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
- Muscles
- Tendons
- Cartilages
- Ligaments

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
- goat
- monkey
- duck
- frog
- toad
- tilapia
- turtle
- tortoise
- chameleon

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
- mosquito
- cricket
- spider
- tick
- crab
- lobster
- prawn
- millipede
- centipede

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
- Tapeworm
- slug
- snail
- squid
- octopus
- tapeworm
- sea urchin
- star fish
- jelly fish

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)	▪ Brain ▪ Eyes ▪ Tongue ▪ Ears ▪ Nose
Ribcage	▪ Heart ▪ Lungs
Pelvis	▪ Kidneys ▪ Female reproductive organs
Backbone (spine or vertebral column)	▪ 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**

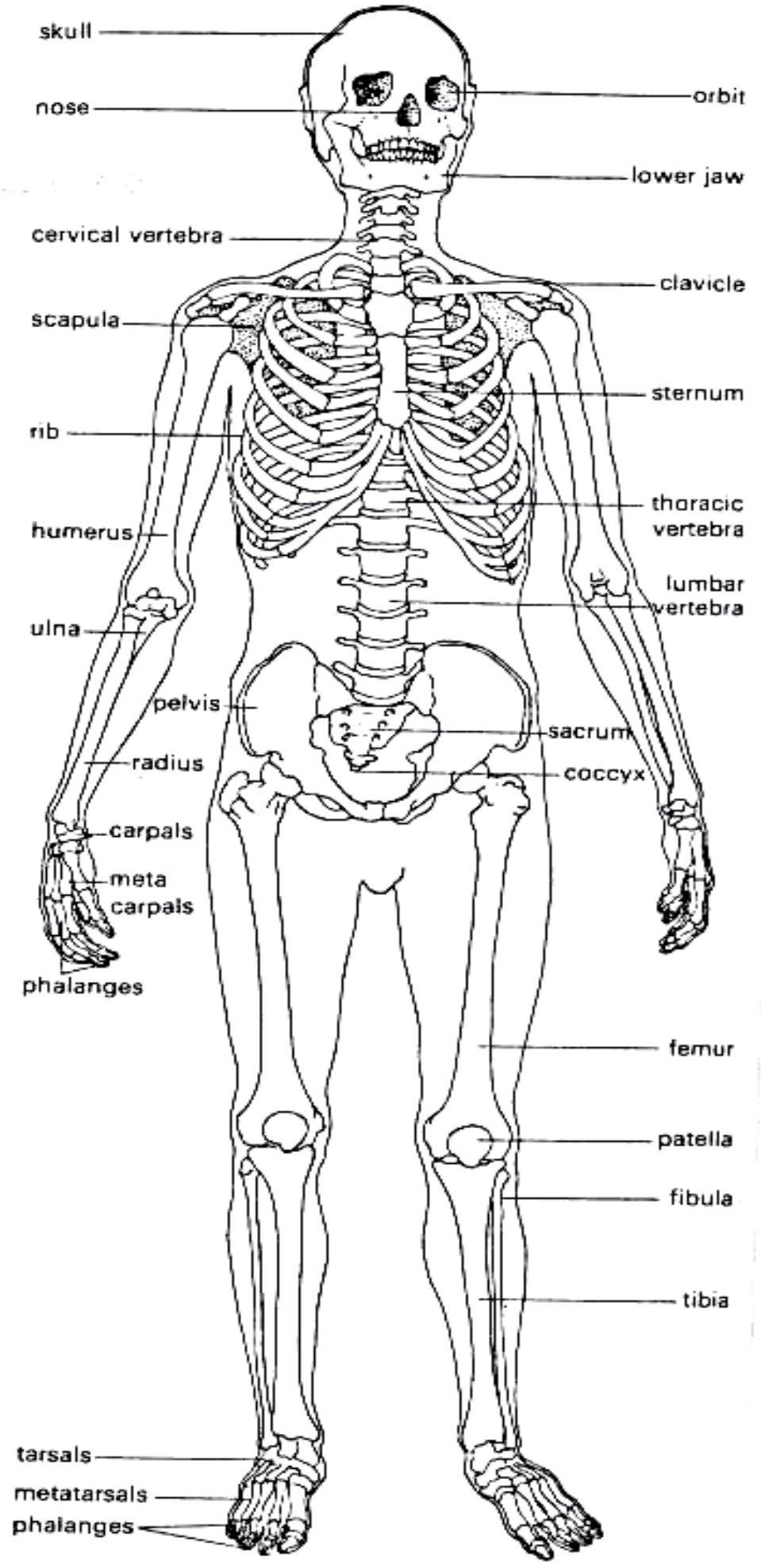
Why do new born babies have more bones than adults?

