body)
- The moon moves around the earth but the moon's orbit is not fixed
- The moon and earth sometimes come in straight line with the sun as they move
- When this occurs, either the moon or the earth is blocked from receiving sunlight
- In this case, we say that it is an eclipse

TYPES OF ECLIPSES

- i) Solar eclipse (eclipse of the sun)
- ii) Lunar eclipse (eclipse of the moon)

SOLAR ECLIPSE (ECLIPSE OF THE SUN)

- This is the type of eclipse that occurs when the moon comes between the sun and the earth.
- The moon blocks sunlight and its shadow is cast on the earth

How is solar eclipse formed?

- When the moon comes between the sun and earth.

Characteristics of solar eclipse

- The moon comes between the sun and earth
- The moon casts its shadow on the earth
- It happens at new moon during day time
- It can happen once every 1-2 years (it is a rare type of eclipse)

Where is the shadow cast during solar eclipse?

- On the earth

Why can't the moon's shadow fully cover the earth?

- The moon is smaller than the earth

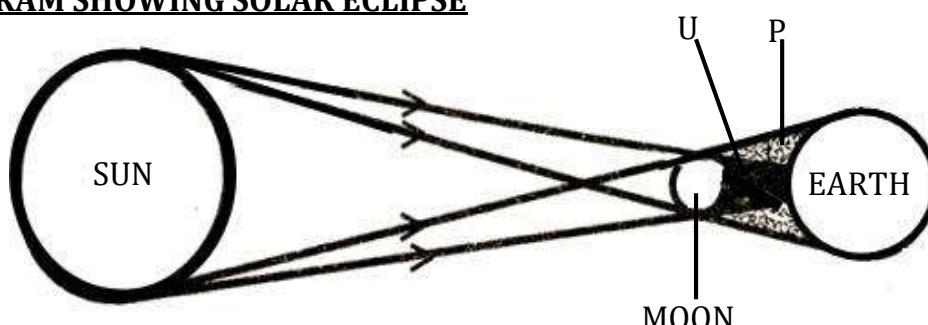
Why is it dangerous to expose the eyes directly to solar eclipse?

- It can damage the eyes/retina
- It can cause blindness

Mnemonic for solar eclipse

- Some Men Eat Snakes (SME----Solar eclipse)

A DIAGRAM SHOWING SOLAR ECLIPSE



P – Penumbra (partial eclipse)

U – Umbra (total eclipse)

TYPES OF SOLAR ECLIPSES

- Total solar eclipse
- Partial solar eclipse
- Annular solar eclipse

Total solar eclipse

- This is when the moon completely covers the sun and casts its umbra on the earth
- It is the only safe time to look directly at the sun **because** the sky is very dark

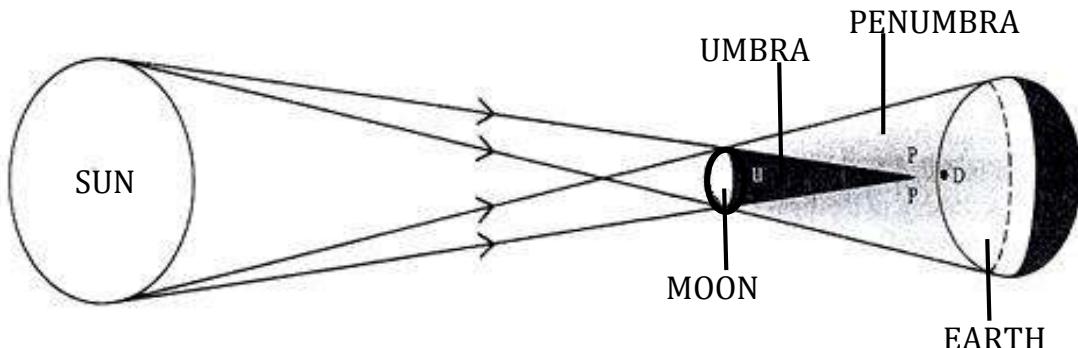
Partial solar eclipse

- This is when the moon partially covers the sun and casts its penumbra on the earth

Annular solar eclipse

- This is when the moon covers sun's centre to form a ring of fire around a dark moon
- The moon's umbra fails to reach the earth and it receives penumbra and antumbra

A diagram showing annular solar eclipse



What will a person at position D see?

- A ring of fire around the dark moon

Why does the moon's umbra fail to reach the earth during annular solar eclipse?

- The moon is farther away from the earth

Name the shadow that extends from the umbra to reach a person at position D?

- Antumbra

LUNAR ECLIPSE (ECLIPSE OF THE MOON)

- This is the type of eclipse that occurs when the earth comes between the sun and the moon.
- The earth blocks sunlight and its shadow is cast on the moon

How is lunar eclipse formed?

- It is formed when the earth comes between the sun and the moon

CHARACTERISTICS OF LUNAR ECLIPSE

- The earth is in between the sun and moon
- The shadow is cast on the moon
- The moon is in total eclipse so it doesn't reflect any light
- It happens at full moon during the night

Why is the whole moon under total eclipse/total shadow/umbra during lunar eclipse?

- The earth is bigger than the moon

Why can't the moon reflect any light during lunar eclipse?

- The moon is in total eclipse

Why is the earth's shadow able to cover the moon fully during lunar eclipse?

- The earth is bigger than the moon

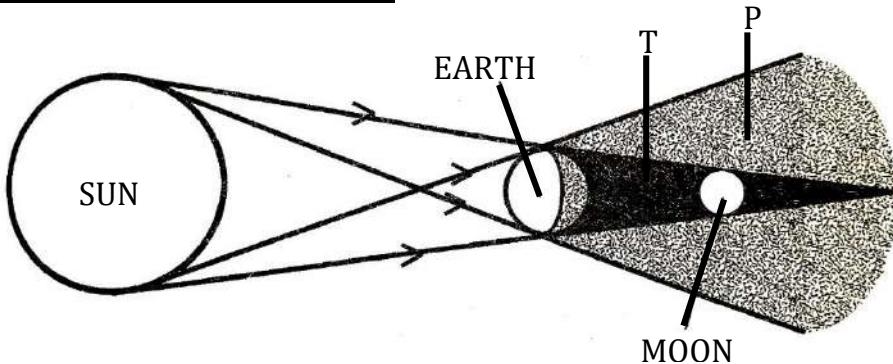
Where is the shadow cast during lunar eclipse?

- On the moon

MNEMONIC FOR LUNAR ECLIPSE

- Simon Entered My Latrine (SEM-----Lunar eclipse)

A DIAGRAM SHOWING LUNAR ECLIPSE



- P – Penumbra (partial eclipse)
- T – Umbra (total eclipse)

DIFFERENCES BETWEEN SOLAR AND LUNAR ECLIPSE

Solar eclipse	Lunar eclipse
The moon is between the sun and the earth	The earth is between the sun and the moon
The shadow is cast on the earth	The shadow is cast on the moon
It occurs during day time	It occurs on the night of full moon

THE SOLAR SYSTEM

This refers to the sun and all the objects that move around it

- The sun is at the centre of the solar system
- The sun is orbited by; planets, moons, asteroids, comets and meteoroids

CELESTIAL (ASTRONOMICAL) BODIES

- These are natural objects in the sky

Celestial (astronomical) bodies in the solar system

- | | | |
|--|----------|--------------|
| ▪ Sun | ▪ Moons | ▪ Asteroids |
| ▪ Planets | ▪ Comets | ▪ Meteoroids |
| ✓ Asteroids and meteoroids are space rocks | | |
| ✓ Comet is a big snowball with a rock in the middle | | |

Why the sun is called a star?

- The sun produces heat and light

What is the colour of stars?

- Stars are either yellow, red or blue

PLANETS

- These are celestial bodies moving round the sun

THE EIGHTPLANETS IN SOLAR SYSTEM

ORDER FROM THE SUN (NEAREST TO FARTHEST)	ORDER OF SIZE (LARGEST TO SMALLEST)
1. Mercury	1. Jupiter
2. Venus	2. Saturn
3. Earth	3. Uranus
4. Mars	4. Neptune
5. Jupiter	5. Earth
6. Saturn	6. Venus
7. Uranus	7. Mars
8. Neptune	8. Mercury

Mnemonic for order of planets from the sun

❖ My Very Excellent Mother Just Served Us NIDO

- Venus is **brightest planet** known as the **morning star (evening star)**
- Mercury is the **closest planet to the sun** but it is not the hottest planet
- Venus is **hottest planet**

Why is Venus the hottest planet yet it is not the closest to sun?

- Venus has a lot of greenhouse gases than other planets

FACTS ABOUT THE UNIVERSE

- Earth takes 24 hours to rotate on its axis and 365 days to move around the sun
- Earth's only natural satellite is **the moon**
- Earth is the only planet that can support life

Why are living things able to survive on earth?

- Earth has enough oxygen in its atmosphere
- Earth has water on its surface
- Earth's temperature is not too hot or too cold

Why is there no life on other planets except Earth?

- There is no oxygen to support life

MAIN PHASES OF THE MOON

- New moon
- Crescent moon
- Quarter moon/half moon
- Gibbous moon
- Full moon

When does a blue moon occur?

- It occurs once every three years

WHEN IS THE MOON SAID TO BE:

i) Waxing?

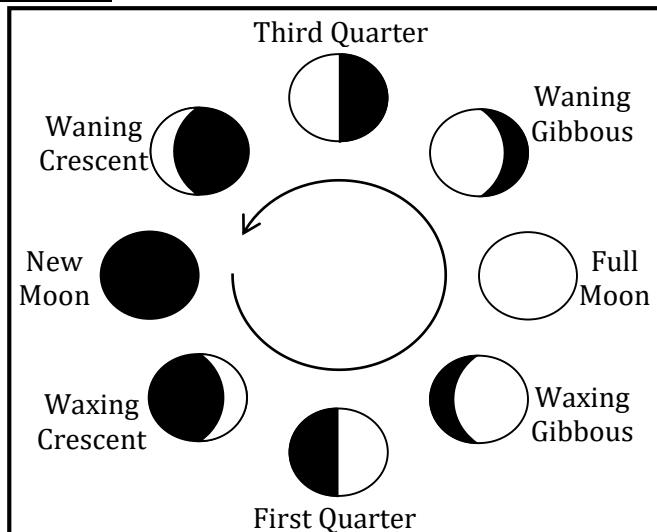
- When it is increasing in size day by day

ii) Waning?

- When it is decreasing in size day by day

What general name is given to the first and last quarter moons?

- Half moon



GALAXY

- This is a group of stars in the night sky
- Our galaxy is called **Milky Way galaxy**
- A galaxy is held together by the **force of gravity**
- **Astrology** is the study of movements and relative positions of celestial bodies to judge their influence on human actions
- **Astronomy** is the study of all celestial bodies outside the earth's atmosphere
- **Astronomer** is a scientist who studies about celestial bodies
- **Astronaut** is a person who is trained to travel in a spacecraft

Why do objects weigh less on moon than on earth?

- The moon's gravity is less than the earth's gravity

REFLECTION OF LIGHT

- This is the bouncing (sending back) of light rays as they strike a shiny surface
- It occurs due to presence of a shiny object in the path of light

Types of light reflection

- Regular (specular) reflection
- Irregular (diffuse) reflection

REGULAR (SPECULAR) REFLECTION

This is the type of reflection where light rays are bounced (sent back) in a definite direction

- It occurs on **smooth shiny surfaces** (such as plane mirror and silvered metal)

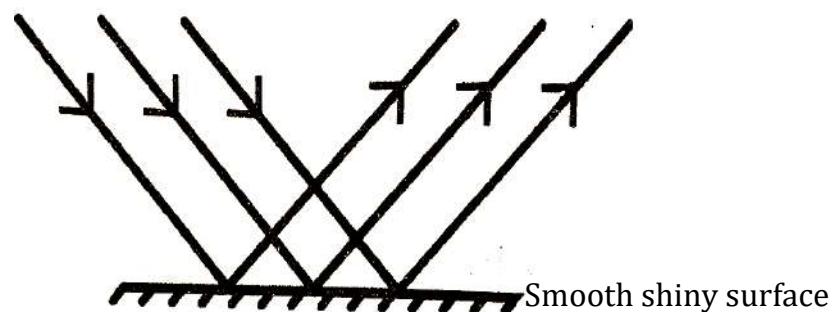
Why do we see clear images in plane mirrors and silvered metals?

- They produce regular reflection

Why do plane mirrors and silvered metals produce regular reflection?

- They are smooth shiny surfaces

An illustration showing regular (specular) reflection



IRREGULAR (DIFFUSE) REFLECTION

- This is the type of reflection where the light rays are bounced (sent back) in different directions.
- ✓ It occurs on **rough shiny surfaces** (such as iron sheets and painted walls)

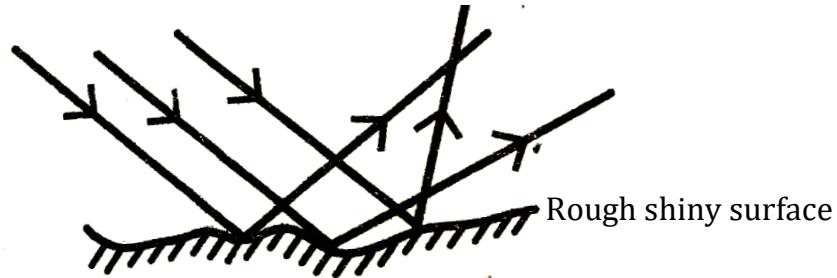
Why are we unable to see clear images on painted walls and iron sheets?

- They produce irregular reflection.

Why do iron sheets and painted walls produce irregular reflection?

- They are rough shiny surfaces

AN ILLUSTRATION SHOWING IRREGULAR (DIFFUSE) REFLECTION



Why are the rays reflected as shown above?

- The surface is rough and shiny

DIFFERENCES BETWEEN REGULAR AND IRREGULAR REFLECTION

Regular reflection	Irregular reflection
▪ It occurs on smooth shiny surfaces	▪ It occurs on rough shiny surfaces
▪ Light rays are sent back in a definite direction	▪ Light rays are sent back in different directions

- Smooth shiny surfaces are also called **highly polished surfaces**
- Rough shiny surfaces are also called **unpolished surfaces**

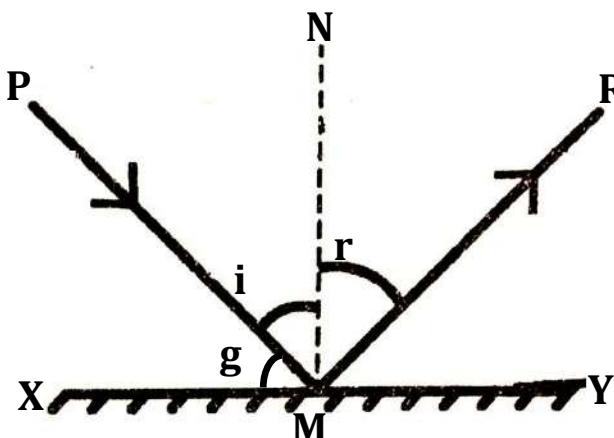
Why do we polish our shoes?

- To reflect heat

LAWS OF REFLECTION:

- The incident ray, the reflected ray and the normal at the point of incidence all lie in the same plane.
- The angle of incidence is equal to the angle of reflection.

A diagram showing regular reflection



XMY -Plane mirror
M -Point of incidence
PM-Incident ray
RM-Reflected ray
NM-Normal
i-Angle of incidence
r-Angle of reflection
g -Glancing angle

Point of incidence

- This is the point at which the incident ray strikes the shiny surface.

Incident ray

- This is the ray of light that hits the shiny surface.

Reflected ray

- This is the ray of light sent back by the shiny surface

Normal

- This is an imaginary line drawn perpendicular to shiny surface at the point of incidence.

Why is the normal always dotted?

- It is imaginary

Angle of incidence

- This is an angle between the incident ray and the normal

Angle of reflection

- This is an angle between the reflected ray and the normal

Glancing angle

- This is the angle between the shiny surface and the incident ray

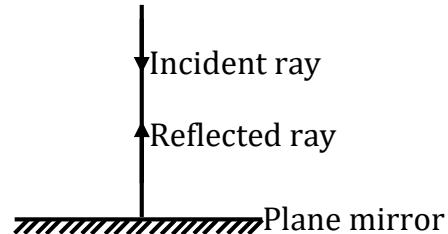
NOTE

- The ray of light that strikes the mirror at a right angle is reflected in the same direction (path)
- If the incident ray and the reflected ray are perpendicular to the surface, the angle of incidence and the angle of reflection are equal to 0° while the glancing angle is 90°

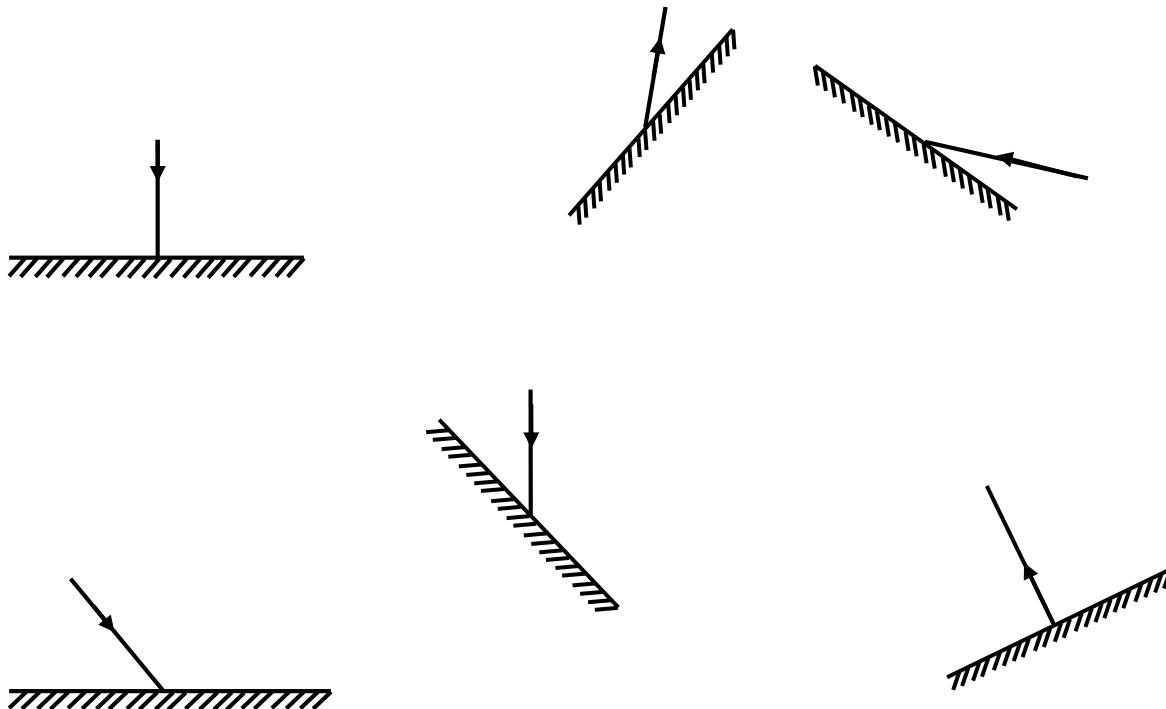
TOTAL INTERNAL REFLECTION

- This is when the incident ray strikes the mirror perpendicularly and the reflected ray takes the same route (path)

AN ILLUSTRATION SHOWING TOTAL INTERNAL REFLECTION



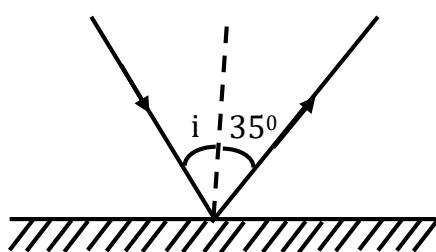
COMPLETE THE FOLLOWING DIAGRAMS



CALCULATIONS RELATED TO LIGHT REFLECTION

Example 1

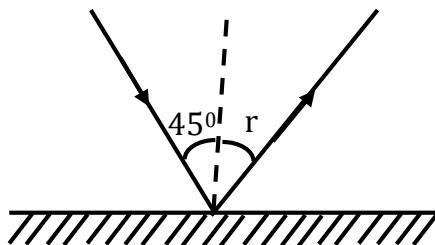
Find the value of the angle of incidence in the figure below.



$$\begin{aligned} i + 35^\circ &= 90^\circ \\ i + 35^\circ - 35^\circ &= 90^\circ - 35^\circ \\ i &= 55^\circ \end{aligned}$$

Example 2

Find the value of the angle of reflection



$$\begin{aligned} \text{Since; } i &= r \\ r &= 45^\circ. \end{aligned}$$

Example 3

The incident ray makes an angle of 60° to the mirror. What is the angle of reflection?

The normal makes 90° to the mirror

$$60^{\circ} + i = 90^{\circ}$$

$$60 - 60 + i = 90 - 60$$

$$i = 30^{\circ}$$

Since; $i = r$

$$r = 30^{\circ}$$

Example 4

If the angle between the incident ray and the mirror is 32° , what is the size of the reflected ray?

Let the angle of incidence be i

$$i + 32^{\circ} = 90^{\circ}$$

$$i + 32^{\circ} - 32^{\circ} = 90^{\circ} - 32^{\circ}$$

$$i = 58^{\circ}$$

Since; $i = r$

$$r = 58^{\circ}$$

IMPORTANCE OF LIGHT REFLECTION

- It enables us to see objects
- It enables formation of images in mirrors
- It enables us to identify colours of objects
- It enables us to see around corners using periscopes

How does reflection help drivers to control accidents?

- It enables them to see images of vehicles and people behind through driving mirrors

REFLECTORS OF LIGHT

- These are materials which reflect light

Examples of good reflectors of light

- Shiny (polished) objects
- White objects/brightly coloured objects

ABSORBERS OF LIGHT

- These are materials which absorb light

Examples of absorbers of light

- Unpolished objects
- Black/dull coloured objects

Why do people in hot places (desert areas) wear white clothes?

- White reflects heat (sun's heat)

Why do people in cold weather wear dark clothes?

- Dark clothes absorb heat and keep the body warm

Why is a white cloth seen easily at a distance than a black cloth?

- White reflects light while black absorbs light

Why do objects appear their colour?

- They absorb all other colours and reflects their own colour

Why does a black object appear black?

- It absorbs all colours and reflects none

Why does a white object appear white?

- It reflects all other colours and absorbs none

Why does a green dress appear green?

- It absorbs all other colours and reflects green

Why does a red shirt appear red?

- It absorbs all other colours and reflects red

Why do most people in hot weather prefer wearing white clothes to black or dark clothes?

- White clothes reflect sun's heat while black clothes absorb sun's heat

Why are most car boards painted white?

- To reflect sun's heat

IMAGES

- An image is the reflection of a real object
- An image is a copy of an object formed by reflection or refraction of light

How is an image formed?

- When light rays meet or appear to meet after reflection

Types of images

- Real images
- Virtual images

Real images

- These are images which are formed on the screen
- They are formed by light rays that meet at a point after reflection

Instruments that form real images

- Camera
- Projector
- Convex lens
- Telescope
- Human eye

Virtual images

- These are images which cannot be formed on the screen
- They are formed by light rays that appear to meet behind the mirror after reflection

Instruments that form virtual images

- Periscope
- Mirrors
- Microscope
- Concave lens

EXAMPLES OF IMAGES

- Diminished images
- Erect images
- Magnified images
- Inverted images

Diminished images

- These are images which are smaller than the object

Instruments that form diminished images

- Convex mirror
- Pinhole camera
- Concave lens
- Human eye

Magnified images

- These are images which are bigger than the object

Instruments that form magnified images

- Concave mirrors
- Magnifying glasses
- Convex lens
- Microscope
- Projector

Erect images

- These are images which are upright

Instruments that form erect images

- Plane mirror
- Convex mirror
- Concave mirror
- Concave lens

Inverted images

- These are images which are upside down

Instruments that form inverted images

- Pinhole camera
- Lens camera
- Projector
- Human eye

MIRRORS

- A mirror is a smooth glass material with a silvered surface that reflects light

Groups (types) of mirrors

- Plane mirrors
- Curved (spherical) mirrors

PLANE MIRRORS

- These are mirrors with flat reflecting surfaces e.g. dressing mirrors

On which principle do plane mirrors form images?

- On the principle of light reflection

Characteristics of an image formed by plane mirrors

- The image distance is equal to the object distance from the mirror
- They are laterally inverted (image is turned sideways)
- They are equal to the object in size
- They are upright (erect)
- They are virtual

Mnemonic is VEELD

V --- Virtual

E --- Erect

E --- Equal to the object in size

L --- Laterally inverted

D --- Distance of image and object from the plane mirror is equal

LATERAL INVERSION

- This is the sideways reversal of images

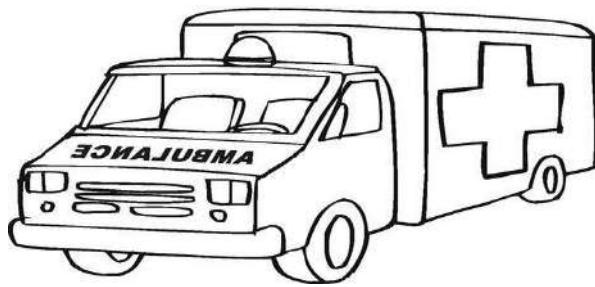
An illustration showing lateral inversion



Why are images formed by plane mirrors laterally inverted?

- Due to reflection of light by the plane mirror

The word AMBULANCE is indicated in mirror writing on the vehicle as shown below



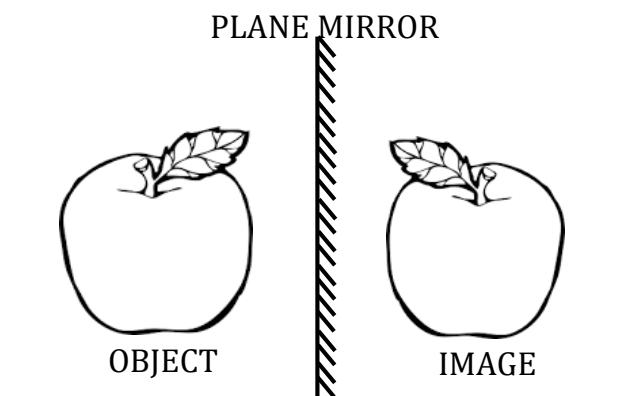
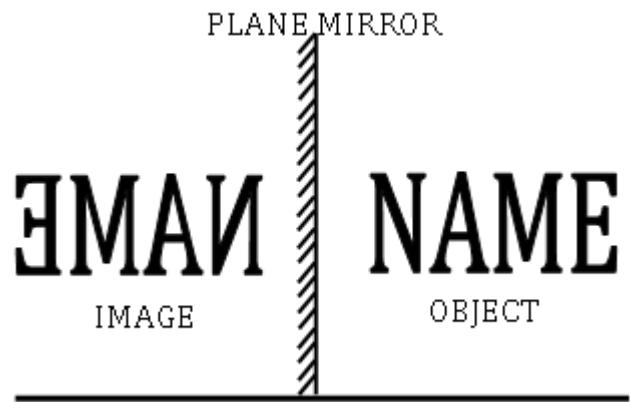
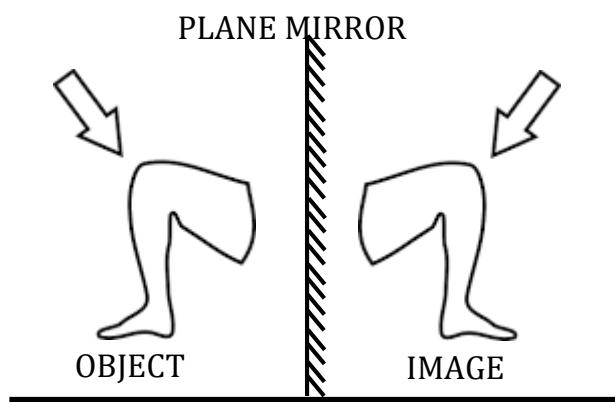
Why is the word AMBULANCE put in mirror writing?

- For correct reading by other drivers in their side mirrors (rear-view mirrors)

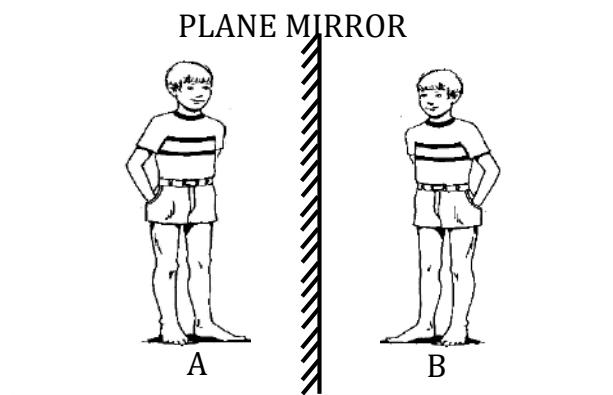
Why is it easier for drivers in front to read the word AMBULANCE in mirror writing on the vehicle?

- It is corrected by the driving mirror during reflection
- It is corrected by lateral inversion during reflection by the driving mirror

DRAWING IMAGES FORMED BY PLANE MIRRORS



The diagram below shows a boy using a plane mirror. Use it to answer the questions below



Which letter which shows the object?

- Letter B

Give a reason to support your answer in (a) above.

- It is in front of the mirror

What enables a very big tree to fit in the view of a human eye?

- The human eye forms diminished images

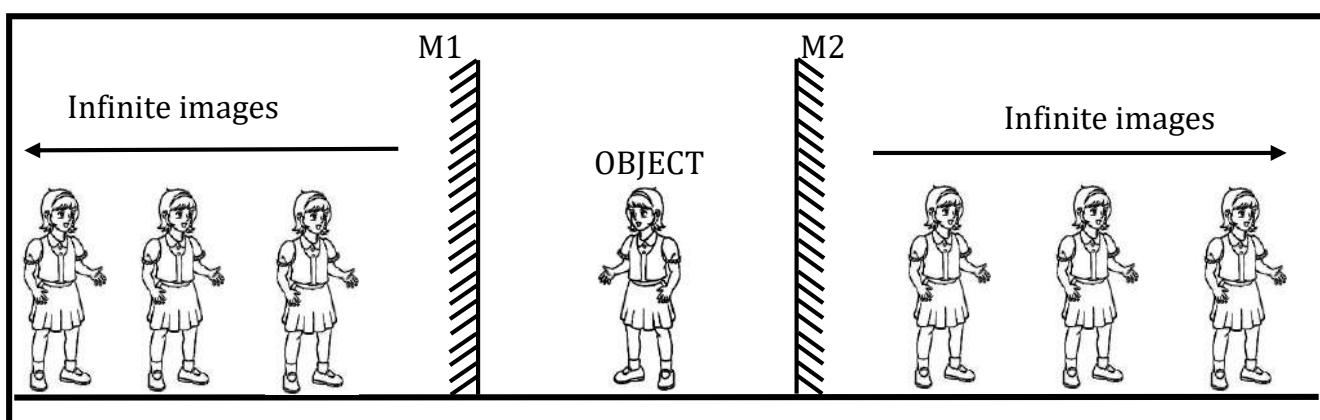
INFINITE IMAGES

- These are images which are endless

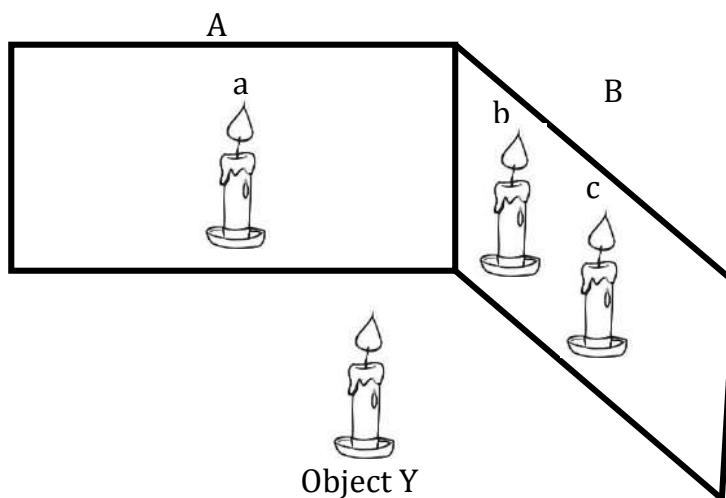
How are infinite images formed?

- When an object is placed between two plane mirrors which are parallel to each other

A diagram showing infinite images



An illustration showing two plane mirrors placed perpendicularly (at a right angle)



Note

- They form three images of an object in front of them.

Why?

- This is because the image of object Y in mirror A is **a**, in mirror B is **c** and the image of **a** in mirror B is **b**

How is an image similar to an echo?

- Both are formed by reflection

CALCULATING DISTANCES OF IMAGES AND OBJECTS FROM PLANE MIRRORS

1. An object was placed 5m away from the plane mirror.

- a) **How far was the image from the plane mirror?**

Solution

Since the distances of the image (v) and object (u) from the plane mirror is equal,

$$U = V$$

$$5m = V$$

The image was 5m away from the plane mirror

- b) **How far was the image from the object?**

$$5m + 5m$$

$$= 10m$$

2. After reflection by a plane mirror, the image was formed 15m away from the plane mirror.

- a) **How far was the object from the plane mirror?**

- The object was 15m away from the plane mirror

- b) **How far was the object from the image?**

- The image distance is equal to the object distance from the mirror.

- c) **How far was the object from the image?**

$$15m + 15m$$

$$= 30m$$

Applications (uses) of plane mirrors

- They are used as dressing mirrors
- They are used in periscopes in submarines
- They are used in kaleidoscopes
- They are used in a sextant
- They are used in an overhead projector

Devices that use plane mirrors

- Periscope
- Kaleidoscope
- Overhead projector

KALEIDOSCOPE

- This is an optical device that produces colourful designs and patterns

What enables a kaleidoscope to produce colourful designs and patterns?

- Multiple reflections in the plane mirrors

PERISCOPE

- This is an instrument used to see over an obstacle and around corners
- ✓ It consists of a tube with two plane mirrors set parallel to each other in its corner and inclined at an angle of 45° to the path of light rays

Why are plane mirrors fixed parallel to each other in a periscope?

- To reflect light

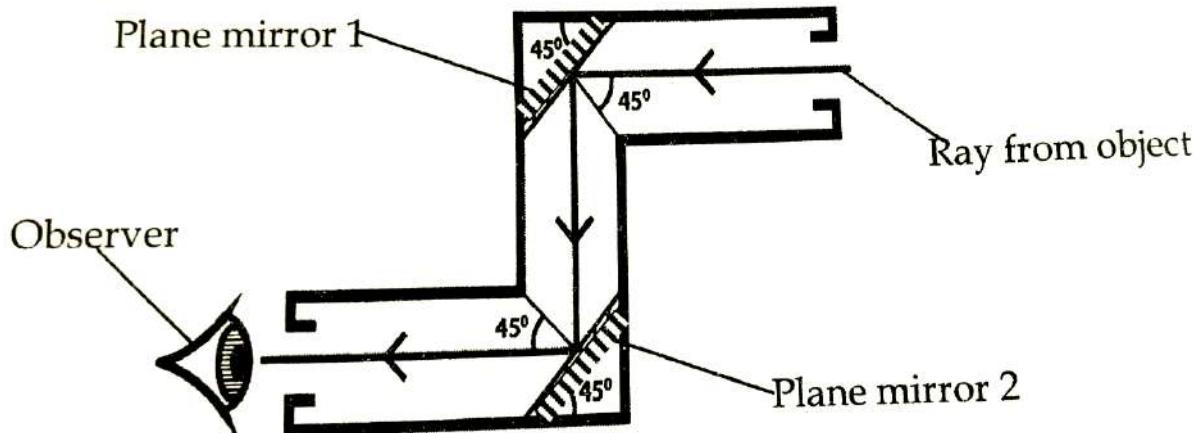
On which principle does a periscope work?

- It works on the principle of reflection of light

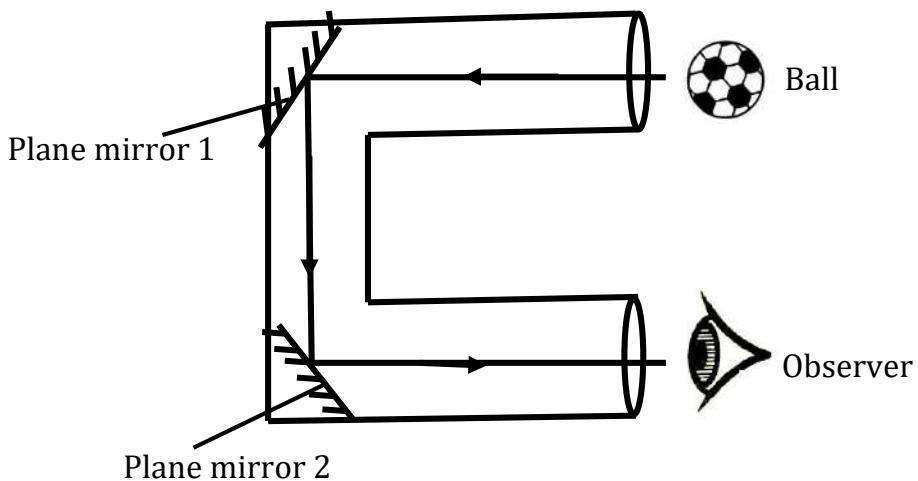
Why are we able to see around corners using a periscope?

- It is due to reflection of light

A DIAGRAM SHOWING A PERISCOPE



Below is an optical instrument. Use it to answer the following questions below.



a) Name the above optical instrument.

- Periscope

b) What role is played by the plane mirrors in the above device?

- They reflect light

c) How is the observer able to see the ball?

- By reflection of light

d) At what angle are the plane mirrors inclined?

- At 45°

USES OF A PERISCOPE

- It is used to see around corners
- It is used by soldiers in trenches to see the enemies on ground
- It is used to see objects ahead
- It is used by marines to see over the water surface
- It is used by spectators to watch overhead the crowd
- They are used by security guards to watch over tall fences at night

Groups of people who use periscopes

- | | |
|------------|-------------------|
| ▪ Soldiers | ▪ Security guards |
| ▪ Marines | ▪ Spectators |

CURVED (SPHERICAL) MIRRORS

- These are mirrors with a curved reflecting surface

How are curved mirrors made?

- By silvering either the inside or outside surface of the sphere

TYPES OF CURVED MIRRORS

- Concave (converging) mirrors
- Convex (diverging) mirrors

CONVEX (DIVERGING) MIRRORS

- These are mirrors made by silvering the inside surface of the sphere.

Why is a convex mirror also called diverging mirror?

- Light rays spread/scatter after reflection by a convex mirror

What happens to light rays when they strike a convex mirror?

- They are diverged

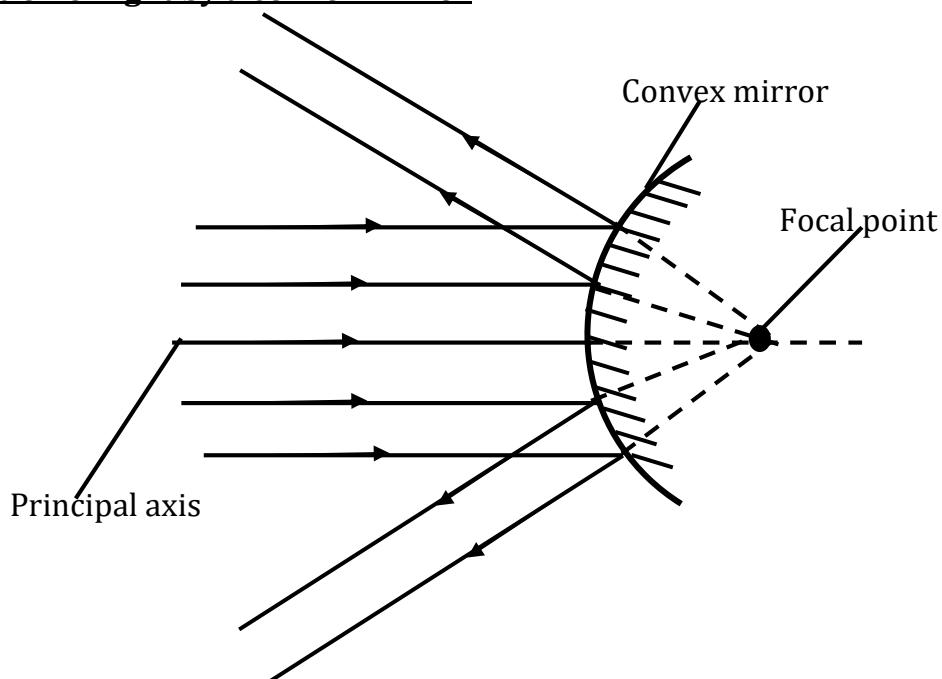
How does a convex mirror affect the beam of light?

- It diverges light rays after reflection

A diagram to show convex mirrors



Reflection of light by a convex mirror



Characteristic of images formed by convex mirrors

- The image is diminished (smaller than the object)
- The image is upright (erect)
- The image is laterally inverted
- The image is virtual (formed behind the mirror)

USES OF CONVEX MIRRORS

- They are used as rear view mirrors (driving mirror/side mirrors) on vehicles.
- ✓ They give a wider field of view
 - They are used as security mirrors in shops and buses
 - They are used in making lenses of sunglasses
 - They are used in magnifying glasses

Difference between images formed by convex mirrors and plane mirrors

- Images formed by convex mirrors are diminished while images formed by plane mirrors are equal to the object in size

CONCAVE (CONVERGING) MIRRORS

- These are mirrors made by silvering the outside surface of the sphere.

Why is a concave mirror also called converging mirror?

- Light rays meet at a point after reflection by a concave mirror

What happens to light rays when they strike a concave mirror?

- They are converge after reflection

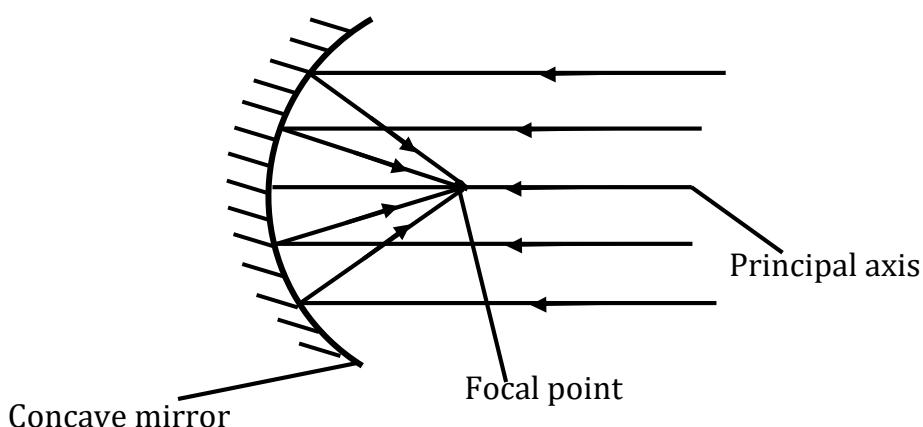
How does a concave mirror affect the beam of light?