- 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

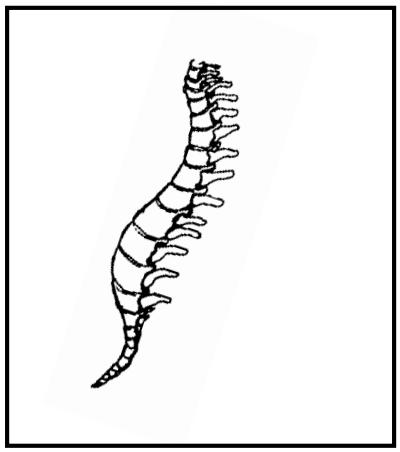
AXIAL SKELETON

- 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
  - Short bones
  - Flat bones
  - Irregular bones
  - Sesamoid bones

LONG BONES

- These are found in limbs (arms and legs)

Examples of long bones

Long bones	**Body parts where they are found**
Humerus Radius Ulna	Arms
Femur Fibula Tibia	Legs

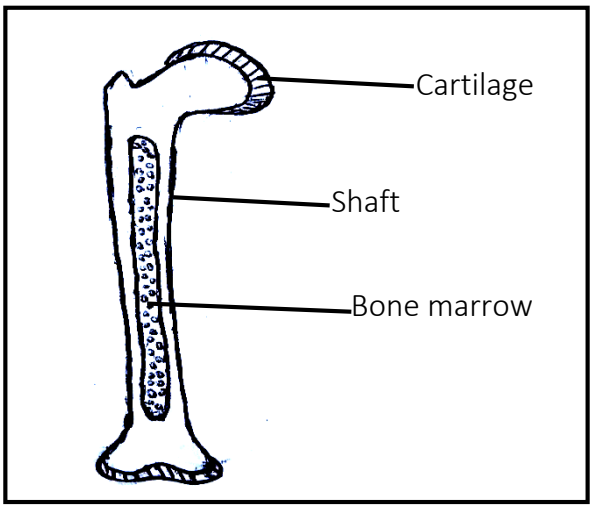
Name the longest and strongest bone in the human body.

- 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

- Scapula (shoulder blade)
- Sternum (breastbone)
- Bones of the skull (cranial bones)
- 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

- Vertebrae (bones of the backbone)
- Jawbones (maxilla and mandible)
- Sacrum
- Coccyx

Importance of irregular bones in the human body

- They protect the internal organs
- 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

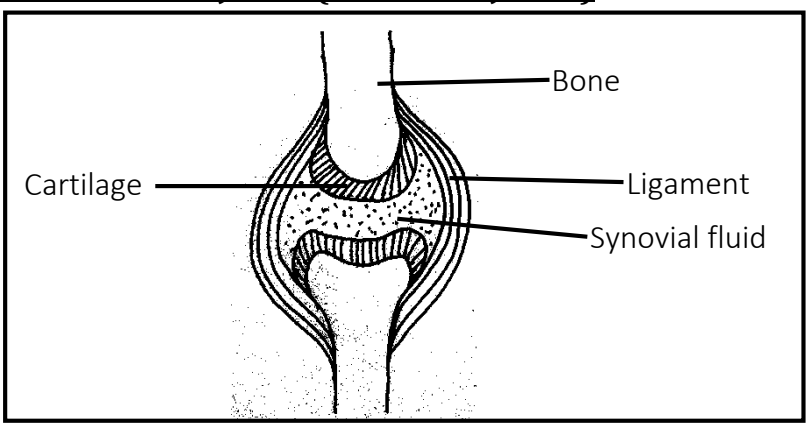
MOVABLE JOINTS

- 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 180^0

Why hinge joints are called so?