- It converges light rays after reflection

A diagram to show concave mirrors



Reflection of light by a concave mirror



Characteristics of images formed by concave mirrors

- The image is magnified (larger than the object)
- They are erect (upright)
- They are laterally inverted
- They are virtual (cannot be cast on the screen)

Differences between images formed by concave mirrors and plane mirrors

- Images formed by concave mirrors are magnified while images formed by plane mirrors are equal to the object in size

USES OF CONCAVE MIRRORS

- They are used as shaving mirrors e.g. by barbers
- ✓ They form enlarged erect image of the face
 - They are used by dentists to examine teeth
- ✓ They form enlarged images of teeth
 - They are used in solar ovens
- ✓ They converge sun rays to produce heat (high temperature)
 - They are used in search-lights and torches
 - They are used in car headlights to reflect light
- ✓ They produce a powerful parallel beam of light
 - They are used at airports to guide landing aeroplanes
 - They are used in electron microscope
 - They are used in satellite dishes
 - They are used in visual bomb detectors

REFRACTION OF LIGHT

- This is the bending of light as it moves from one transparent medium to another

What causes refraction of light?

- Change in speed of light as it moves from one transparent medium to another

Why does light bend as it moves from one transparent medium to another?

- Due to change in speed of light

THE SPEED OF LIGHT IN DIFFERENT MEDIA

Medium	Speed of light
Vacuum	300,000 Km/s
Air	299,700 Km/s
Water	225,000 Km/s
Glass	200,000 Km/s
Diamond	12,400 Km/s

- ✓ Light travels faster in a rarer (less dense) medium
- ✓ Light travels slower in a denser medium

Why does light travel fastest in vacuum?

- There is no matter

Why does light travel faster in air than in glass?

- Air is less dense than glass

Explain the meaning of the following terms as used in refraction of light?

i) **Rarer (less dense) medium**

- This is the medium in which the speed of light is more

ii) **Denser medium**

- This is the medium in which the speed of light is less

NOTE

1. When a ray of light is moving from a rarer (less dense) medium to a denser medium (e.g. from air to glass), the refracted ray bends towards the normal

Why?

- The speed of light reduces

2. When a ray of light is moving from a denser medium to a rarer (less dense) medium (e.g. from glass to air), the refracted ray bends away from the normal

Why?

- The speed of light increases
3. When a ray of light falls normally (perpendicularly) on a medium, it is not refracted (it goes straight)

PRINCIPLES OR LAWS OF REFRACTION (SNELL'S LAW)

- The incident ray, the refracted ray and the normal at the point of incidence all lie in the same plane.
- The ratio of sine angle of incidence to sine angle of refraction is constant
- A ray of light travelling along the normal is not refracted

When does refraction occur?

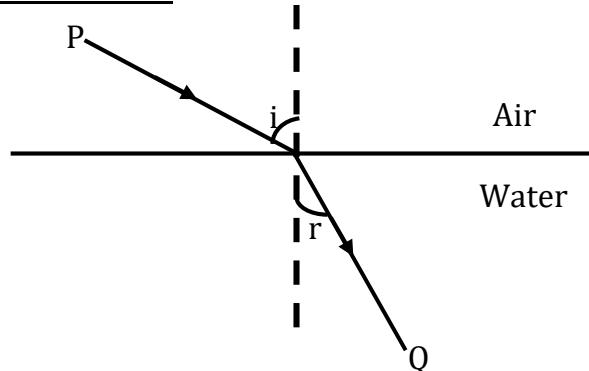
- When the incident ray strikes the boundary of another medium at an angle

When does no refraction of light occur?

- When the incident ray strikes the boundary of other medium normally
- When the refractive indices of two media in contact is equal

DIAGRAMS SHOWING REFRACTION OF LIGHT

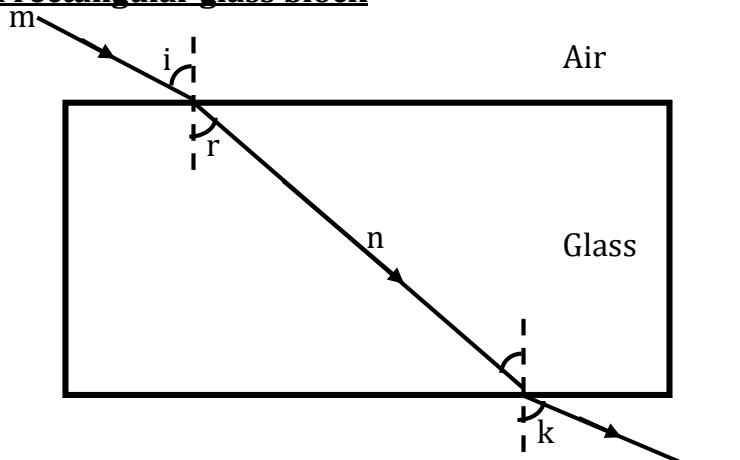
a) Refraction in water



Naming the rays of light

- P ---- Incident ray
 - Q ---- Refracted ray
- #### Naming the angles
- i ---- Angle of incidence
 - r ---- Angle of refraction

b) Refraction in a rectangular glass block



Naming the rays of light

- m ---- Incident ray
- n ---- Refracted ray
- x ---- Emergent refracted ray

Naming the angles

- i ---- Angle of incidence
- r ---- Angle of refraction
- k ---- Angle of emergence

Why does a ray of light bend as it moves from air to glass?

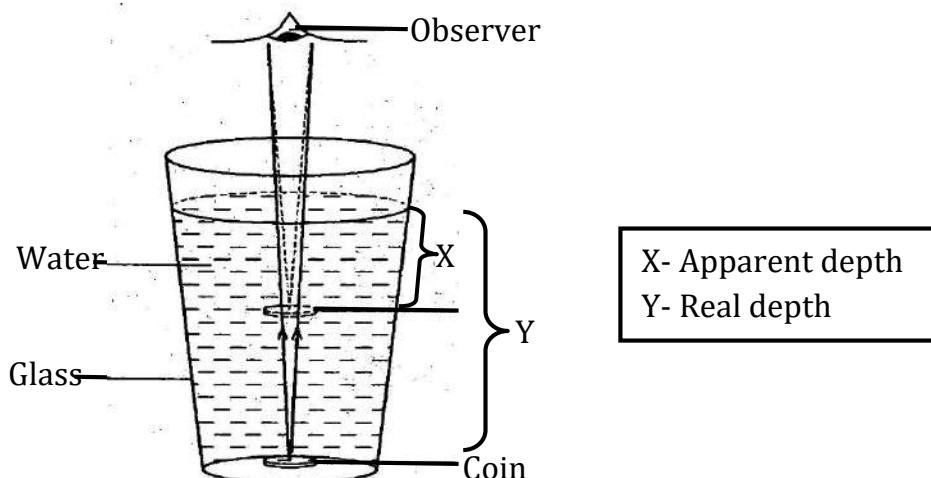
- Due to change in speed of light

EFFECTS OF REFRACTION

- It makes a swimming pool to appear shallower than its real depth
- It makes a coin or stone at the bottom of water in the container to appear raised
- It makes a ruler or stick partly dipped in water at an angle to appear bent or broken
- It makes a fish appear to be nearer the water surface than its real depth
- It makes a line or words on a paper to appear raised when seen through a glass block
- It causes dispersion of light
- It makes a lemon put in a glass of water to appear bigger when seen from the sides of a glass
- It forms optical illusions e.g. mirage and looming
- It makes stars to appear twinkling at night

DIAGRAMS SHOWING EFFECTS OF REFRACTION

Illustration 1



X- Apparent depth
Y- Real depth

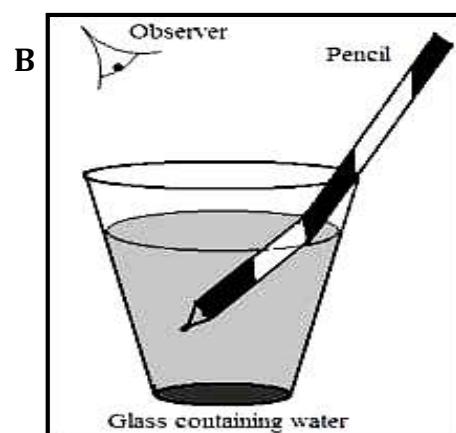
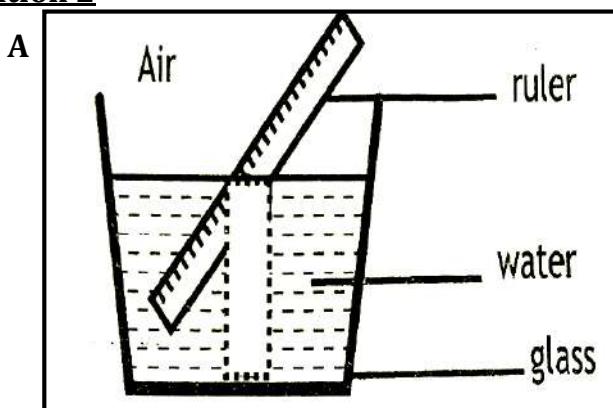
Qn. Why does the observer see the coin as if it's in the middle of the bucket?

- Due to refraction

Qn. What causes real and apparent depth?

- Refraction

Illustration 2



Qn. Why does a pencil appear bent in diagram B?

- Due to refraction

MIRAGE

- This is an optical illusion of water in a desert and on a hot road caused by refraction of light from the sky by hot air near the ground.

EFFECTS OF MIRAGE

- It leads to accidents on highways (on tarmac roads)
- It causes false images along high ways in deserts.

Name any two places where mirages are common during sunny weather?

- Highways (tarmac roads)
- Deserts

DANGERS OF REFRACTION OF LIGHT

- It can lead to near drowning and drowning in swimming pools
- It makes harvesting of fish difficult
- It forms mirages which can lead to road accidents

DISPERSION OF LIGHT

- This is the splitting of white light into the seven colours.

What causes dispersion of light?

- Refraction of light

LIGHT SPECTRUM

- This is a band of seven distinct colours that make up white light
- This is the arrangement of the seven colours that make up white light

How is a light spectrum formed?

- It is formed when white light is split by a prism.

What is a prism?

- This is a transparent glass that splits white light into seven colours.

Who discovered that white light is made up of seven colours?

- Sir Isaac Newton

THE ORDER OF LIGHT SPECTRUM FROM TOP TO BOTTOM

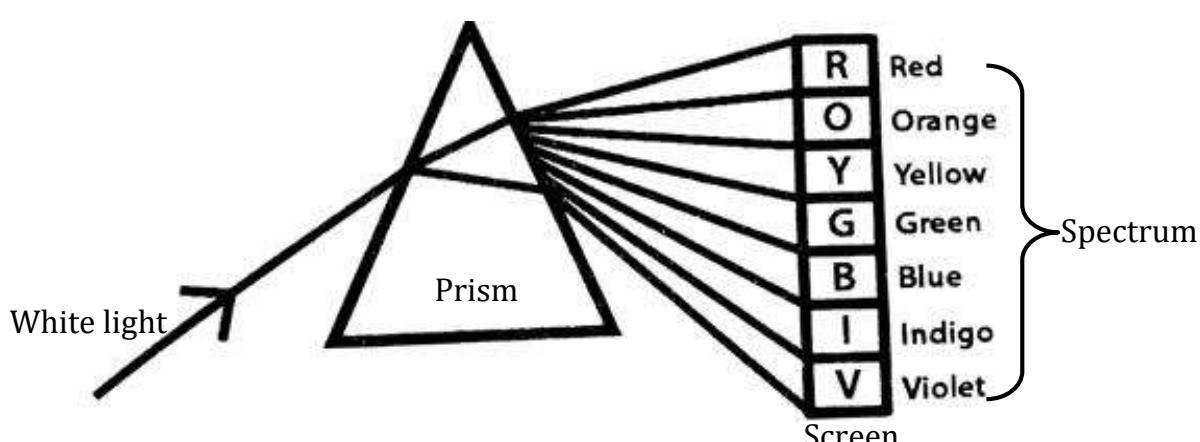
- Red
- Orange
- Yellow
- Green
- Blue
- Indigo
- Violet

MNEMONICS FOR THE ORDER OF SPECTRUM

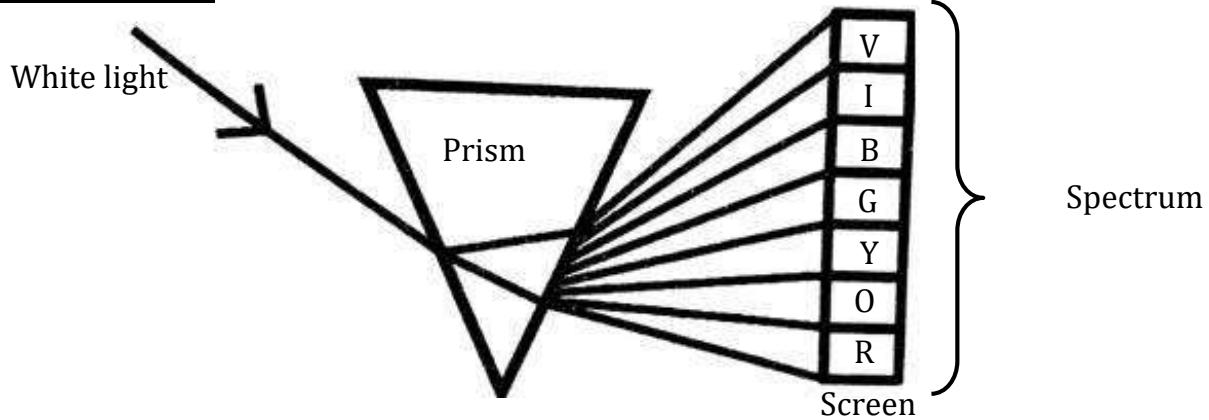
1. Richard Okello Your Girl Betty Is Vomiting
2. Richard Of York Gave Birth In Vain
3. Read Only Your Golden Book In Venus

DIAGRAMS TO SHOW DISPERSION OF WHITE LIGHT

1. ILLUSTRATION 1



2. ILLUSTRATION 2

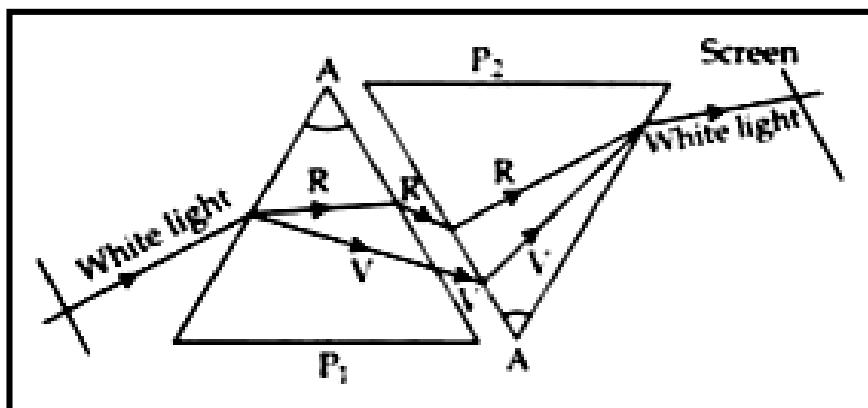


- Light rays in the prism bend at different angles because they move at different speed
- The fastest ray of light bends most and it has the shortest wavelength
- The slowest ray of light bends least and it has the highest wavelength
- **Red** colour bends the least and **violet** bends most.

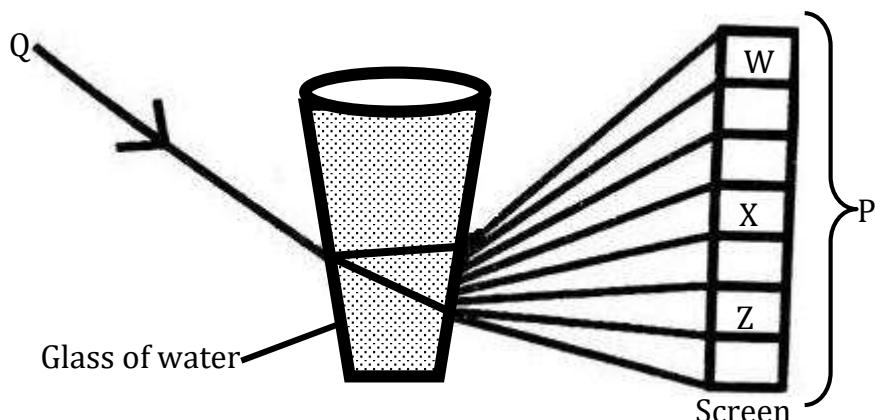
NOTE

- The seven colours of light spectrum can be recombined to form white light by arranging the second prism to deviate light in the opposite direction

ILLUSTRATION



Study the diagram below and answer the questions about it.



What does the diagram above illustrate?

- Dispersion of light

Name the parts marked Q and P

- Q is white light
- P is spectrum/light spectrum

Name the colours marked W, X and Z

- W is Violet
- X is Green
- Z is Orange

What role does a glass of water play in the experiment above?

- It splits white light into seven colours (it causes dispersion of light)

Give any one source of white light

- Sun
- Torch
- Fluorescent light bulb
- White LED

Why is a laser light not dispersed/spread when passed through a prism?

- It has perfectly parallel rays with only one colour

RAINBOW

- This is a natural light spectrum

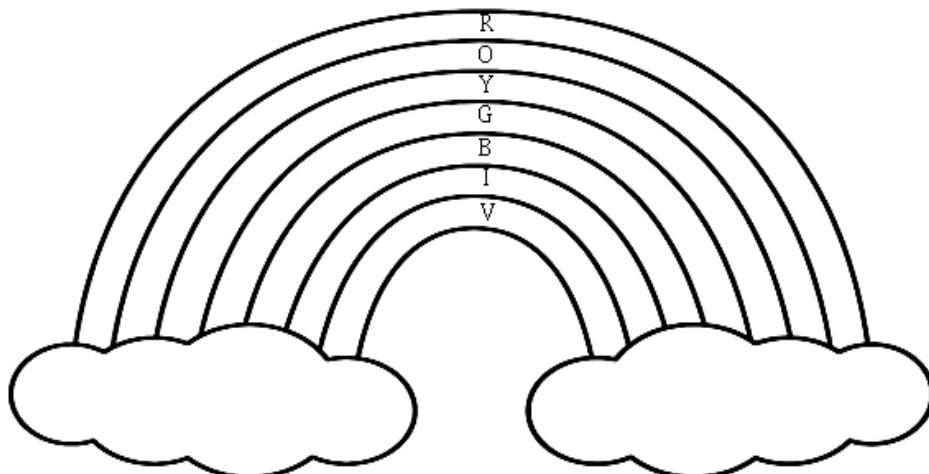
How is a rainbow formed?

- When sunlight is split by raindrops

Why does a rainbow appear in the morning and evening (late afternoon) only?

- The sun is at an angle to the earth's surface

A DIAGRAM SHOWING A RAINBOW



- The outer (top most) colour of rainbow is red and Violet is at the bottom

Why is the rainbow seen with red on top and violet at bottom?

- Red bends the least and violet bends the most

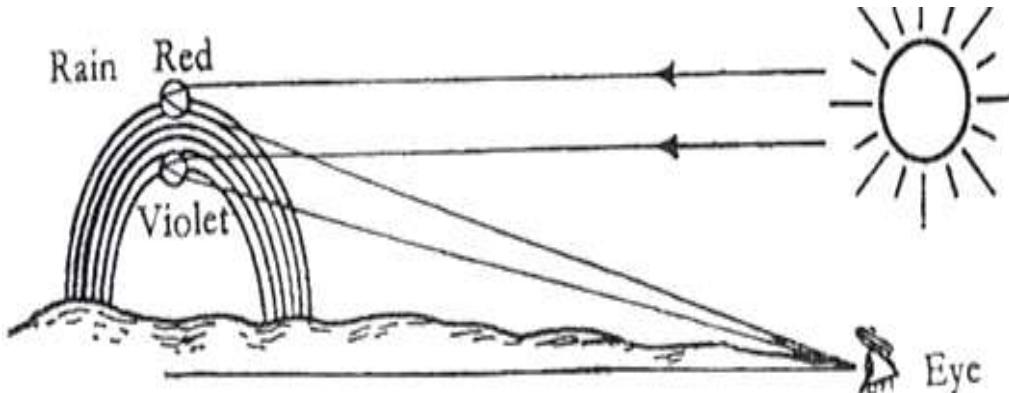
Why is red bent the least in a rainbow?

- Red travels slowest

Why is violet bent the most?

- Violet travels fastest

An illustration showing the formation of a rainbow



PRIMARY, SECONDARY AND COMPLEMENTARY COLOURS OF LIGHT

1. PRIMARY COLOURS

- These are colours that cannot be got by mixing other colours.
- ✓ Primary colours exist on their own

Examples of primary colours

- Red
- Blue
- Green

NOTE

- **Primary colours** absorb other colours and reflect themselves.
- When all primary colours are mixed, we get **white**.
- **White** is a universal colour
- **Red + Blue + Green = White**

Who is a colour blind person?

- This is a person who cannot see any of the primary colours.

2. SECONDARY COLOURS

- These are colours got by mixing two primary colours

Examples of primary colours

- Yellow
- Cyan (peacock blue)
- Magenta

Mixture of primary colours	Secondary colour
Red + Green	Yellow
Blue + Green	Cyan (peacock blue)
Red + Blue	Magenta

3. COMPLEMENTARY COLOURS

- These are any two colours that mix to form white
- This is a pair of colours that mix to form white

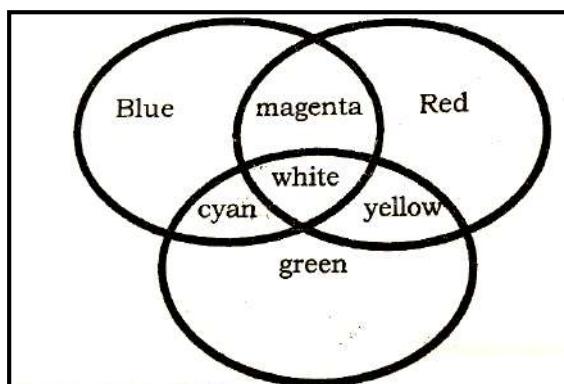
One colour must be a primary colour and another is a secondary colour mixing that primary colour.

Examples of complementary colours

- Blue and yellow
- Green and magenta
- Red and cyan

COMPLEMENTARY COLOURS	PRODUCT
Blue and yellow	White
Red and cyan	
Green and magenta	

AN ILLUSTRATION SHOWING COLOUR CHART



What is observed when the colour wheel (Sir Isaac Newton's colour Disc) is rotated at high speed?

- White light is observed

LENSES

- This is a transparent glass or plastic material with curved sides that refract light.

What is the use of the curved sides of a lens?

- They refract light passing through the lens.

Name any two materials from which lenses are made.

- Glass
- Plastic

Types of lenses

- Convex (converging) lens
- Concave (diverging) lens

CONVEX LENS (CONVERGING LENS)

- This is a lens which is thicker in the middle but thinner at the edges.

An illustration of convex lens



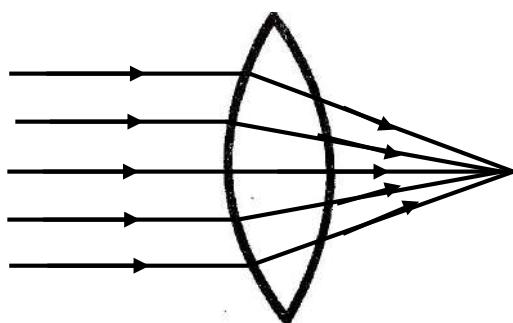
Why is a convex lens also called a converging lens?

- It refracts parallel light rays to meet at a focal point

What happens to parallel light rays when they strike a convex lens?

- They converge at a focal point (they bend and meet at a focal point)

A diagram to show the effect of light rays on a convex lens.



Characteristics of an image formed by a convex lens

- It is real
- It is inverted
- It is magnified

Uses of convex lenses

- They are used in some optical instruments e.g. magnifying glasses, light microscopes, eyeglasses, lens cameras and human eye
- They are used to correct long sightedness

CONCAVE LENS (DIVERGING LENS)

- This is a lens which is thinner in the middle but thicker at the edges.

AN ILLUSTRATION OF A CONCAVE LENS



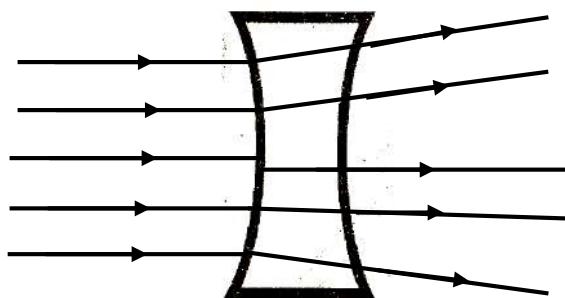
Why is a concave lens also called a diverging lens?

- It refracts parallel light rays to spread out in different directions

What happens to parallel light rays when they strike a concave lens?

- They diverge (they bend and spread out in different directions)

A diagram to show the effect of light rays on a concave lens.



Characteristics of an image formed by a concave lens

- It is virtual
- It is erect (upright)
- It is diminished

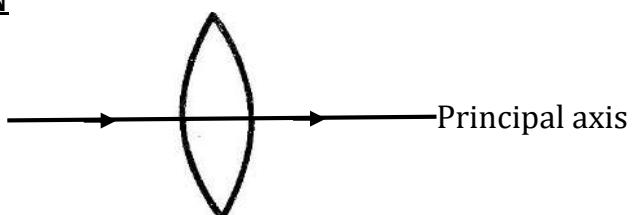
Uses of concave lenses

- They are used in some optical instruments like telescopes, binoculars, eyeglasses and TV projectors
- They are used to correct short sightedness

NOTE:

- A ray of light travelling along the normal is not refracted

ILLUSTRATION



EXPLAIN THE MEANING OF THE FOLLOWING TERMS

Principal axis of the lens

- This is the line passing through the centre of the lens

Focal point (principal focus)

- This is the point at which light rays converge

Focal length

- This is the distance between the centre of the lens and the focal point

GENERAL USES OF LENSES

- They are used in optical instruments
- They are used to correct eye defects

OPTICAL INSTRUMENTS

- These are instruments which use light to work
- These are instruments whose proper working depends on presence of light

How do optical instruments form images?

- They use mirrors and lenses to reflect and refract light and form images

Examples of optical instruments that use lenses.

- **Telescopes (refracting telescopes)**

They are used to see magnified image of very distant small objects e.g. stars

- **Binoculars**

They are used to see magnified images of distant objects

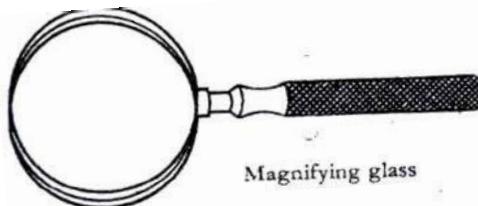
- **Projectors**

They are used to focus magnified images onto a screen

- **Magnifying glasses**

They are used to produce a magnified image for clear vision

An illustration showing a magnifying glass



- **Light microscopes**

They are used to magnify germs or tiny objects

- **Lens camera**

They are used to take photographs or videos

- **Eyeglasses (spectacles)**

They act as vision aids

- **Human eyes**

They enable us to see

Examples of optical instruments that use plane mirrors.

- Periscopes
- Kaleidoscopes

Examples of optical instruments that use concave mirrors

- Telescopes (reflecting telescopes)
- Electron microscope

An example of optical instrument that uses convex mirrors

- Magnifying glasses

Optical instruments that form real images

- | | |
|---------------|-------------|
| ▪ Camera | ▪ Telescope |
| ▪ Convex lens | ▪ Human eye |
| ▪ Projector | |

Optical instruments that form virtual images

- | | |
|--------------|----------------|
| ▪ Periscope | ▪ Mirrors |
| ▪ Microscope | ▪ Concave lens |

Characteristics of images formed by projectors

- They are real
- They are magnified
- They are inverted

CAMERAS

- These are optical devices used to capture still images (pictures)

Types of cameras

- Pinhole camera
- Lens camera (photographic camera)

A PINHOLE CAMERA

- This is a device that forms images by allowing light through a very small hole.

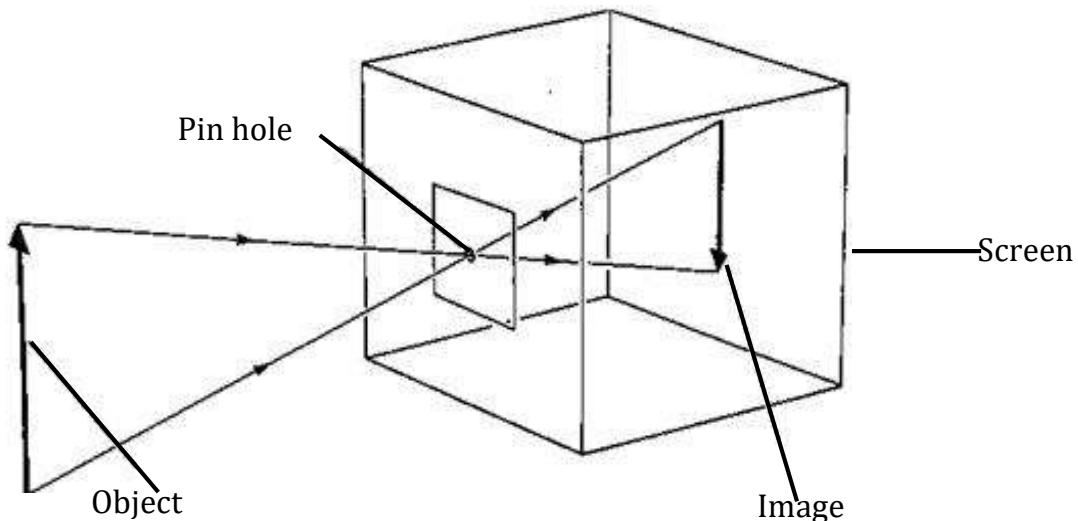
On which principle does a pinhole camera work?

- It works on the principle that light travels in a straight line (rectilinear propagation of light)

Why does a pinhole camera form an inverted image?

- Light travels in straight line (due to rectilinear propagation of light)

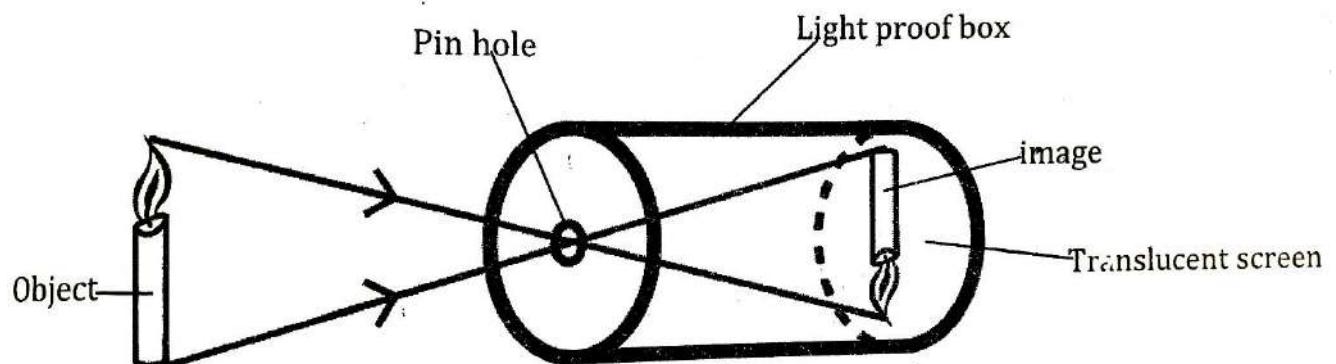
A diagram showing a pinhole camera



NOTE

- You can make your own pinhole camera using a cylindrical tin

ILLUSTRATION



Characteristics of the image formed by a pinhole camera

- It is real
- It is inverted
- It is diminished

RID

Why is an image formed by a pinhole camera real?

- The image is formed (cast) on the screen

Why is (the light proof box) the inside of a pinhole camera painted black?

- To prevent internal reflection/to prevent unwanted reflections inside

Why is the image formed by a pinhole camera sharp but not bright?

- The pinhole allows in little light

State the importance of a screen in a pinhole camera?

- It is where the image is formed

State the importance of the translucent paper (e.g. oiled paper) on a pinhole camera?

- It acts as a screen on which an image is formed

Note

- The **screen** in a pinhole camera acts as the **retina** in the eye or the **film** in the lens camera

FACTORS THAT AFFECT THE SIZE OF AN IMAGE FORMED BY PINHOLE CAMERA

- Length of the pinhole camera (distance from the pinhole to the screen)
- Distance of an object from the pinhole

Length of the pinhole camera

- Longer pinhole camera forms bigger images while a shorter one forms smaller images

Distance of an object from the pinhole

- An object nearer to the pinhole camera has a big and clear image while an object far from the camera has a small and blurred image

When does a pinhole camera form a blurred image?

- When the pinhole is made larger(When the size of pinhole is increased)
- When the object is far from the camera

Note

- A smaller pinhole makes the image sharper (clear)

THE LENS CAMERA (PHOTOGRAPHIC CAMERA)

- This is an optical instrument used to take photographs and videos

Why is a photographic camera called an optical instrument?

- It uses light to work

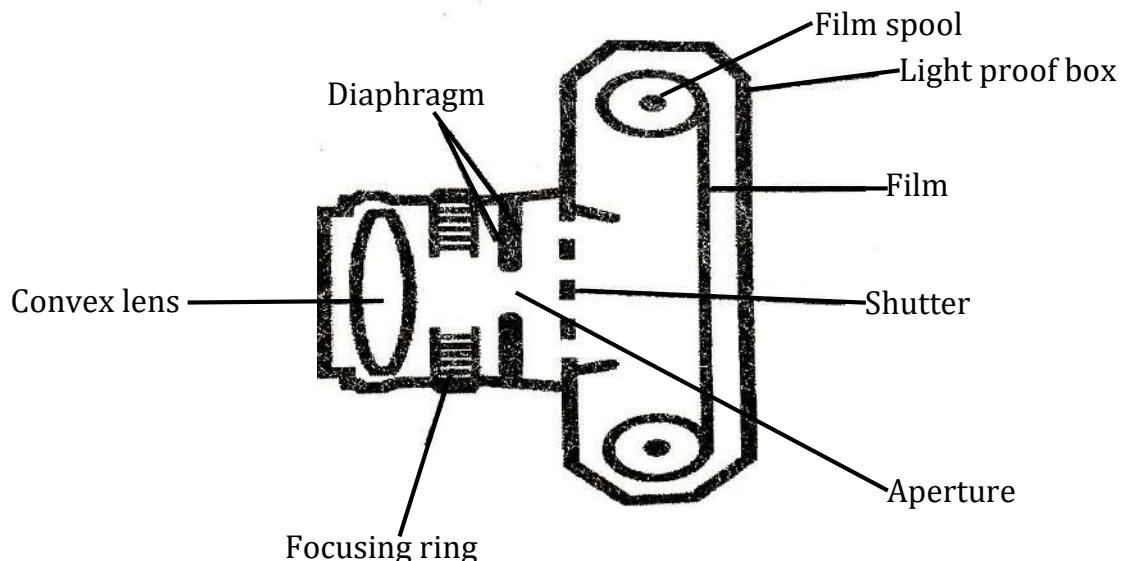
Name the type of lens used in a lens camera?

- Convex lens

Note

- A photographic camera consists of a light proof box with a glass lens, diaphragm, shutter, film and focusing ring.

THE STRUCTURE OF A PHOTOGRAPHIC CAMERA (LENS CAMERA)



FUNCTIONS OF EACH PART

Glass lens (convex lens)

- It focuses light onto the film
- It refracts light and focuses a real image on the film

Film

- It is where the image is formed.

Why are images formed on the film?

- ✓ It has light sensitive silver halide crystals

Diaphragm

- It regulates (controls) the amount of light entering the aperture

How?

- ✓ By regulating the size of the aperture

Aperture

- It allows light into the camera

Shutter

- It exposes the film to light
- It keeps out light when it is not needed
- It opens or closes the aperture

Focusing ring (screw mounting)

- It adjusts the distance of the lens from the film to produce a sharp image

Why?

- ✓ To produce a sharp image (for accommodation)

How does a focusing ring adjust the distance of the lens from the film?

- By moving the lens forward and backward

How is focusing (accommodation) made in a lens camera?

- By adjusting the distance of the lens from the camera using a focusing ring

Which part of a photographic camera determines accommodation?

- Focusing ring

Why is the inside of a light proof box of a photographic camera painted black?

- To prevent internal reflection/to prevent unwanted reflections inside

Characteristics of images formed by a lens camera (photographic camera)

- They are real.
- They are inverted.
- They are diminished.

RID

How does a photographic camera work?

- The film is exposed to light
- It is removed from camera and treated with chemicals in a darkroom to produce a negative image. This is called **developing**.
- A negative image has the bright parts of the photographed object appear dark and the dark parts appear bright.
- The negative is printed to give a positive image which has the same colour as the object.

THE HUMAN EYE

- The eye is an organ of sight
- It is a receptor organ for light
- It is an optical organ
- It is spherical in shape and enclosed in the **orbit (eye socket)**

In which part of the skull are the eyes fixed?

- In the orbit (eye socket)

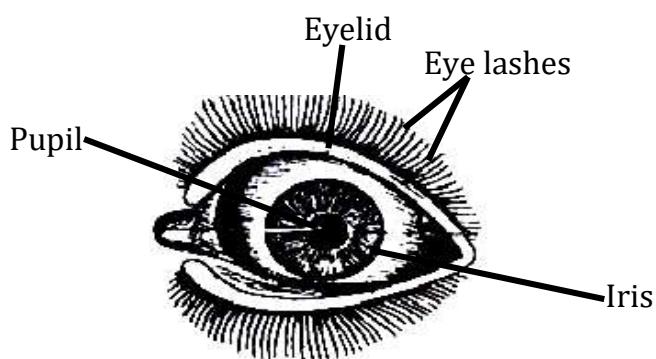
How are eyes protected from mechanical injury?

- They are enclosed in the orbits of the skull

Why is the human eye called an optical organ?

- ✓ It requires light to work

FRONT VIEW OF THE EYE



Eyelids

- They protect the eye from foreign bodies e.g. dust, small stones and small insects
- They close and keep out light when it is not needed

Blinking

- This is the closing and reopening of the eye quickly

It can be voluntary or involuntary (reflex) action.

Importance of regular blinking to the eye

- It provides the eye with protection from foreign bodies
- It spreads tears over the surface of the eye

Tear glands (lacrimal gland).

They are located on the outer corner of each eye

- They produce tears

USES OF TEARS

- They kill some germs (bacteria) on the eye
- They clean the eye (wash away dust from the eye)
- They keep the eye moist (prevent the eye from drying up)
- They lubricate the surface of the eye
- They heal damage on the surface of the eye

Sclera

It is the white part of the eye

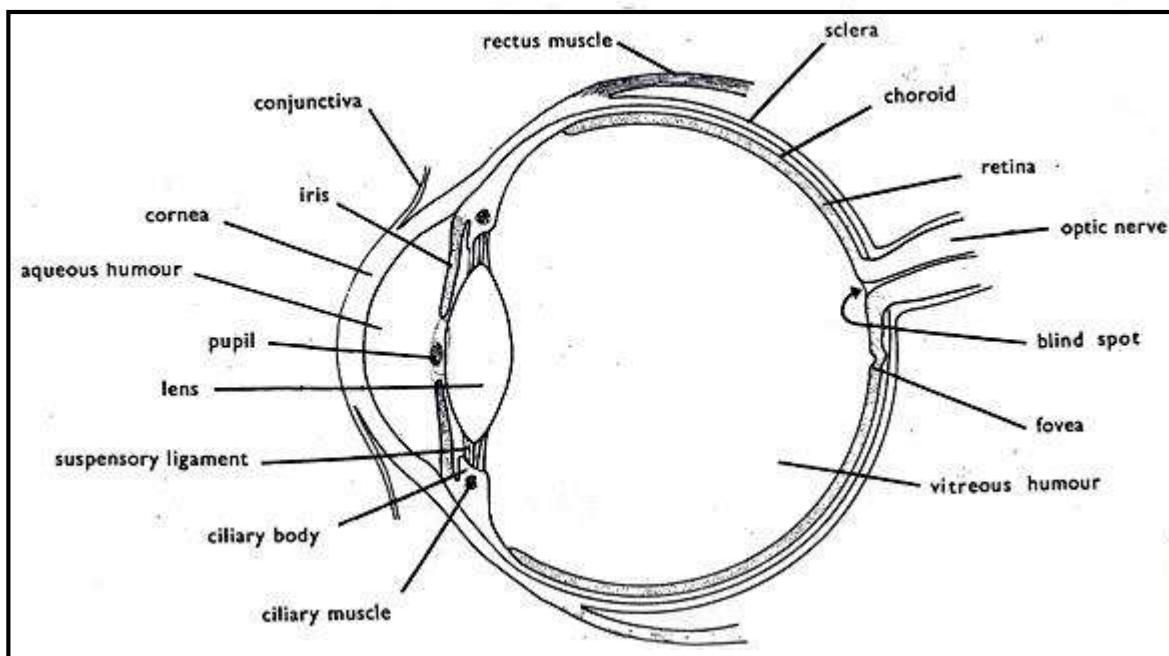
It acts as a protective outer coat for the eyeball.

- It protects the inner parts of the eye
- It maintains the shape of the eyeball

Name the diseases that can make the sclera turn:

- i) **Yellow** --- yellow fever, liver cirrhosis, malaria, sickle cell anaemia, pancreatitis, hepatitis A, B and C
- ii) **Pink** --- conjunctivitis
- iii) **Red** --- trachoma

THE STRUCTURE OF THE HUMAN EYE



FUNCTIONS OF EACH PART OF THE EYE

Cornea

It is a transparent part of the eye

- It refracts light
- It protects the iris and pupil

Pupil

It is the small hole in the middle of the iris of the eye

It is the darkest part in the centre of the eye

- It allows light into the eye.