- They allow movement similar to that of a door on its hinges

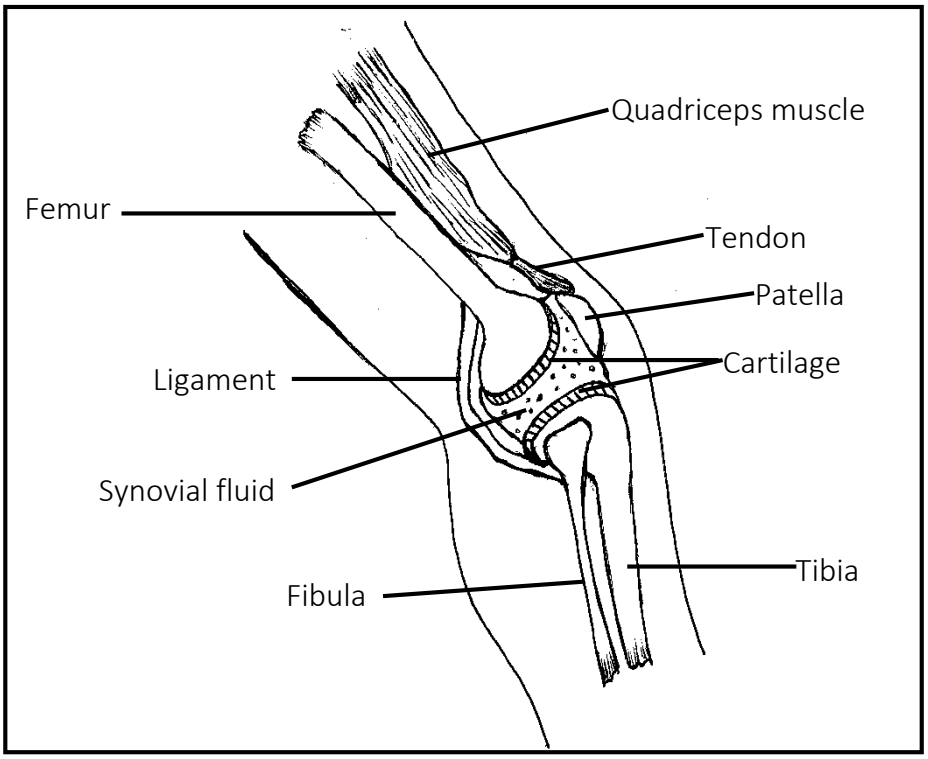
Examples of hinge joints

- 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 360^0

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
- Backward
- Circular form
- Side ways