Iris

It is the coloured part of the eye

The iris has the pigment which determines the colour of the eyes

- It regulates the amount of light entering the eye

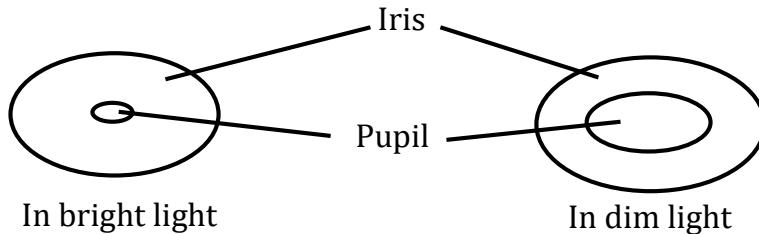
How does the iris regulate the amount of light entering the eye?

- By regulating the size of the pupil

How does the iris regulate the size of the pupil in different light intensities?

- It widens the pupil in dim light to allow more light enter the eye
- It constricts the pupil in bright light to allow little light enter the eye

DIAGRAMS SHOWING THE HUMAN EYE IN BRIGHT LIGHT AND DIM LIGHT



Eye lens (crystalline lens)

It is convex in nature

- It focuses light onto the retina.

Retina

- It is where the images are formed.

Why are images formed on the retina?

- It has light sensitive cells (**rod cells** and **cone cells**)

Cone cells and rod cells

- **Cone cells** are nerve cells in retina that are sensitive to bright light.

Cone cells help in day light and colour vision.

- **Rod cells** are nerve cells in retina that are more sensitive to dim light.

Rod cells help in dim light and night vision.

Why do human beings see more clearly during day than at night?

- They have more cone cells than rod cells

Why do cats see more clearly at night than during day time?

- They have more rod cells than cone cells

Fovea

This is a small depression on the retina

- It is where the sharpest image is formed.
- It helps to give a very clear vision.

Why is the fovea called the most sensitive part of the retina?

- It has the highest concentration of cone cells

Blind spot (optic disc)

- It is where the optic nerve connects to the retina
- It is the entry of blood vessels that supply the retina
- It is where the optic nerve leaves the eye.

Why is the optic disc also called the blind spot?

- It has no light sensitive cells

Optic nerve

- It transmits nerve signals from the eye to the brain for interpretation

Conjunctiva

This is a thin mucous membrane which lies inside the eyelid

- It has mucus which keeps the eye moist

Choroid

It is located between the retina and sclera

It is pigmented black and has a dense network of blood capillaries

- It supplies food and oxygen to the eye.
- It prevents internal reflection of light in the eye

Suspensory ligament

- It holds the lens in one position by connecting it with the ciliary muscle

Ciliary muscle

- It controls the shape of the eye lens
- It controls the accommodation of the eye

Explain the meaning of the term “Accommodation of the eye.”

- This is the ability of the eye lens to focus near and distant objects

How do ciliary muscles control accommodation of the eye?

- By contracting and relaxing to change the shape of the lens

Aqueous humour and vitreous humour

Aqueous humour is a watery liquid between the eye lens and the cornea

Vitreous humour is a clear gel (jelly-like liquid) between the eye lens and the retina

- They maintain the shape of the eye
- They refract light

Besides refracting light and giving the eye its shape, give other two functions of aqueous humour.

- It maintains eye pressure
- It provides nutrients to the cornea and eye lens

Eyelashes

- They prevent foreign bodies from entering the eye

Eyebrows

- They prevent sweat from falling down into the eye socket

Rectus muscle

- It holds the eyeball in the orbit

Characteristics of images formed by the eye

- The images are real
- The images are inverted
- The images are diminished

RID

PARTS OF THE HUMAN EYE AND LENS CAMERA WITH SIMILAR FUNCTIONS

HUMAN EYE	LENS CAMERA	FUNCTION
Convex lens	Convex lens	Focus light
Iris	Diaphragm	Regulate the amount of light that enters
Pupil	Aperture	Allow in light
Eyelids	Shutter	Keep out light (prevent light from entering)
Ciliary muscle	Focusing ring	Determine accommodation
Retina	Film	They are where images are formed

SIMILARITIES BETWEEN THE EYE AND LENS CAMERA

- Both have light sensitive parts where images are formed
- Both have convex lenses
- Both form real, inverted and diminished images
- Both are black inside to prevent internal reflection of light

DIFFERENCES BETWEEN A HUMAN EYE AND LENS CAMERA

The human eye	The photographic camera
▪ The distance between the lens and retina is fixed.	▪ The distance between the lens and film changes.
▪ The iris adjusts itself.	▪ The diaphragm is adjusted physically.
▪ The eye lens is soft and elastic.	▪ The lens is a hard glass.
▪ Image is focused by making lens thicker.	▪ The image is focused by moving lens.
▪ The lens, aqueous and vitreous humour refracts light.	▪ Only the lens refracts light
▪ The thickness of the lens changes.	▪ Thickness of the lens is constant
▪ The eye has a wider view	▪ The camera has a narrow view

DIFFERENCES BETWEEN THE HUMAN EYE AND A PINHOLE CAMERA

Eye	Pin hole camera
Focusing is done by changing the shape of the lens.	Focusing is done by moving the camera forward or backward
Image is formed on the retina.	Image is formed on the screen
Iris controls light entering the eye	No control of light.
The eye can be covered by eyelids.	The pinhole is always exposed to light

SIMILARITIES BETWEEN THE EYE AND PINHOLE CAMERA

- Both have light sensitive parts where images are formed
- Both form real, inverted and diminished images
- Both are black inside to prevent internal reflection of light

NORMAL EYESIGHT

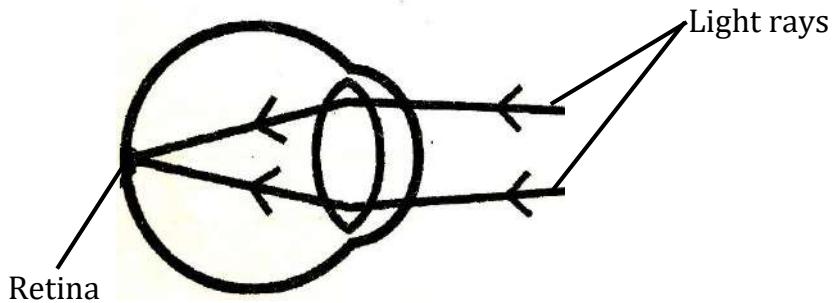
- During normal vision, both near and distant objects can be focused on the retina.

The normal eyesight acuity is 20/20 vision or 6/6 vision mean?

What does 20/20 vision or 6/6 vision mean?

- A person is able to see clearly at 20 feet or 6 metres what should normally be seen at that distance

An illustration showing normal vision (normal eyesight)



EYE DEFECTS (REFRACTIVE ERRORS/EYE DISORDERS)

- An eye defect is the inability of an eye to focus certain distances normally.

Causes of eye defects (refractive errors)

- | | |
|---------------------------------|----------------------------------|
| ▪ Eye strain | ▪ Abnormal shape of the eye lens |
| ▪ Abnormal shape of the eyeball | ▪ Aging (old age) |

EXAMPLES/TYPES OF EYE DEFECTS (REFRACTIVE ERRORS/EYE DISORDERS)

- Short sightedness (myopia)
- Long sightedness (hyperopia)
- Old age sight (presbyopia)
- Astigmatism

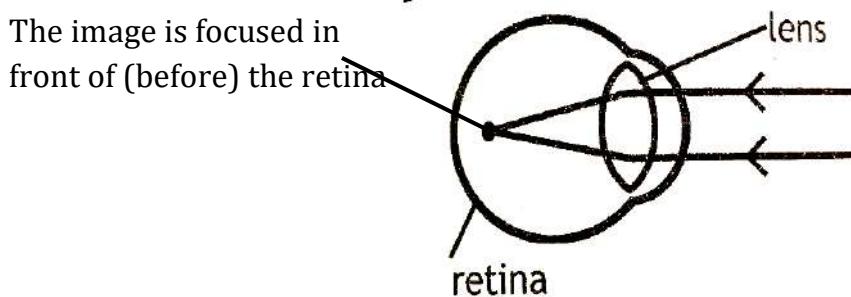
1. Short sightedness (myopia)

- This is the condition when a person can only see near objects clearly but cannot see distant objects
- ✓ Images from distant objects are focused in front of the retina.

Causes of short sightedness

- Very thick eye lens
- Very long eyeball (elongated eyeball)

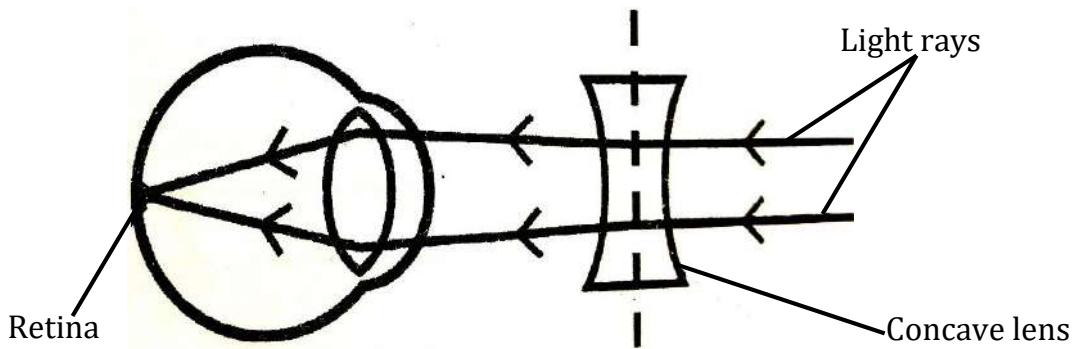
AN ILLUSTRATION SHOWING MYOPIA



How is short sightedness corrected?

- By wearing spectacles with concave lenses (diverging lenses)

A diagram showing correction of short sightedness



How does a concave lens help to correct short sightedness?

- It slightly diverges light rays

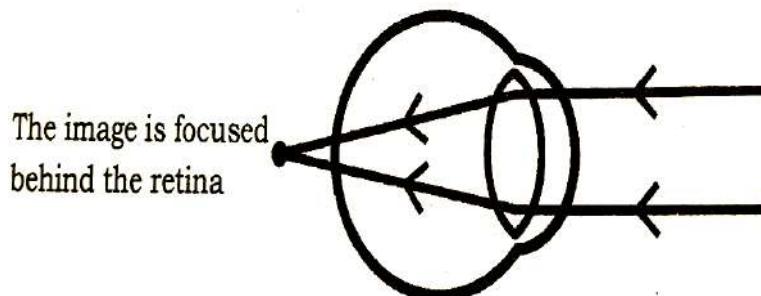
2. Long sightedness (hyperopia):

- This is a condition when a person can see distant objects clearly but cannot see nearby objects.
- ✓ Images from nearby objects are focused behind the retina.

Causes of long sightedness

- Very thin eye lens
- Very short eyeball

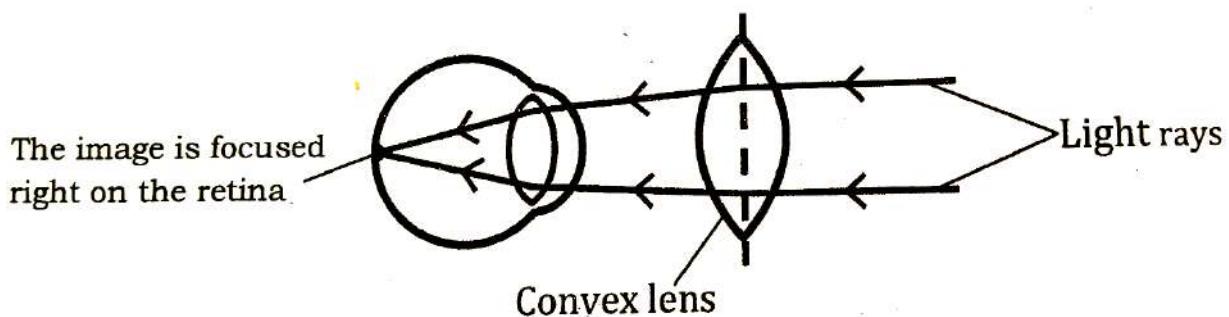
AN ILLUSTRATION SHOWING HYPEROPIA



How is long sightedness corrected?

- By wearing spectacles with convex lenses (converging lens)

A diagram showing correction of long sightedness



How does a convex lens help to correct long sightedness?

- It slightly converges light rays

3. Old age sight (presbyopia)

- This is the loss of focusing power for near objects that occurs naturally with age as eye lens loses its elasticity
- ✓ It occurs in old age above 60 years
- ✓ A person with presbyopia can clearly see only distant objects and has poor vision for objects that are up close, such as; reading from books and computers

How is presbyopia corrected?

- By wearing reading eyeglasses with convex lenses

4. Astigmatism

- This is the condition in which light fails to come to a single focus on the retina hence blurred vision (distorted vision)
- ✓ Here light rays are not focused on the fovea resulting into blurred vision
- ✓ Astigmatism is the most common of all eye defects

Causes of astigmatism

- Unevenly curved cornea
- Rough cornea

How is astigmatism corrected?

- By wearing spectacles with cylindrical lenses
- By refractive surgery

DISEASES OF THE HUMAN EYE

Major eye diseases

- Trachoma
- River blindness (onchocerciasis)
- Night blindness (xerophthalmia)
- Conjunctivitis

Other eye diseases

- Blepharitis
- Cataracts
- Glaucoma
- Keratitis
- Stye (sty)
- Leucoma

TRACHOMA

- It is a bacterial eye disease
- It is caused by a bacterium (germ) called **chlamydia trachomatis**
- It is spread by **houseflies**
- It is common in places with poor sanitation
- It is a water cleaned disease which affects the eyes

How does trachoma spread?

- When infected houseflies land on our eyes
- Through sharing face towels with an infected person.
- Through sharing the same basin with an infected person.
- Through shaking hands with an infected person and then touch your eyes
- Through sharing handkerchiefs with an infected person

Signs of trachoma

- Eyes turn red
- Watery discharge from the eyelids
- Swollen eyelids

Symptoms of trachoma

- Pain while looking at light
- Itching of the eyes

Control of trachoma

- Always wash eyes with enough clean water
- Avoid sharing face towels with an infected person
- Always wash and iron handkerchiefs
- Avoid touching your eyes with dirty hands
- Avoid places with a lot of houseflies

NIGHT BLINDNESS

- It is a **deficiency eye disease** common in children between 2 – 5 years
- It is caused by **lack of vitamin A** in the diet

Signs of night blindness

- Poor sight at night (poor night vision)
- Dry eyes

Prevention of night blindness

- Feeding children on food rich in vitamin A

RIVER BLINDNESS

- It is caused by a filarial worm (nematode) called **onchocerca volvulus**
- It is spread by a small humped fly called **blackfly (Simulium fly/Jinja fly)**
- A black fly breeds in rapidly flowing rivers
- Female blackflies usually bite during **day time** as they suck blood to develop their eggs

Why a blackfly lays its eggs in fast flowing rivers?

- Water in fast flowing rivers has a lot of oxygen

Signs of river blindness

- Bumps under the skin (nodules in the skin)
- Swelling of the lymph nodes
- Tough rough skin
- Red watery eyes

Symptoms of river blindness

- Itching skin rashes
- Itching of the eyes
- Severe skin itching

Prevention and control of river blindness

- Spraying adult blackflies with insecticides
- Avoid sleeping near rivers or streams during day time
- Early treatment of an infected person

CONJUNCTIVITIS

- This is the swelling (inflammation) of conjunctiva
- It is caused by **virus, bacteria or chemicals**
- It is also known as **pink eyes**

Mention three types of conjunctivitis

- **Bacterial conjunctivitis**

It is caused by eye contact with bacteria for gonorrhoea or chlamydia

- **Viral conjunctivitis**

It is caused by eye contact with viruses for common colds

- **Allergic conjunctivitis**

It is caused by eye contact with chemicals (e.g. air irritants **or** Chlorine in swimming pools)

How do newly born babies get infected with bacterial conjunctivitis?

- When gonorrhoea or chlamydia germs come into contact with the baby's eyes at birth

Signs of conjunctivitis

- The white of the eye (sclera) becomes pink
- Watery discharge from the eyes with pus
- Swollen eyelids

Symptoms of conjunctivitis

- Itchy eyes
- Pain when looking at light

BLEPHARITIS

- It is an inflammation of the eyelids
- The eyes itch, burn and swell

CATARACT

- This is when the eye lens becomes grey and opaque.
- It is caused by diabetes or continued exposure of the eyes to high temperature.

GLAUCOMA

- It is caused by increased internal pressure of fluids.
- It damages the optic nerve

KERATITIS

- This is the inflammation of the cornea
- It is caused by virus or bacteria or fungus

STYE

- This is a small inflammation of the eyelid
- It is caused by bacteria
- It is usually a sign of poor health, anaemia or diabetes.

LEUCOMA

- This is where an opaque white spot on the cornea.

CARE FOR OUR EYES

- Always wash your eyes with clean water and soap
- Never look directly at the sun
- Do not touch your eyes with dirty fingers
- Do not share face towels with a person who has sick eyes
- Feed on food rich in vitamin A
- Avoid staying in smoky and dusty places
- Read books in enough light
- Never use eyeglasses without health worker's advice

CAUSES OF BLINDNESS

- | | |
|---|--|
| <ul style="list-style-type: none">▪ Uncorrected eye defects
(uncorrected refractive errors)▪ Eye diseases▪ Vitamin A deficiency▪ Injuries to the eye▪ Birth defects | <ul style="list-style-type: none">▪ Premature birth▪ Measles during childhood▪ Use of traditional eye medicines▪ Looking directly at an eclipse▪ Conjunctivitis in new born babies |
|---|--|

PARAMOUNT SCIENCE NOTES

PRIMARY SEVEN

TERM THREE

TOPIC ONE: INTERDEPENDENCE OF THINGS IN THE ENVIRONMENT

ENVIRONMENT

- Environment refers to all things that surround an organism

Main components of the environment

- | | |
|-----------|--------|
| ▪ Plants | ▪ Air |
| ▪ Animals | ▪ Soil |
| ▪ Water | ▪ Sun |

Plants and animals are the main **organic components** of the environment

TYPES OF THE ENVIRONMENT

- Biotic (biological) environment
- Abiotic (physical) environment

Biotic (biological) environment

- This is the type of environment made up of living things

Components of biotic environment (living components of the environment/groups of living things)

- Plants
- Animals
- Bacteria (monerans)
- Fungi
- Protists

Abiotic (physical) environment

- This is the type of environment made up of non-living things

Components of abiotic environment (non-living components of the environment)

- Soil
- Water
- Air
- Sun

INTERDEPENDENCE

- This is the way how things depend on each other in the environment.

How do animals depend on plants?

- Some animals (herbivores) get food from some plants.
- Some animals get shelter from plants
- Animals get herbal medicine
- Animals get oxygen for respiration
- People get plant fibres from plants (e.g. cotton wool, sisal, jute, flax, hemp, raffia and ramie)
- People get wood fuel from plants
- People get wood for timber from plants
- Animals get shades from plants

How do plants depend on animals?

- Plants get carbon dioxide from animals to make glucose (starch)
- Plants get farmyard manure from animals
- Some animals help in pollination of flowers
- Some animals help in seed dispersal
- Carnivorous plants feed on some insects

Examples of carnivorous plants

- Venus flytrap
- California pitcher plant (Cobra lily)
- Sundew (*Drosera*)
- Nepenthes
- Bladderwort

How do animals depend on other animals?

- Some animals provide food to other animals
- Some animals provide protection(security) people and other animals
- Some animals provide transport to people (e.g. donkey, camel and horse)
- Some animals provide animal labour to people (e.g. oxen)
- Some animals (hosts) provide shelter to other animals (parasites)
- Some animals provide animal fibres to people (e.g. mohair, wool, silk, Angora hair and Chiengora)

Examples of guard animals

- | | |
|------------|----------|
| ▪ Dogs | ▪ Llamas |
| ▪ Donkeys | ▪ Geese |
| ▪ Dolphins | |

How do plants depend on other plants?

- Some plants climb others to get enough sunlight and extra support
- Plants depend on other plants as habitat
- Tall plants provide shade to short plants
- Strong plants protect weak plants from strong wind
- Leguminous plants fix nitrogen in the soil which is used by other plants.
- Parasitic plants-get nutrients from other plants

How do animals depend on non-living things?

- Animals use oxygen for respiration
- Animals drink water to survive
- Some animals use soil as their habitat
- Some animals use sand soil and stones for construction
- People use clay soil for brick making and pottery
- People use water for bathing and cooking food
- Animals use heat and light from the sun

How do plants depend on non-living things?

- Plants get water and mineral salts from the soil
- Plants use carbon dioxide and water to make glucose (starch)
- Sunlight helps plants to make glucose (starch)
- Wind helps in pollination.
- Plants use oxygen for respiration at night
- Wind aids in seed and fruit dispersal

How do non-living things depend on living things?