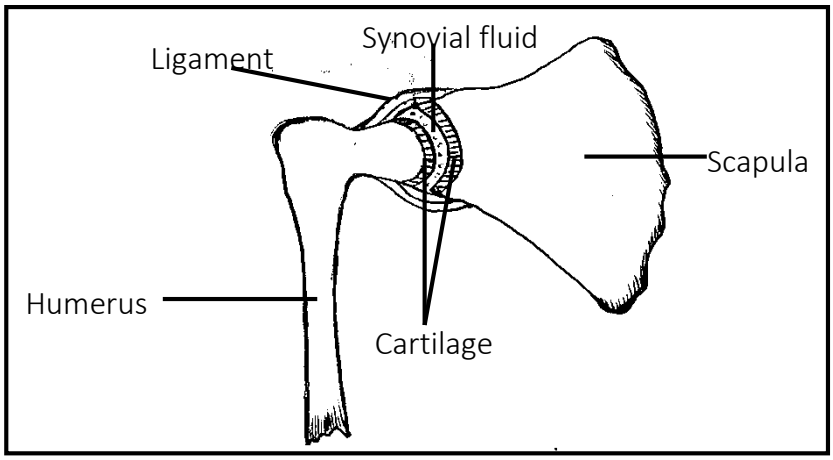
Examples of ball and socket joints

- 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

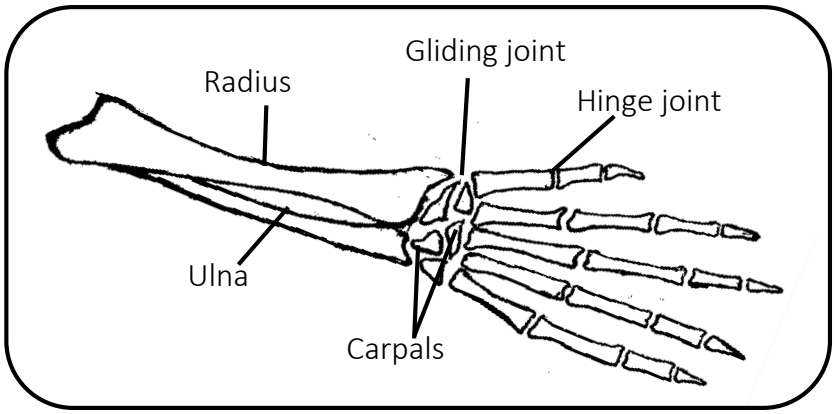
Examples of gliding joints

- 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

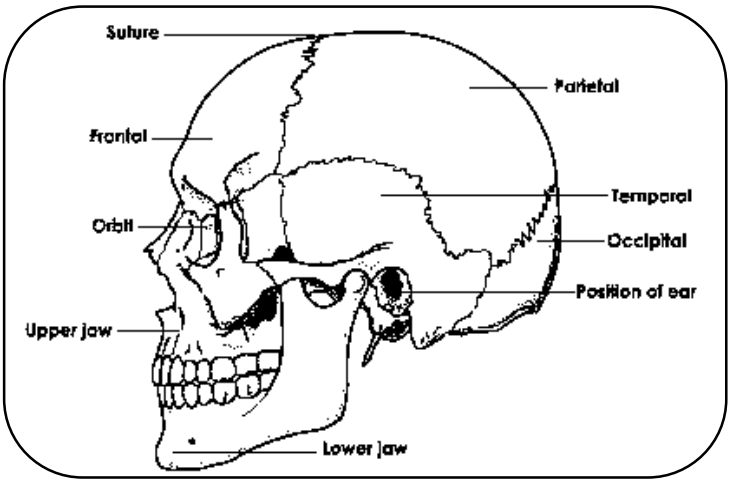
In which part of the body are suture joints found?

- 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
- Parietal bone
- Temporal bone
- Occipital bone

Where in the skull are eyes found?

- In the eye sockets (orbits)

CONDITIONS THAT MAY MAKE JOINTS FAIL TO FUNCTION PROPERLY

- Dislocation
- Sprain
- Fracture
- 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

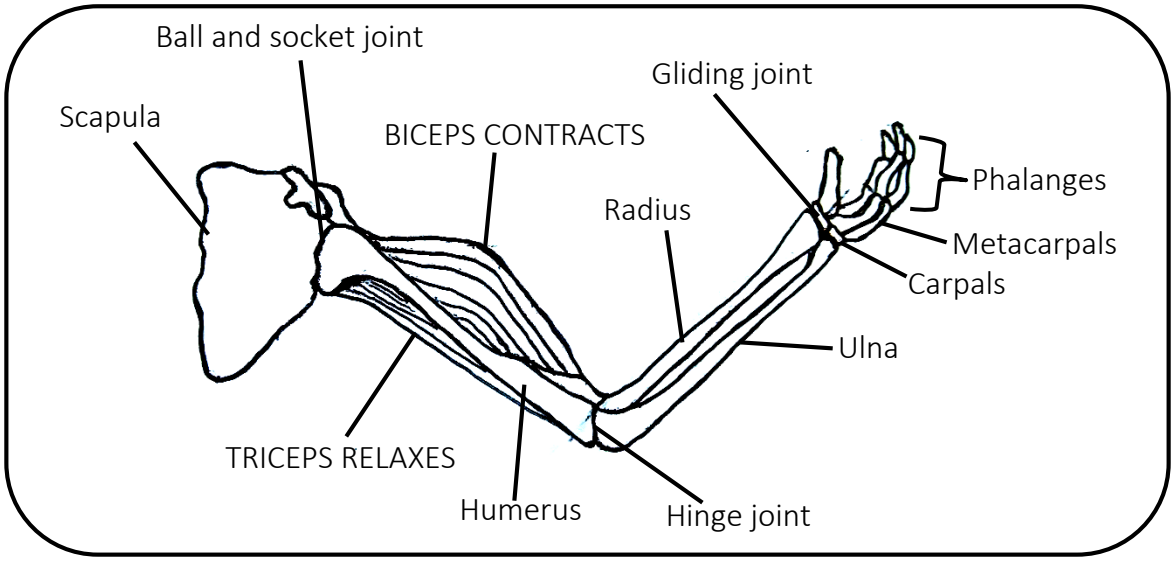
- Biceps and triceps muscles
- Quadriceps and hamstrings