- Trees act as windbreaks to control soil erosion
- Bacteria and fungi help in soil formation
- Plants help in water cycle
- Soil organisms improve soil aeration
- Animal wastes act as manure to improve soil fertility
- Plants purify air during photosynthesis

FOOD CHAIN

- This is the feeding relationship among organisms (living things)
- This is the linear sequence for the transfer of food energy from one organism to another

Ecosystem

- This is a community of organisms in a habitat

Habitat

- This is a natural home of an organism (living thing)

Biodiversity

- This is the variety of living things in an ecosystem

Trophic level

- This is the position that an organism occupies in a food chain

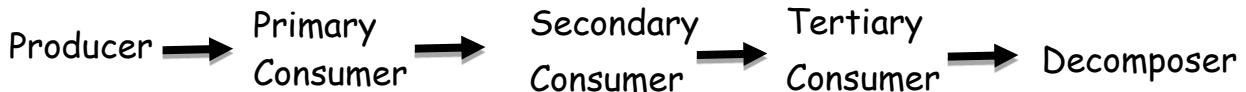
Components of a food chain (trophic levels in a food chain)

- Producer
- Consumers
- Decomposer

Groups of consumers in the food chain

- Primary consumer
- Secondary consumer
- Tertiary consumer

AN ILLUSTRATION SHOWING A FOOD CHAIN



EXPLANATION OF THE FOOD CHAIN

The arrow →

- The arrow **shows** the direction of energy flow
- The arrow in a food chain points from the food to the organism that eats it

Producer

- This is an organism that makes food

They are usually **plants, algae and cyanobacteria**

Why are plants regarded as producers?

- They make their own food

Of what use is the sun in a food chain?

- It provides solar energy (sunlight) for plants to make their own food

Primary consumer

- This is an organism that feeds directly on a producer

They are mainly **herbivores** because **they feed on plants**

Secondary consumer

- This is an organism that feeds on a primary consumer.

These are mainly **carnivores** because **they feed on flesh (meat)**

Tertiary consumer

- This is an organism which feeds on a secondary consumer.

They are mainly **scavengers** because **they feed on abandoned meat**

What do we call the “Apex predator” in a food chain?

- This is an animal at the top of a food chain, preying but not prey.
- It is a tertiary consumer

Decomposer

- This is an organism that causes decay or rotting

They are mainly **bacteria and fungi** because **they break down dead organic matter**

Why do decomposers have the highest population in a food chain?

- They do not have any organisms that depend on them.

EXAMPLES OF FOOD CHAINS

1. Ground nuts → Rat → Cat → Bacteria
2. Maize → Grasshopper → Hen → Eagle → Fungi
3. Leaves → Caterpillar → Bird → Dog → Bacteria
4. Algae → Fish → Man → Bacteria

What happens to the food chain when all producers become extinct (die off)?

- The food chain collapses (the food chain undergoes population crash)

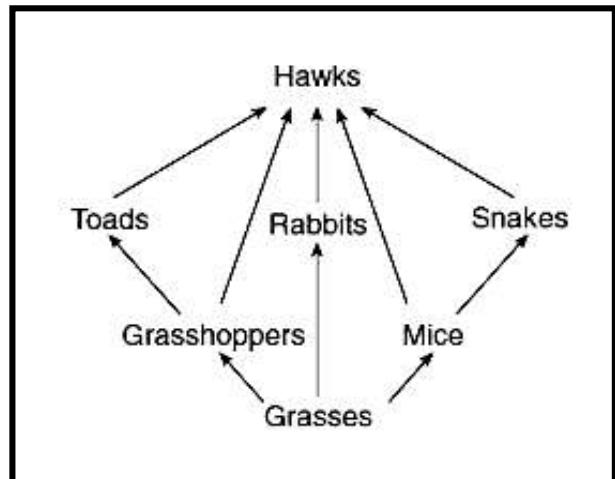
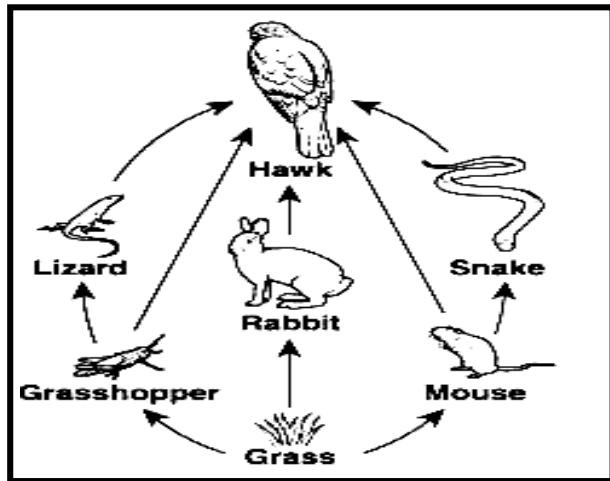
What happens to producers when primary consumers reduced?

- The population of producers increases

FOOD WEB

- This is a connection of multiple food chains

Illustrations showing food web



GROWING CROPS AND TREES

A crop

- This is a plant grown for a purpose
- This is a plant grown and cared for

Reasons why people grow crops

- To get food (to promote food security)
- To get money after selling harvested crops
- To get raw materials for agro based industries
- To get plant fibres

Importance of a school garden

- It enables school children to practise crop growing
- It enables school children to learn how to dig
- It is a source of food for the school
- The school gets money after selling excess food
- It helps in agriculture practical lessons

Factors to consider when plan starting a school garden.

- | | |
|---|---|
| <ul style="list-style-type: none">▪ Capital▪ Land▪ Labour | <ul style="list-style-type: none">▪ Availability of planting materials▪ Availability of garden tools▪ Well drained soil |
|---|---|

GROUPS OF CROPS

- Annual crops
- Biennial crops
- Perennial crops

ANNUAL CROPS

- These are crops that take one year to mature

Examples of annual crops

- Beans
- Tomato
- Maize
- Cowpeas
- Groundnut
- Bitter tomato
- Soybean
- Eggplant
- Millet
- Rice
- Cassava
- Simsim

BIENNIAL CROPS

- These are crops that take two years to mature

Examples of biennial crops

- Onions
- Carrots
- Beets

PERENNIAL CROPS

- These are crops that take more than two years to mature.
- These are crops that are planted once and harvested year after year.

Examples of perennial crops

- Oil palm
- Mango
- Coffee
- Tea
- Sugarcane
- Vanilla
- Banana
- Cocoa

NOTE

- Cotton and tobacco are perennial crops in nature but always grown as **annual crops**.

TYPES OF CROPS

Food crops

- These are crops grown for food like legumes, vegetables, cereals and fruits

Cash crops

- These are crops grown for sale like rubber tree, coffee and tea

Spice crops

- These are crops that give our food taste and sweet aroma like tomatoes, ginger, pepper and onion

Tuber crops

- These are crops with swollen edible underground stems or roots like cassava, carrot, Irish potato, white yam and sweet potato

Why is a sugarcane not a stem tuber yet it stores its food in the stem?

- ✓ It does not have a swollen underground stem

Oil crops

- These are crops grown for oil like oil palm, coconut and groundnut

Drug crops

- These are crops used to cure diseases and wounds like Neem tree and eucalyptus

Forage crops

- These are crops grown for feeding animals like guinea grass and elephant grass

Fibre crops

- These are crops that provide materials for weaving clothes, ropes , bags and sacks like sisal, cotton and jute

Ornamental crops

- These are crops grown to beautify the surroundings

Ornamental crops include; rose flower and hibiscus flower

Vegetable crops

- These are crops grown for some of their edible parts such as leaves, roots, fruits and flowers

TYPES OF VEGETABLES AND THEIR EXAMPLES

Type of vegetables	Examples
Leafy vegetables	Cabbage, spinach, lettuce, pigweed, sukuma wiki
Root vegetables	Carrot, beet
Fruit vegetables	Eggplant, bitter tomato, tomato, green pepper, red pepper
Flower vegetables	Cauliflower

AGROFORESTRY

- This is the growing of crops and trees together in the same garden
- This is the growing of productive trees alongside crops in the same garden

Importance of agroforestry

- Trees provide shade to the crops
- Trees provide extra support to weak stems like passion fruits.
- Trees control soil erosion
- Trees help in water cycle (rain formation)
- A farmer gets double income e.g crops and trees
- Shady trees prevent growth of some weeds
- Tree leaves form manure when they rot

Advantages of combining agroforestry with animal husbandry

- Trees provide shade to animals
- Trees act as live fences on livestock farms
- Trees and crops provide oxygen to animals for respiration
- Trees provide natural habitat to animals
- Some crops act as food for animals

GROWING OF TREES

- Trees are either grown (propagated) by using **seeds** or **stem cuttings**

Groups of trees

- Local (indigenous trees)
- Exotic trees

Examples of indigenous (local) trees

- | | |
|-------------|----------------------|
| ▪ Mvule | ▪ Musizi |
| ▪ Mangoes | ▪ Acacia |
| ▪ Avocado | ▪ Mahogany |
| ▪ Jackfruit | ▪ Natal fig (mutuba) |

Characteristics of local trees

- They produce hard wood
- They mature slowly
- They are resistant to bad weather conditions

Examples of exotic trees

- Cypress
- Gingko
- Pine
- Cedar
- Podo
- Spruce
- Eucalyptus
- Fir

Characteristics of exotic trees

- They produce soft wood
- They mature quickly
- They are vulnerable to bad weather

IMPORTANCE OF TREES

- Trees provide shade to people
- Trees control soil erosion
- Trees help in water cycle (rain formation)
- Trees act as windbreaks
- Trees provide wood fuel
- Trees provide wood for timber
- Some trees provide us with fruits
- Some trees provide herbal medicine
- Some trees act as live fences
- Trees purify air

How do trees purify air?

- ✓ By using carbon dioxide and producing oxygen during photosynthesis

DANGERS OF TREES

- They hide dangerous animals like snakes
- Thorny trees skin injuries
- They shed leaves which make the compound dirty

QUALITIES OF GOOD PLANTING MATERIALS (GOOD SEEDS FOR PLANTING)

- They should have a high germinating rate
- They should be free from pest damages
- They should be free from diseases
- They should be mature
- They should be of a right variety
- They should not be broken
- They should be obtained from healthy parent plant
- The cereals should not have overstayed
- They should be of a suitable size

STARTING A TREE NURSERY BED

- Tree seeds can be planted into seedbeds, nursery beds or polypots
- Most tree have very small seeds which are first planted in a seedbed or nursery bed

Why is it difficult to grow cassava and banana using seeds?

- Their seeds may not be viable (seeds do not germinate)

Why can't cassava be propagated by use of root tubers?

- Cassava root tubers do not have buds

SEEDBED

- This is a small garden where seeds are planted to make them germinate.

NURSERY BED

- This is a small garden where seedlings are raised before transplanting.

Advantages (importance) of a nursery bed

- It protects seedlings from harsh weather
- It helps a farmer to select good seedlings for transplanting
- It helps a farmer to provide extra care to the seedlings
- It gives a farmer enough time to prepare the main garden

PROCEDURES (STEPS) FOR PREPARING A NURSERY BED

- Clear the weeds and plough the land
- Break the big soil lumps and make the soil surface smooth and fine.
- Mix the manure well with soil and plant the seeds
- Apply some mulch and construct a shade about one metre high.

Why should watering should be done every evening and morning?

- To keep the soil moist for a longer time.

Why are some seeds first planted in a nursery bed or seedbed?

- They are too small to withstand harsh conditions in the main garden
- To be given extra care

Examples of crops whose seeds are first planted in a seedbed (nursery bed)

- | | |
|-----------------|-----------------|
| ▪ Tomato | ▪ Eucalyptus |
| ▪ Coffee | ▪ Red pepper |
| ▪ Cabbage | ▪ Bitter tomato |
| ▪ Passion fruit | ▪ Egg plant |

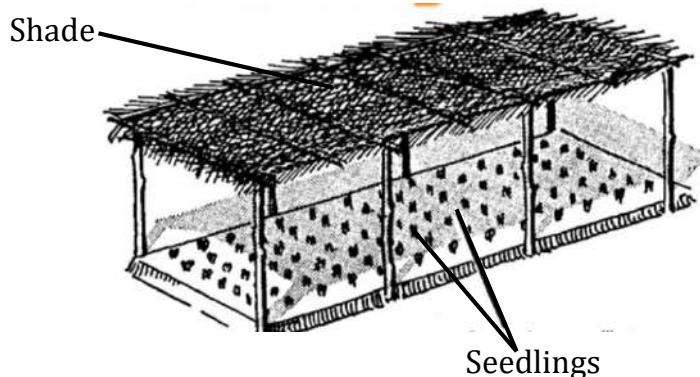
What is pricking out?

- This is the transfer of congested seedlings from a seedbed to polypots

REQUIREMENTS FOR STARTING A NURSERY BED

- Wooden poles; for building shelter
- Hoes; for weeding/ploughing/harrowing
- A rake; for leveling soil
- Watering can; for watering crops
- Polythene papers; for making polythene polypots
- Mulches (e.g. dry grass); for mulching
- Water source; to provide water for irrigation
- Panga
- Dibber; for making holes where seeds are planted
- Manure; for making the soil fertile
- Seeds or stem cuttings
- Hand fork ;for light weeding in a nursery bed

A DIAGRAM SHOWING A NURSERY BED



Importance of a shade on a nursery bed

- To protect seedlings from strong sunshine and heavy rainfall

What is a seedling?

- This is a young plant raised from a seed

CARE FOR SEEDLINGS IN A NURSERY BED (ACTIVITIES DONE IN A TREE NURSERY)

- By watering
- By weeding
- By spraying with pesticides
- By thinning
- By mulching
- By manuring
- Providing them with a shade
- By fencing the nursery bed
- By hardening off

METHODS OF APPLYING FERTILIZERS

- Broadcasting (top dressing)
- Placement (band placement and ring placement)
- Spraying (foliar application)
- Fertigation (application of fertilizers through irrigation system)

HARDENING OFF

- This is the process of gradually exposing seedlings to outdoor conditions
- ✓ Hardening off should be done when about to transplant the seedlings

Ways (methods) of hardening off

- Reducing watering
- Removing the shade gradually (exposing of seedlings to sunshine gradually)
- Exposing of seedlings to wind gradually
- Placing the seedlings in a cold frame

Advantages of hardening off

- It encourages the seedlings to withstand the conditions in the main garden
- It prevents transplant shock (reduces plant stress)

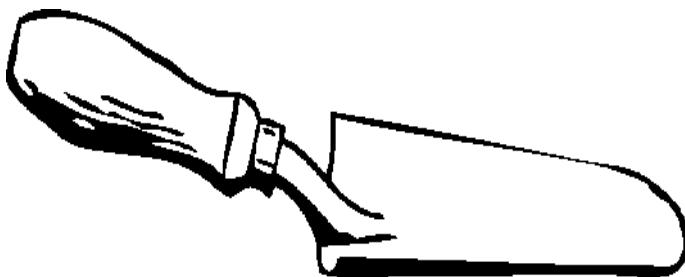
Steps for hardening off

- Place seedlings outside in the shade for sometime
- Gradually lengthen exposure daily
- Monitor seedlings for wilting
- Finally leave seedlings out overnight

TRANSPLANTING

- This is the transfer of seedlings from the nursery bed to the main garden.
- ✓ It is done using a **garden trowel**

A drawing showing a garden trowel



- A **garden trowel** is used for transplanting seedlings

Why is the garden trowel the suitable garden tool for transplanting seedlings?

- It does not damage the root system of the seedling

Reasons why transplanting seedlings is done in the evening or on a cloudy day

- To reduce the rate of transpiration

Why is evening time the best for transplanting?

- It prevents wilting since the rate of transpiration is low

Why should seedlings be well watered a day before transplanting?

- To enable soil stick onto the roots
- For easy removal of polypots from the seedling

PLANTING

- This is putting of planting materials in the soil
- ✓ It is done during **wet season**

Reasons for planting crops in wet season

- There is enough rainfall to support plant growth
- There is enough water for seed germination
- The soil is soft for easy growth of roots

METHODS OF PLANTING

- Row planting
- Broadcasting

1. ROW PLANTING

- This is the planting of crops in lines giving proper space among plants.
- It is done using a **garden line**

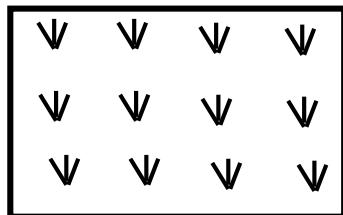
A diagram showing a garden line



How is a garden line useful to a crop farmer?

- It is used to make straight lines during row planting

An illustration showing row planting



Advantages of row planting

- It makes weeding easy
- It makes harvesting easy
- It makes spraying easy
- It controls over crowding of crops
- It controls pests and diseases
- It prevents wastage of planting materials (e.g seeds)
- It enables crops to get enough sunlight

Disadvantages of row planting

- It needs much labour
- It is time consuming
- It requires a large piece of land

Example of crops planted by row planting

- Maize
- Cassava
- Beans
- Potatoes
- Coffee
- Pineapples

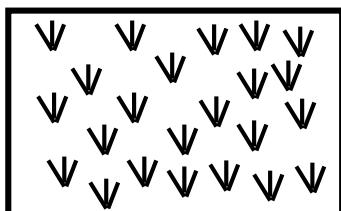
2. BROADCASTING METHOD

- This is the method of planting by scattering seeds over a large area

Advantages of broadcasting methods

- It saves time
- It needs less labour
- It prevents wastage of soil nutrients

An illustration showing broadcasting



Disadvantages of broadcasting methods

- It makes weeding difficult
- It makes harvesting difficult
- It makes spraying difficult
- Seeds may be eaten by birds
- Seeds may be removed by agents of erosion
- It encourages easy spread of crop diseases
- There is competition for nutrients and sunlight

Examples of crop seeds planted by broadcasting

- Carrots
- Lettuce
- Millet
- Sorghum
- Rice
- Beets

WAYS OF CARING FOR PLANTS (TREES) IN THE MAIN GARDEN

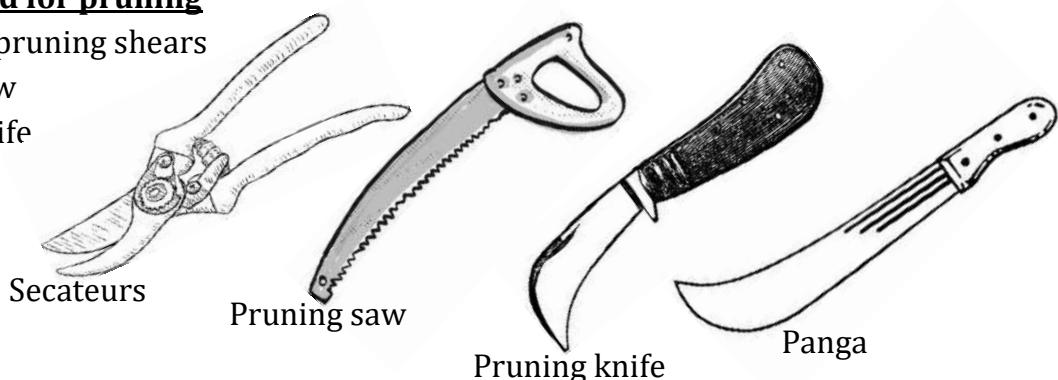
- Weeding
- Pruning
- Thinning
- Roguing
- Plant training
- Mulching
- Spraying with pesticides

PRUNING

- This is the removal of extra or unwanted parts of a plant
- This is the cutting of excess branches or leaves from a plant.

Garden tools used for pruning

- Secateurs/pruning shears
- Pruning saw
- Pruning knife
- Panga



Advantages of pruning

- It reduces hiding places for pests
- It reduces weight of the plant
- It improves crop yields
- It creates space in the garden
- It makes weeding easy
- It makes spraying easy
- It makes harvesting easy
- It allows plants to get enough sunlight
- It controls the spread of crop diseases

Why should pruning be done towards the end of a dry season?

- To allow easy recovery of the plant during wet season

Name the crop growing practice that reduces the rate of transpiration.

- Pruning

THINNING

- This is the removal of excess plants/seedlings from the garden.

Why should thinning be done when the plants are still young?

- To prevent them from taking a lot of nutrients from the soil

Why should thinning be done when the soil is wet?

- To prevent destroying the roots of the remaining plants

Advantages of thinning

- It reduces hiding places for pests
- It reduces competition for nutrients
- It reduces overcrowding of crops
- It improves on crop yields
- It makes weeding easy
- It makes spraying easy
- It makes harvesting easy

Examples of crops which are thinned

- Banana
- Maize
- Sorghum
- Millet

Name the crop growing practice that reduces population of crops in the garden

- Thinning

ROGUING

- This is the removal of plants with unwanted characteristics from the garden

What is a rogue?

- This is a plant with unwanted characteristics in the garden

Examples of rogues

- Off-type crops
- Diseased crops

Advantages of roguing

- It prevents easy spread of crop diseases
- It improves the quality of crop yields

PLANT TRAINING

- This is the way of making a crop to grow in a specific direction or shape

Methods of plant training

- Staking
- Propping
- Trellising

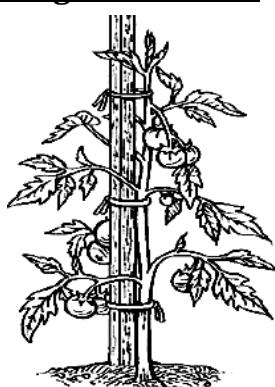
1. STAKING

- This is the giving of extra support to a crop with weak stem using a strong stick.
- The strong stick has a pointed end driven into the ground

Examples of plants that can be staked

- Tomatoes
- Vanilla
- Garden peas
- Some beans

A diagram showing staking in tomatoes



2. PROPPING

- This is the giving of extra support to crops with much weight using a forked (Y-shaped) poles

Reasons why banana plants with heavy bunches should be propped

- To protect banana plants from falling down due to strong wind
- To reduce the weight put on the plant stem

Examples of crops commonly propped

- Banana
- Coffee
- Mango
- Avocado

A diagram showing propping in banana



Why do farmers cut off leaves of banana suckers during transplanting?

- To reduce the rate of transpiration

Why are stems of banana suckers cut in a slanting form?

- To prevent water logging that would cause rotting

3. TRELLISING

- This is the providing of extra support to crops with weak stems using wires held between poles.

Examples of plants commonly trellised

- Passion fruit
- Cucumber
- Gourd

A diagram showing trellising in passion fruits



ADVANTAGES OF PLANT TRAINING

- It enables a farmer to harvest clean fruits
- It enables all parts of the plant to get enough sunlight
- It makes harvesting easy
- It makes pruning easy
- It makes spraying easy
- It makes weeding easy
- It prevents rotting of fruits as the plant grows above the ground

WEEDING

- This is the removal of unwanted plants from the garden

Advantages of weeding

- It reduces hiding places for pests
- It reduces the competition for nutrients and sunlight
- It makes harvesting easy
- It makes spraying easy
- It creates space in the garden
- It improves crop yields

EARTHING UP

- This is the heaping of soil around the base of a plant

Importance of earthing up

- It promotes formation of tubers e.g. in sweet potatoes and Irish potatoes / it enables tubers to grow bigger
- It promotes formation of seeds in ground nuts
- It provides extra support in maize and prevents lodging

GAP FILLING (GAPPING)

- This is the replacing of empty spaces and dead seedlings in the garden

Importance of gap filling (gapping)

- It increases crop yields
- It prevents wastage of space in the garden
- It increases crop population in the garden

WEEDS

- These are unwanted plants in the garden
- These are unwanted plants that grow in-between crops
- ✓ Weeds are classified as **annual, biennial or perennial weeds** basing on their lifespan

EXAMPLES OF WEEDS

i) Annual weeds

- | | |
|------------------------------|------------------|
| ▪ Black jack (Bidens pilosa) | ▪ Crabgrass |
| ▪ Common chickweed | ▪ Foxtail millet |
| ▪ Pigweed | |

ii) Biennial weeds

- | | |
|------------------|----------------|
| ▪ Wild carrot | ▪ Moth mullein |
| ▪ Common burdock | |

iii) Perennial weeds

- | | |
|------------------|----------------|
| ▪ Elephant grass | ▪ Guinea grass |
| ▪ Star grass | ▪ Couch grass |
| ▪ Dandelion | ▪ Spear grass |
| ▪ Wandering jew | ▪ Poison ivy |
| ▪ Thorn apple | ▪ Pampas grass |

IMPORTANCE (USES) OF WEEDS

- Some weeds are used as vegetables e.g. pig weed
- Some weeds act as food to wild animals
- Some dry weeds can be used as mulches
- Some weeds are used as herbal medicine
- Some weeds control soil erosion
- Some weeds are used as animal feeds
- Leguminous weeds add nitrogen in the soil

DISADVANTAGES OF WEEDS (DANGERS OF WEEDS)

- They hide crop pests
- They compete with crops for water and nutrients
- They lead to poor crop yields
- Some weeds are poisonous when eaten
- They make harvesting difficult
- They increase the cost of production since herbicides are expensive

METHODS (WAYS) OF CONTROLLING WEEDS

a) Mechanical weed control methods

- Slashing/mowing
- Tillage/Ox cultivation/digging
- Uprooting
- Digging with hoes
- Burning the weeds

b) Cultural weed control methods

- Crop rotation
- Mulching
- Cover cropping
- Proper spacing of crops
- Timely planting
- Planting shady trees in the garden

c) Chemical weed control method

- Spraying with herbicides

How are herbicides useful in crop husbandry?

- They are used to kill weeds

d) Biological weed control method

- Use of livestock e.g using goats to graze in coconut plantations
- Use of moths to control cacti
- Use of beetles to control water hyacinth

MULCHING

- This is the covering of top soil with dry plant materials

Mulches

- These are dry plant materials used to cover top soil

Examples of mulches

- Dry grass
- Coffee husks
- Dry banana leaves
- Chopped banana stems
- Dry maize stalks

Advantages of mulching

- It keeps water/moisture in the soil
- ✓ By preventing evaporation of water from the soil
 - It controls soil erosion.
- ✓ By reducing the speed of running water
- ✓ By protecting soil from direct raindrops
- ✓ By preventing strong wind from blowing away top soil
- ✓ By preventing moving animals from carrying away top soil
 - It controls the growth of weeds
- ✓ By preventing weeds from getting sunlight
 - It improves soil fertility
- ✓ Mulches rot to form humus
 - It increases infiltration of water into the soil.

State the main reason for mulching

- To keep water/moisture in the soil.

DISADVANTAGES OF MULCHING

- | | |
|--|--|
| <ul style="list-style-type: none">▪ Mulches hide pests▪ Undried/wet mulches can grow into weeds | <ul style="list-style-type: none">▪ Mulches can be fire hazards▪ It is tiring▪ Some mulches are expensive to buy |
|--|--|

HARVESTING

- This is the removal of ready or mature crops from the garden
- Harvesting is always done during **dry season**

Why should harvesting of crops be done during dry season?

- There is enough sunshine to dry the harvested crops

Disadvantages of early harvesting

- The seeds are not well dried (seeds contain moisture)
- It leads to poor quality harvests
- The seeds are not good for planting
- The seeds can be infested with pests and diseases easily
- The grains are small and shrunk

Reasons why seeds should be well dried before storage

- To prevent rotting of seeds
- To prevent them from germinating

CROP PESTS

- These are organisms (living things) that destroys crops

Vermins

- These are small animals that destroy crops or spread germs to animals

GROUPS OF PESTS

- Field pests (garden pests)
- Storage pests

1. FIELD PESTS

- These are organisms that destroy crops in the garden.

EXAMPLES OF FIELD PESTS

- Locusts
- Caterpillars
- Crickets
- Aphids
- Armyworms
- Sweet potato weevil
- Banana weevil (banana root borer)
- Termites
- Monkeys
- Rats
- Squirrels
- Moles
- Nematodes
- Warthogs
- Maize stalk borer
- Whitefly; a pest that spreads cassava mosaic disease
- Coffee twig borer
- Cotton bollworm
- Weaverbirds

2. STORAGE PEST

- These are organisms that destroy stored crops

Examples of storage pests

- Bean weevil
- Maize weevil
- Rats

EXAMPLES OF CROPS AND PESTS WHICH ATTACK THEM

CROPS	CROP PESTS
Pineapples	Pineapple mealy bug
Tomato	Nematodes
Bananas	Banana weevils (banana root borer), nematodes, banana thrips
Sweet potato	Caterpillars, mole rats, rats
Irish potato	Potato aphid, potato tuber moth, nematodes
Maize	Maize stalk borer, armyworm, weaverbirds, monkeys, maize weevils, rats
Coffee	Coffee berry borer, mealy bug
Beans	Bean aphids, American ball worm, bean fly, bean bruchids, cut worm, thrips, spotted borer, bean weevils
Sorghum	Sorghum shoot fly, stem borer, sorghum midge
Cotton	American ball worm, spring ball worm, cotton strainers, aphids
Tobacco	Termites, cutworms, ants, millipedes, crickets
Cow peas	Pod borer, blossom beetles
Ground nuts	Thrips, millipedes, ants, termites, weevils, aphids, squirrels, rats
Cassava	Rats, squirrels, millipedes, nematodes, whitefly

SIGNS OF PESTS AND DISEASE DAMAGE IN CROPS

- Rotting of tubers
- Drying of the crop
- Eaten parts of the crop
- Wilting of the crop
- Holes on fruits, leaves and stems
- Premature ripening of fruits
- Yellowing of leaves
- Spots on the leaves
- Poor growth (stunted growth)

METHODS (WAYS) OF CONTOLLING CROP PESTS AND DISEASES

a) MECHANICAL METHODS

- By trapping some pests
- By fencing the garden
- By chasing away some pests (e.g rodents)
- Putting scarecrows in the garden
- By removing and burning infected plants

b) CHEMICAL METHODS

- By poisoning some pests
- By spraying with pesticides and fungicides
- By seed dressing
- Dusting crop stores with chemicals to avoid infections

c) CULTURAL METHODS (TRADITIONAL METHODS)

- | | |
|---|---|
| <ul style="list-style-type: none">▪ By crop rotation▪ Regular weeding▪ Pruning▪ By early planting▪ By timely harvesting▪ Roguing | <ul style="list-style-type: none">▪ Proper spacing of crops▪ Planting resistant varieties▪ Storing harvested crops in a granary▪ Use of clean planting materials▪ Planting resistant crop varieties |
|---|---|

d) BIOLOGICAL METHODS

- By keeping cats to eat rats
- By using dogs to hunt squirrels
- By using predator insects to feed on insect pests (e.g using ladybirds to feed on aphids)

What is meant by seed dressing?

- This is the applying of chemicals on seeds to prevent infections and pests

Of what use is a scarecrow in a maize garden?

- It helps to frighten (scare away) pest birds

Of what importance are ladybirds to crop farmers?

- They help in pollination
- They feed on some insect pests like aphids

How does early planting control pests?

- Crops mature before pests multiply

DISADVANTAGES OF CROP PESTS

- Pests eat leaves, roots and stems
- Some pests spread diseases to plants
- They reduce the quality of yields
- They lead to stunted growth of the plants
- They lead to low crop yields
- They increase the cost of production since a farmer buys pesticides

CROP DISEASES

- These are diseases that affect crops

SIGNS OF DISEASED CROPS

- Stunted growth
- Poor quality of yields
- Yellowing of leaves
- Black patches on the leaves
- Wilting of the plant
- Crinkled leaves

A TABLE SHOWING CROP DISEASES AND THE PART OF CROP MAINLY AFFECTED

CROP	DISEASES	CROP PART AFFECTED
Bean	Bean rust, Halo blight, Angular leaf spot	Leaves
Groundnut	Groundnut rosette, Leaf spot disease, Leaf blight, Bacterial wilt	Leaves
Cowpeas	Zonate leaf spot, Bacterial blight	Leaves
Tomato	Tomato blight, Bacterial wilt	Leaves
Cassava	Cassava mosaic	Leaves
	Brown streak	Root tubers
Maize	Maize rust, White leaf blight, Maize streak disease	Leaves
	Corn smut	Leaves, ear, tassel and stalk
Banana	Panama disease	Leaves
	Cigar end rot	Banana fingers (fruit)
	Banana Bacterial Wilt	Flower (blossom) and fruit
Sweet potato	Potato blight	Leaves
	Bacterial wilt (Brown rot)	Leaves and stems
Irish potato	Potato blight, Bacterial wilt	Leaves
	Black scurf	Stem tuber
Coffee	Coffee berry disease, Coffee leaf rust	Leaves
Sorghum	Leaf blight, Zonate leaf spot, Sorghum downy mildew	Leaves
	Scott stripes	Fruit
Sugarcane	Sugarcane smut, Red rot	Stem (internodes)
	Red leaf spot	Leaves
	Yellow leaf disease, Leaf scald disease	Leaves
Tobacco	Black spot disease, Blue mould, Frog-eye leaf spot, Brown spot, Bacterial wilt	Leaves
	Black shank	Stalk

DANGERS (EFFECTS) OF PESTS AND DISEASES

- They lead to poor yields
- They lead to wilting and drying of crops
- They lead to rotting of tubers
- They lead to deformed leaves (curling of leaves)
- They lead to stunted growth of the crops

WOOD LOT:

- This is a plot set aside for growing trees

Importance of the wood lot project

- Trees provide firewood
- Trees provide timber
- Trees help in rain formation
- Trees provide poles for building and electricity installation
- Trees control soil erosion
- Trees help to purify air

FACTORS TO CONSIDER WHEN STARTING A WOOD LOT PROJECT

- Multipurpose trees (MTPS)
- Drought resistant varieties of trees
- Trees that mature quickly
- Land
- Capital
- Labour
- Market
- Record keeping

Records to keep on a woodlot project

- Date of making seedbed
- Time spent by seedlings in nursery bed
- Date of transplanting
- Type of crops grown with trees
- Type of trees planted
- Number of trees planted
- Spacing of trees and crops
- Possible date for harvesting
- Date of weeding, pruning and spraying

An inventory is a detailed list of farm tools and equipment and their value.

Silviculture is the cultivation of trees for forests

METHODS OF HARVESTING TREES

- Pollarding
- Lopping
- Coppicing

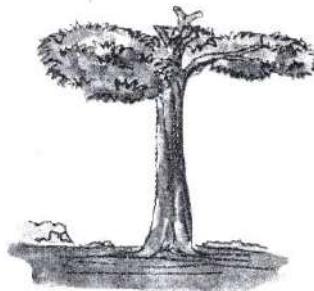
POLLARDING

- This is the cutting of the top part of a tree.

Importance of harvesting trees by pollarding

- It enables fruit trees to produce more and better fruits e.g mangoes
- It keeps fruit trees short for easy harvesting of fruits.

An illustration showing pollarding



LOPPING

- This is the cutting of side branches of a tree.
- ✓ Mature side branches are harvested as the tree continues to grow

Importance of lopping

- It enables the tree to grow taller
- It enables the tree to continue growing after harvesting firewood

An illustration showing lopping



COPPIRING

- This is the cutting of the whole tree leaving a short stump.

Importance of coppicing

- It allows growth of new shoots
- It provides good wood for timber

AN ILLUSTRATION SHOWING COPPIRING (E.G EUCALYPTUS)



- **Sprouting** means to develop new shoots

Why is pollarding or coppicing not done on some trees (e.g pine, podo and cypress)?

- Some trees cannot grow new branches

USES OF WOOD

- It is used as fuel
- It is used as timber
- It is a source of income after sale
- It is used for fencing
- It is used for installing electric wires
- It is used for making papers and soft boards

PREPARATION AND STORAGE OF WOOD

a) WOOD FOR CHARCOAL

- It can be harvested by lopping, pollarding or coppicing, packed into a heap and covered with soil

Why is wood for charcoal covered with soil?

- To limit the supply of oxygen

How is charcoal formed?

- By burning wood in limited supply of oxygen

How is ash formed?

- By burning wood in full (excess) supply of oxygen

How does charcoal burning affect the environment?

- It increases the rate of deforestation for wood fuel

b) WOOD FOR FIREWOOD

- It can be harvested by lopping, pollarding or coppicing
- After cutting, wood is split and put under sunshine **to dry**
- Dry wood burns very well and can be used for cooking
- Wood stores **chemical energy**

Why is it not good to use wet wood for cooking?

- It does not burn well
- It produces a lot of smoke

Why do people split firewood?

- For quick drying
- For easy usage

Which energy change occurs when wood is burnt?

- Chemical energy changes to heat and light energy.

c) WOOD FOR POLES (FENCING, ELECTRICITY AND HOUSE CONSTRUCTION)

- It is mainly harvested using **coppicing**
- The bark is removed and the wood surface is smeared with wood preservatives (e.g Used engine oil)

IMPORTANCE OF TREATING WOOD/POLES WITH PRESERVATIVES

- It prevents termites destroying the poles
- It prevents poles from rotting
- It makes poles resistant to fire

d) WOOD FOR TIMBER

- Wood for timber is harvested by **coppicing**
- The felled tree is cut into pieces after removing the side branches
- Wood for timber is cut (split) into pieces using a **hand saws** or **chainsaws**

TIMBER SEASONING

- This is the controlled removal of moisture content from timber

IMPORTANCE OF SEASONING OF TIMBER (DRYING OF TIMBER)

- It prevents bending /warping of timber
- It prevents timber from cracking
- It reduces weight of the timber
- It prevents timber from rotting
- It increases durability of timber
- It increases the strength of timber

REASONS WHY NATURAL SEASONING (DRYING) OF TIMBER SHOULD BE DONE IN A SHADE BUT NOT IN DIRECT SUNSHINE

- To prevent warping (bending) of timber
- To prevent cracking of timber

Why should seasoning of timber be done on a flat surface?

- To enable the timber remain straight (to prevent bending/warping of timber)

WHY IS WET TIMBER NOT GOOD FOR USE?

- It bends on drying
- It cracks easily
- It is not durable
- It rots easily
- It is weak

OF WHAT USE IS A HAND PLANE TO A CARPENTER?

- For flattening/shaping timber
- For reducing thickness of timber
- For smoothing timber

STORAGE OF WOOD

- It should be stored in a well roofed place **to protect it from rain**
- It should be kept on a dry raised platform **to prevent dampness of firewood**

INSECT PESTS FOR HARVESTED WOOD

- Powder-post beetles
- Termites
- Carpenter bees
- Carpenter ants
- Woodworms
- Sawflies

PRESERVATION OF WOOD AND TIMBER

- Applying coal tar on wood
- Smearing wood with used engine oil
- Soaking wood in kerosene
- Wood charring timber (half-burning the timber)
- Smearing wood with ash

SCIENCE ORIENTED CLUBS

- These are clubs that are formed on science basis

OBJECTIVES OF SCIENCE ORIENTED CLUBS

- To enable children acquire science skills
- To make children pick interest in science subjects
- To enable children discover science facts

Examples of science oriented clubs

- Young farmers' club
- School health club
- Wildlife club
- Environmental conservation clubs
- Science and technology clubs

YOUNG FARMERS' CLUB

- This is a group of young people in a community who have interest in farming

IMPORTANCE OF YOUNG FARMERS' CLUB IN A SCHOOL

- It grows food crops for the school
- It teaches good farming methods to school children
- It organizes study tours to farm schools
- It helps school children to pick interest in agriculture

EXAMPLES OF SCIENCE PROJECTS IN SCHOOLS

- Piggery project (pig keeping)
- Cuniculture project (Rabbit keeping)
- Apiculture project (bee keeping)
- Woodlot project (tree growing)
- Horticulture project
- Poultry keeping project

TOPIC: POPULATION AND HEALTH

POPULATION

- This is the total number of organisms in an area

Human population

- This is the total number of people living in an area

Health

- This is the state of complete physical, mental and social well being
- This is the state of being free from illness or injury

Components (aspects) of health

- Physical health
- Mental health
- Social health

Ways of promoting good health

- | | |
|-------------------------------------|-----------------------|
| ▪ Proper sanitation | ▪ Proper food hygiene |
| ▪ Feeding on balanced diet | ▪ Drinking safe water |
| ▪ Proper personal hygiene | ▪ Avoiding drug abuse |
| ▪ Performing regular body exercises | ▪ Having enough rest |

SICKNESS

- This is the unhealthy condition of the body or mind
- This is the state of not well-being physically, mentally, socially and spiritually

Common sickness in a home

- | | |
|---------------|-----------------|
| ▪ Dysentery | ▪ Typhoid |
| ▪ Cholera | ▪ Diarrhoea |
| ▪ Malaria | ▪ Measles |
| ▪ Kwashiorkor | ▪ Poliomyelitis |

Causes of common sickness at home

- | | |
|-------------------------------|------------------------|
| ▪ Poor sanitation | ▪ Smoking |
| ▪ Poor personal hygiene | ▪ Alcoholism |
| ▪ Malnutrition (poor feeding) | ▪ Drug abuse |
| ▪ Inadequate water supply | ▪ Air pollution |
| ▪ Lack of physical exercises | ▪ Lack of immunization |
| ▪ Drinking contaminated water | |

SIGNS AND SYMPTOMS OF SICKNESS

- Vomiting
- Diarrhoea
- Loss of body weight
- Jaundice
- Runny nose (stuffy nose)
- Chronic cough

SYMPTOMS OF SICKNESS

- Nausea
- Loss of appetite
- Fever
- Headache
- Body weakness

Ways of preventing and controlling common sicknesses at home and school

- By feeding on a balanced diet
- By immunization
- By proper disposal of human wastes
- By sleeping in treated mosquito nets
- By drinking safe water
- By avoiding drug abuse
- By performing regular body exercises
- By living in well ventilated houses
- By draining still water near our homes
- By slashing bushes around our homes

DISEASES

- **A disease** is an abnormal condition of the body that causes discomfort

Groups (types) of diseases

- Communicable diseases
- Non-communicable diseases

COMMUNICABLE DISEASES

- These are diseases that can spread from one person to another
- ✓ They are caused by germs (pathogens)

GERMS (PATHOGENS)

- These are tiny organisms that cause diseases

TYPES OF GERMS

- Bacteria
- Fungi
- Protozoa
- Virus

WAYS THROUGH WHICH COMMUNICABLE DISEASES SPREAD (HOW DO GERMS ENTER OUR BODIES?)