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

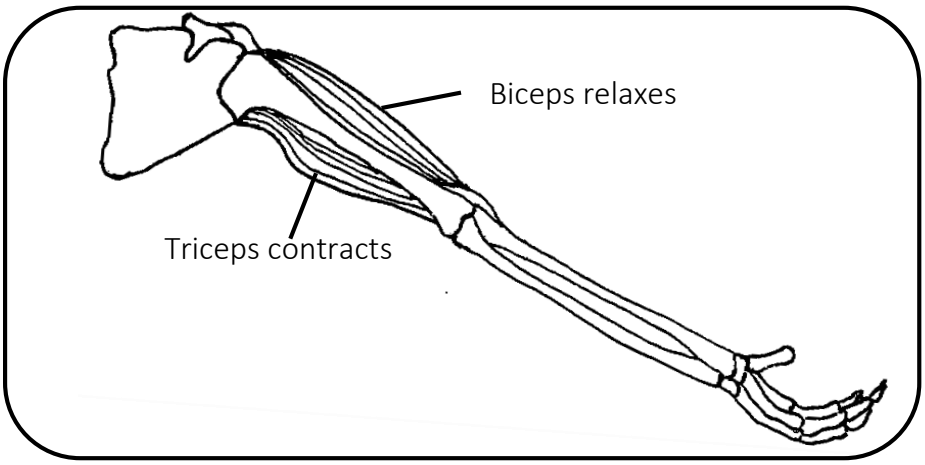
1. **WHEN THE FOREARM IS RAISED (BENT)**



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)
- Cold abscess
- Paralysis of the legs

Symptoms of tuberculosis of bones/spinal tuberculosis

- Backache
- Pain in the spine while walking
- Pain at joints

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
- Common fractures
- Poor teeth formation

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
- Wasting of muscles
- Loss of fingernails and toenails

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

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

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)
- Liquid state (liquid)
- Gaseous state (gas)
- 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
- Sound energy
- Light energy
- Electrical energy (electricity)
- Magnetism
- Mechanical energy
- Chemical energy

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)

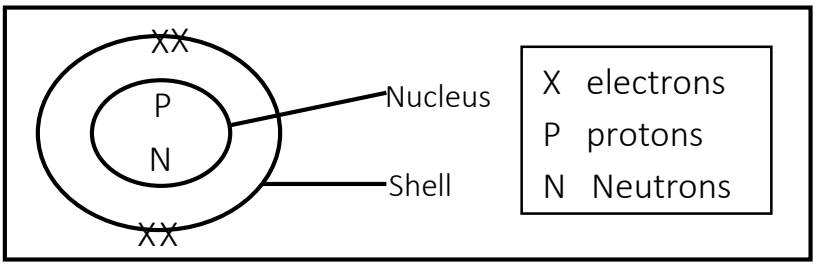
When does a body (an atom) become positively charged?

- 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
- Clouds
- Fast flowing water
- Steam from hot springs
- Tides
- Fossil fuels
- Uranium

Examples of artificial sources of electricity

- Dry cells
- Wet cells
- Accumulators/car batteries
- 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/formed?