- Through vector bites (animal and insect bites)
- Through using contaminated water
- Through inhaling contaminated air
- Through contact with an infected person
- Through open cuts and wounds

GROUPS OF COMMUNICABLE DISEASES

- Water associated diseases
- Airborne diseases
- Vector-borne diseases
- Contagious diseases

WATER ASSOCIATED DISEASES

- These are diseases which are spread through contaminated water

Groups (classes) of water associated diseases

- Water borne diseases
- Water contact diseases
- Water cleaned diseases
- Water habitat vector diseases

GROUPS OF WATER ASSOCIATED DISEASES	EXAMPLES
<u>Water borne diseases</u>	<ul style="list-style-type: none"> ▪ Cholera ▪ Typhoid fever ▪ Bilharziasis (schistosomiasis) ▪ Poliomyelitis ▪ Dysentery ▪ Hepatitis A ▪ Diarrhoea ▪ Guinea worm disease
<u>Water contact diseases</u>	<ul style="list-style-type: none"> ✓ Bilharziasis ✓ Swimmer's itch ✓ Swimmer's ear (otitis externa)
<u>Water cleaned diseases</u>	<ul style="list-style-type: none"> ❖ Scabies ❖ Impetigo ❖ Trachoma ❖ Ringworm ❖ Athlete's foot ❖ Conjunctivitis
<u>Water habitat vector diseases</u>	<ul style="list-style-type: none"> • Bilharziasis (schistosomiasis) • River blindness (onchocerciasis) • Malaria • Elephantiasis (filariasis) • Dengue fever • Yellow fever • Zika fever • Chikungunya fever

CONTROL OF WATER BORNE DISEASES

- Drinking safe water
- Proper disposal of human wastes
- Keeping drinking water in clean containers

CONTROL OF WATER CONTACT DISEASES

- Avoid swimming in dirty water
- Treating water in swimming pools
- Avoid bathing with contaminated water
- Fencing swimming pools to prevent water contamination

CONTROL OF WATER CLEANED DISEASES

- Always bathe with enough clean water
- Washing and ironing clothes
- Always wear clean clothes
- Do not share clothes with an infected person

CONTROL OF WATER HABITAT VECTOR DISEASES

- Draining stagnant water
- Oiling stagnant water
- Destroying broken pots and bottles around our homes
- Do not sleep near rivers during day time
- Sleeping under treated mosquito nets
- Slashing bushes and tall grass around our homes

AIRBORNE DISEASES

- These are diseases that spread through inhaling contaminated air

EXAMPLES OF AIRBORNE DISEASES:

i) BACTERIAL AIRBORNE DISEASES

- Tuberculosis
- Whooping cough/pertussis
- Diphtheria
- Pneumonia
- Meningitis

ii) VIRAL AIRBORNE DISEASES

- COVID-19
- Influenza
- Measles
- Mumps
- Chicken pox

CONTAGIOUS DISEASES

- These are diseases that spread through direct body contact with an infected person

Examples of contagious diseases

- AIDS
 - Syphilis
 - Gonorrhoea
 - Chancroid
 - ✓ Leprosy
 - ✓ Ebola
 - ✓ Ringworm
 - ✓ Scabies
- STDS

VECTORBORNE DISEASES

- These are diseases that are spread by vectors

EXAMPLES OF VECTOR BORNE DISEASES

VECTORS	VECTOR BORNE DISEASE	GERM
Insect vectors	Insect vector borne diseases	
Tsetse fly	Sleeping sickness (Trypanosomiasis)	Trypanosomes
Blackfly	River blindness (onchocerciasis)	Onchocerca volvulus
Female anopheles mosquito	Malaria	Plasmodium
Culex mosquito	Elephantiasis (Filariasis)	Filarial worm
Aedes mosquito (Tiger mosquito)	Yellow fever Dengue fever Zika fever Chikungunya fever	Flavivirus Dengue virus (DENV) Zika virus Chikungunya virus (CHIKV)
Body Louse	Typhus fever Relapsing fever	Rickettsia Borrelia
Cockroach	Poliomyelitis Leprosy (Hansen's Disease) Amoebic dysentery (Amoebiasis) Typhoid Food poisoning	Poliovirus Mycobacterium leprae Entamoeba histolytica Salmonella typhi Salmonella/Norovirus
Housefly	Cholera Typhoid Trachoma Bacillary dysentery Amoebic dysentery Diarrhoea	Vibrio cholerae Salmonella typhi Chlamydia trachomatis Shigella Amoeba (Entamoeba histolytica) Rotavirus/E. coli/Norovirus
Rat fleas	Bubonic plague	Yersinia pestis
Non-insect vectors	Non-insect vector borne diseases	
Rabid dog/Rabid cat/Rabid fox	Rabies	Rabies virus
Fresh water snail	Bilharziasis (Schistosomiasis)	Blood flukes (Schistosomes)
Tick	Lyme disease Relapsing fever	Borrelia Borrelia

Ways through which vectors spread diseases (How do vectors spread diseases?)

- Through infected bites
- Through the 4Fs germ path
- Through vomiting on food
- Through defecating on food

Name any two diseases that can spread through cuts and wounds

- Tetanus
- AIDS

NON-COMMUNICABLE DISEASES

- These are disease that cannot spread from one person to another

Groups of non-communicable diseases

- Deficiency diseases
- Hereditary diseases
- Metabolic diseases
- Self-inflicted diseases

DEFICIENCY DISEASES (NUTRITIONAL DISEASES)

- These are diseases that are caused by lack of some food values in the diet

EXAMPLES OF DEFICIENCY DISEASES

Deficiency disease	Deficiency (lack of)/food value lacked
Marasmus	Carbohydrates
Kwashiorkor	Proteins
Vitamin deficiency diseases	
Night blindness	Vitamin A
Beriberi	Vitamin B ₁
Pellagra	Vitamin B ₃
Scurvy	Vitamin C
Rickets/osteoporosis	Vitamin D
Infertility	Vitamin E
Hemorrhagic disease/Vitamin K deficiency bleeding	Vitamin K
Mineral salt deficiency diseases	
Anemia	Iron
Rickets/Osteoporosis	Calcium
Goitre	Iodine

MALNUTRITION

- This is the lack of some food values in the body

Causes of malnutrition

- Poverty
- Shortage of food
- Ignorance about balanced diet
- Food taboos
- Inadequate breastfeeding

Signs of malnutrition in children

- Swollen belly
- Reduced night vision
- Swollen moon face
- Stunted growth
- Swollen legs
- Poor healing of wounds
- Swollen moon face
- Little brown hair
- Bleeding gums
- Poor growth of teeth
- Too much sleeping

Symptoms of malnutrition in adults

- Tiredness/fatigue
- Loss of interest in work
- Low concentration at work

Prevention of deficiency diseases

- By feeding on a balanced diet

HEREDITARY DISEASES

- These are diseases that are passed on from parents to off springs through defective genes.

Examples of hereditary diseases

- Sickle cell anemia
- Epilepsy
- Haemophilia
- Hypertension

METABOLIC DISEASES

- These are diseases that disrupt the normal process of converting food into energy in the body cells

Examples of metabolic diseases

- Diabetes
- Obesity
- Liver cancer

SELF-INFILCTED DISEASES

- These are diseases caused due to poor health life styles

Examples of self-inflicted diseases

- Lung cancer
- Emphysema
- Heart attack
- Kidney stones
- Liver cirrhosis

EXAMPLES OF POOR HEALTHY LIFE STYLES

- Smoking
- Alcoholism
- Over eating
- Lack of physical exercises
- Inadequate sleep

EXAMPLES OF GOOD HEALTHY LIFE STYLES

- Doing regular physical exercises
- Getting immunized
- Resting after meals
- Bathing daily
- Feeding on a balanced diet
- Having enough rest
- Going for regular medical checkups

HEALTH CONCERNS

- These are health problems in the community that need immediate solutions

EXAMPLES OF HEALTH CONCERNs

- Poor sanitation
- Inadequate food
- Poor water supply
- Anti-social behavior

POOR SANITATION

- This is the general dirtiness of a place where we stay

Causes of poor sanitation

- Poor disposal of human wastes
- Poor disposal of rubbish
- Lack of clean water supply
- Poor drainage in a home
- Bursting of sewage pipes
- Overcrowding in a home
- Sharing a house with domestic animals

Why is it unhealthy practice to defecate in bushes near our homes?

- It leads to outbreak of faecal diseases

SIGNS (INDICATORS) OF POOR SANITATION

- Tall grass in the compound
- Poor ventilation of a house
- Bushes around homes
- Sharing houses with animals
- Bad smell in a place
- Many insect vectors in a place
- Still water near our homes
- Rubbish in the compound
- Faeces in the compound
- Dirty water sources

Diseases associated with poor sanitation

- Dysentery
- Malaria
- Cholera
- Typhoid
- Bilharziasis
- Trachoma
- Poliomyelitis
- Diarrhoea
- Leprosy

Dangers (effects) of poor sanitation

- Bad smell in the place
- Outbreak of diarrhoeal and faecal diseases
- Outbreak of mosquito borne diseases
- Easy contamination of water sources
- Multiplication of vectors and germs

Solutions/control of poor sanitation (ways of promoting proper sanitation)

- Proper disposal of rubbish
- Scrubbing the floor of latrines
- Mopping the floor of the house
- Draining still water
- Picking rubbish around homes
- Burning rubbish at home
- Proper disposal of human wastes
- Spraying insecticides to kill insect vectors
- Avoid sharing a house with domestic animals
- Avoid sharing a living house with domestic animals
- Sweeping rubbish in the compound
- Smoking ordinary pit latrines
- Slashing tall grass in the compound
- Cutting bushes around our homes
- Treating sewage before disposal
- Sweeping around water sources
- Fencing wells and boreholes

INADEQUATE FOOD (FOOD INSECURITY)

- This is the condition when the family or community does not have enough food to eat throughout the year
- This is a condition when the available food is not enough to meet the people's daily nutritional needs

Causes of inadequate food

- Rapid population growth
- Crop pests and disease
- Poor soils (infertile soils)
- Inadequate land for farming
- Poor farming methods
- Drought
- Poverty
- Floods
- Wars
- Poor attitude towards farming
- Laziness
- Low level of technology

FOOD SECURITY

- This is the condition when the family or community have enough food to eat throughout the year
- This is a condition when the available food is enough to meet the daily nutritional needs of the people

Importance of food security

- It prevents malnutrition
- It prevents deficiency diseases
- It prevents famine

Solutions to inadequate food (ways of promoting food security)

- Growing enough food crops
- Preserving food
- Promoting family planning
- Growing drought resistant food crops
- Providing soft loans to farmers
- Practising better farming methods
- Proper storing of harvested food crops
- Growing food crops that mature faster
- Avoiding the habit of selling food crops for money
- Providing irrigation facilities to farmers in dry season

POOR WATER SUPPLY

- This is the condition when the community does not have enough clean water to meet their needs

Causes of poor water supply

- Drought
- Floods
- Wars
- Over population
- Silting
- Swamp drainage

Solutions/measures on how to overcome poor water supply

- By extending piped water to rural areas
- By protecting wetlands
- By protecting open water sources from contamination
- By educating people the importance of protecting water sources
- By constructing boreholes and taps

Effect of poor water supply

- It leads to spread of water associated diseases
- It leads to poor sanitation

ANTISOCIAL BEHAVIOUR

- These are habits which are not accepted in the community

Examples of antisocial behaviour (social problems in the community)

- | | |
|--|--|
| <ul style="list-style-type: none">▪ Telling lies (deception)▪ Bullying▪ Stealing▪ Using bad language▪ Arson (fire setting)▪ Fighting▪ Smoking▪ Violence and aggression▪ Alcoholism | <ul style="list-style-type: none">▪ Truancy▪ Child prostitution▪ Premarital sex▪ Drug abuse▪ Raping▪ Disobedience▪ Wandering (running away from home)▪ Abortion |
|--|--|

Juvenile

- This is a young person below 18 years.

Juvenile delinquent

- This is a young person who commits a bad act which violates law

Juvenile delinquency (delinquency)

- This is a bad act committed by a young person below 18 years which violates law

Criminal

- This is an adult who commits a bad act which violates law

Crime

- This is a bad act committed by an adult person which violates law

Causes of antisocial behaviour and delinquency

- Peer influence
- Pampering of children
- Media influence
- Unfulfilled expectations
- Bad teaching by teachers
- Poor social environment
- Over strictness by parents or teachers
- Failure to enforce rules in a community
- Inconsistency on standards of behaviour
- Ignorance about society rules/laws

Effects of antisocial behaviour and delinquency

- Dropping out from schools
- Imprisonment
- Rejection by parents
- Teenage/adolescent pregnancy
- Young people develop into adult criminals

How to control antisocial behaviors and delinquency in schools

- Forming health clubs in schools
- Pupils should avoid bad peer groups
- Delinquents should be taken to reformatory schools
- Slightly punish children for wrong behaviour
- Parents must have good morals all the time
- Pupils should not go to discos
- Treating children equally
- Children can participate in religious choirs
- Children should be counselled and guided
- Parents should avoid quarrels and divorce in marriage
- Children should not watch pornographic films
- Children should be engaged in games and sports

TRUANCY

- This is when a school-age child frequently misses school without good reason

Causes of truancy

- | | |
|--|--|
| <ul style="list-style-type: none">▪ Bad teaching by teachers▪ Boredom in class▪ Overcrowding in classes▪ Peer pressure▪ Bullying▪ Learning difficulties in some subjects▪ Attractions from outside the school like discos and cinema halls | <ul style="list-style-type: none">▪ Poor grades▪ Teenage pregnancy▪ Mental health issues▪ Child neglect |
|--|--|

VIOLENCE

- This is the intentional use of physical force to self-harm or harm others
- This is the state in which a person is aggressive and has a destructive behaviour

How does masochism differ from sadism?

- Masochism is the enjoyment of experiencing pain **while** sadism is the enjoyment of causing pain to others

SEXUAL DEVIATIONS

- These are sexual practices that are not accepted in the community

Examples of sexual deviations

- **Bestiality;** sexual activity with a nonhuman animal
- **Masturbation;** touching or rubbing your own genitals for sexual pleasure
- **Homosexuality;** sexual attraction to a person of your own sex e.g lesbianism
- **Oral sex;** using mouth, lips or tongue to stimulate your partner's genitals
- **Anal sex;** putting penis or finger into a person's anus for sexual pleasure
- **Incest;** sexual activity between close relatives
- **Necrophilia;** sexual activity with a corpse (dead body)
- **Pedophilia;** sexual attraction to young children
- **Fetishism;** sexual attraction to non-living objects
- **Bisexuality;** sexual attraction to members of either sex

Causes of sexual deviations

- Peer influence
- Exposure to pornography
- Greed for money
- Ignorance on dangers of sex deviations
- Poverty
- Drug abuse

Effects of sexual deviation

- Contraction of STDs
- Dropping out from schools
- Loss of respect
- Rejection by the community
- Imprisonment
- Rejection by parents
- Family breakup

Ways of avoiding sexual deviations

- Avoid groups that practice sexual deviations (Have good friends)
- Join good productive clubs
- Avoid watching and reading pornographic materials
- Parents should provide proper counseling and guidance to their children
- Encourage sex education to youth in school and at home
- Get advice from respectable people (e.g religious leaders)
- Avoid drug abuse
- Engage in games and sports during your free time

Reasons why some societies condemn sexual deviations

- They oppose religious teachings
- They oppose the laws of nature
- They are a source of some STDs
- They bring a curse to the family

WAYS OF ADDRESSING HEALTH CONCERNs

- Constructing pit latrines
- Constructing rubbish pits
- Draining still water
- Providing good nutrition
- Treating the sick
- Supply of clean water
- Through healthy surveys
- Through demography
- Through health education
- Through child to child programme

HEALTH EDUCATION

- This is the way in which community members are informed on how to solve their health problems

Importance of health education

- It helps people to address health concerns
- It helps people to know the value of good health
- It helps people to maintain proper sanitation
- It helps people to promote proper personal hygiene
- It helps people in preventing the spread of some diseases
- It reduces poor traditional beliefs about diseases

Ways of providing health education

- Through health songs
- Through health programmes on media (e.g newspapers, radios and televisions)
- Through health debates and discussions
- Through forming health clubs

HEALTH SURVEY

- This is a way of collecting information about health concerns of a family or community

Health data

- This is the information collected during a health survey

Importance of health surveys to the government

- They help a government to know and solve the health concerns
- They help a government to know health status of its people
- They help the government to provide health services to its people

WAYS OF MAKING HEALTH SURVEY

- Through interviews
- Through questionnaires
- Through observations

GROUPS OF PEOPLE WHO CARRY OUT HEALTH SURVEYS

- Health workers
- Community leaders
- Media members

Kinds of information collected during a health survey

- | | |
|--------------------------------------|-----------------------------|
| ▪ Health services in an area | ▪ Immunization coverage |
| ▪ Common sickness in the community | ▪ Food security in the area |
| ▪ Ways of preventing common sickness | ▪ Housing information |

Housing information collected during health survey

- | | |
|----------------------------|---|
| ▪ Type of houses | ▪ Number of people who live in each house |
| ▪ Size of each house | |
| ▪ Ventilation of the house | |

Immunization information collected during health survey

- The number of children immunized
- The ages of the children immunized
- Disease immunized

Health services information collected during a health survey

- Number of public health centres and private health centres
- People's response towards medical services and herbal services

Examples of health services provided by health centres

- Family planning
- Ante-natal and post-natal care
- Immunization
- Oral health care
- Health education
- Counselling and guidance
- Control of diarrhoeal diseases (CDD)
- X-ray

Groups of people found in health units

- Doctors
- Nurses
- Lab technicians
- Midwives
- Clinic officers
- Surgeons
- Pharmacists
- Gynaecologists

DEMOGRAPHY

- This is the scientific study of changes in human populations

Importance of demography

- It helps the government to plan for health services of its population
- It helps the government to determine the population structure of an area
- It helps the government to know the birth and death rates

Kinds of information collected during demography

- Birth rates
- Death rates
- Migration
- Housing information

YOUNG PARENTS

- These are young girls and boys who give birth before the age of consent.

Young mother

- This is the girl who gives birth before the age of consent

Young father

- This is a boy who gives birth before the age of consent

Problems faced by young parents

- Lack of skills to manage the family
- Lack of financial support
- Isolation by friends
- Dropping out from schools
- Ignorance about caring for the baby
- Risks of abortion
- Risks of getting STDs
- Obstructed labour

HOW TO AVOID HEALTH AND SOCIAL PROBLEMS

- Construct latrines for proper disposal of faeces and urine
- Construct rubbish pits for proper disposal of rubbish
- Join good social clubs (e.g young farmers' clubs and sports clubs)
- Provide counselling and guidance to people with health problems
- Get health education about drug abuse and prevention of diseases
- Avoid premarital sex

FAMILY BUDGET

- This is the statement which shows how the expected family income is spent

FAMILY BUDGETING

- This is an advance plan of how the expected family income is to be spent

ADVANTAGES OF FAMILY BUDGETING

- It prevents debts
- It prevents over spending
- It promotes saving in the family
- It reduces quarrels in a home over money
- It gives priority to essential needs of the family

TYPES OF FAMILY BUDGETING (SYSTEMS OF BUDGETING)

- Allowance budgeting
- Joint control budgeting
- Handout budgeting

Allowance budgeting

- This is when a money earning family member gives allowances to the house wife and keeps the balance for his own use

Joint control budgeting

- This is when both the wife and husband earn and share expenses of family needs

Handout budgeting

- This is when one family member controls the family income and pays what is on demand

COMPONENTS OF FAMILY BUDGETING (WAYS OF MANAGING FAMILY BUDGETING)

- | | |
|----------------|---------------------|
| ▪ Planning | ▪ Accounting |
| ▪ Prioritizing | ▪ Strict management |
| ▪ Evaluation | |

Prioritizing enables essential family needs to be catered for first

SCHOOL HEALTH CLUB/COMMITTEE (COMMUNITY HEALTH COMMITTEE)

- This is a group of people in a school or community members who work together to promote good health

Members of the school health committee

- | | |
|---------------------|------------------------|
| ▪ School nurse | ▪ Senior man and woman |
| ▪ Sanitary prefects | ▪ School cleaners |
| ▪ Science teachers | ▪ Food mess |

ACTIVITIES/ROLES/DUTIES OF A SCHOOL HEALTH COMMITTEE

- Organizing health parades
- Organizing class health meetings
- Organizing general cleaning activities
- Organizing health education seminars
- Reporting any diseases outbreak
- Discouraging anti-social behaviour
- Designing health rules
- Identifying school children who are not immunized
- Inviting health workers to sensitize school children about health issues

HEALTH PARADES

- This is an assembly done at school to check on children's hygiene

ACTIVITIES CARRIED OUT AT A HEALTH PARADES

- Checking children with unbrushed teeth
- Checking children with long fingernails
- Checking children with dirty uniforms
- Checking children with uncombed hair
- Checking children with jiggers

WHY ARE HEALTH PARADES DONE? (IMPORTANCE/REASONS FOR CARRYING OUT HEALTH PARADES)

- To promote personal hygiene among school children
- To promote good health among school children
- They promote child to child programme

Which element of Primary Health Care (PHC) is promoted on health parades?

- Personal hygiene

CHILD TO CHILD PROGRAMME

- This is a programme in communities where older children help the young ones to promote good health

A SYMBOL SHOWING CHILD TO CHILD PROGRAMME (APPROACH)



ACTIVITIES DONE IN CHILD TO CHILD PROGRAMME

- Older children teach young children how to use a latrine
- Older children teach young children how to brush their teeth
- Older children teach young children to wash hands before meals
- Older children teach young children to wash hands after visiting latrines

IMPORTANCE OF CHILD TO CHILD PROGRAMME

- It prevents the spread of some communicable diseases among children
- It promotes good healthy lifestyles among children
- It improves health among children