- 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

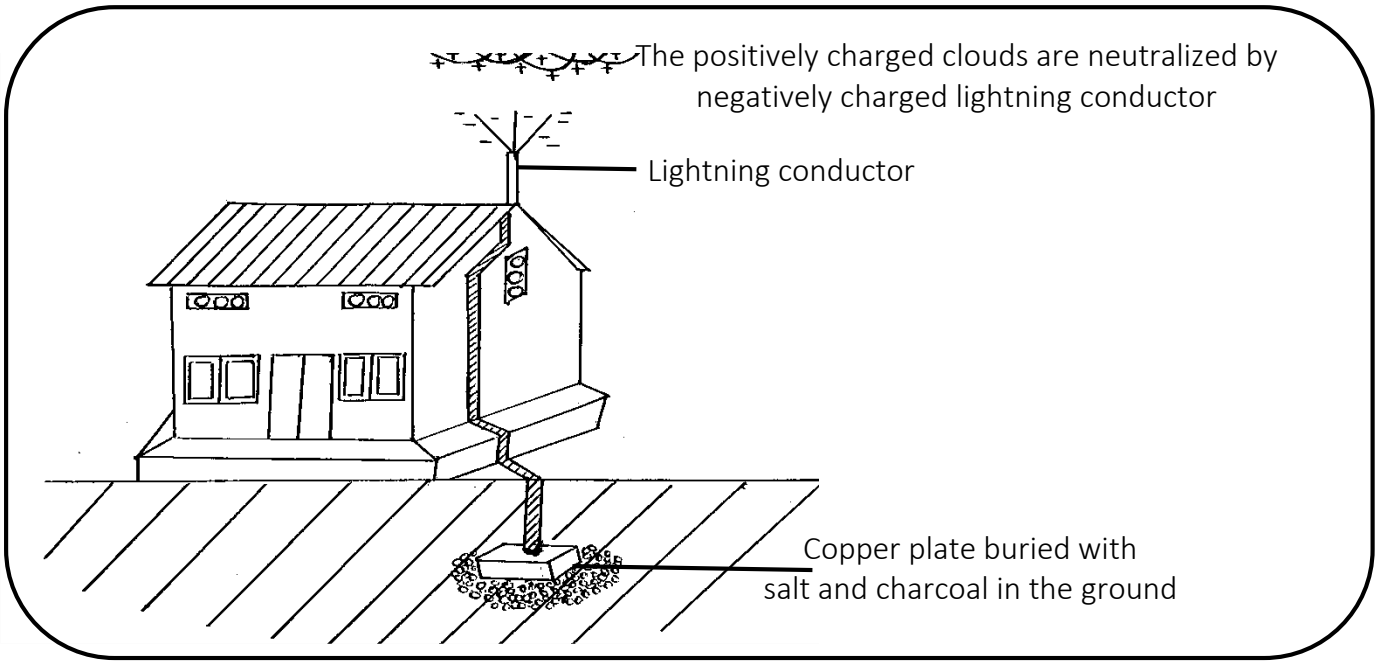
What do we call the abnormal fear of thunder and lightning?

- Astraphobia

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
- Solar calculators
- Solar ovens
- Satellites
- Solar radios
- Solar torches
- Solar road signs

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)

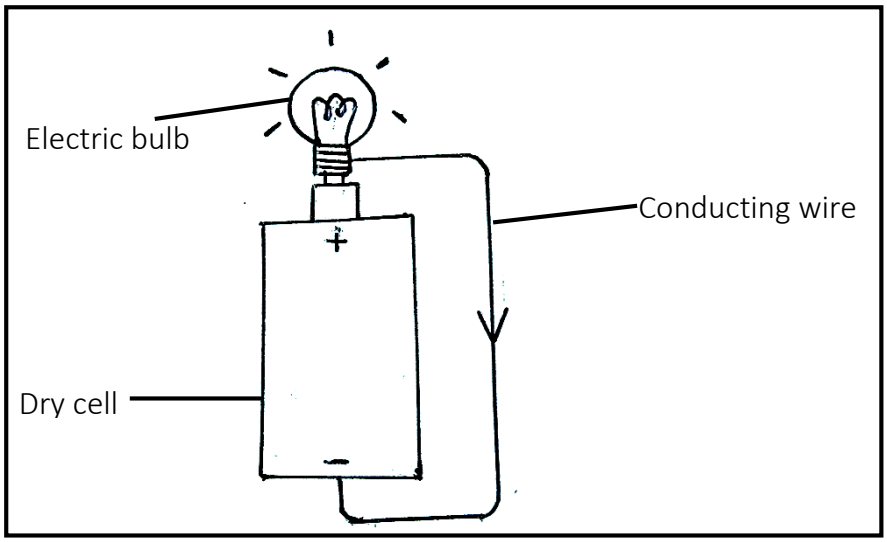
- This is the rate of flow of electric charge in a conductor
- This is the flow of electrons in a conductor

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**

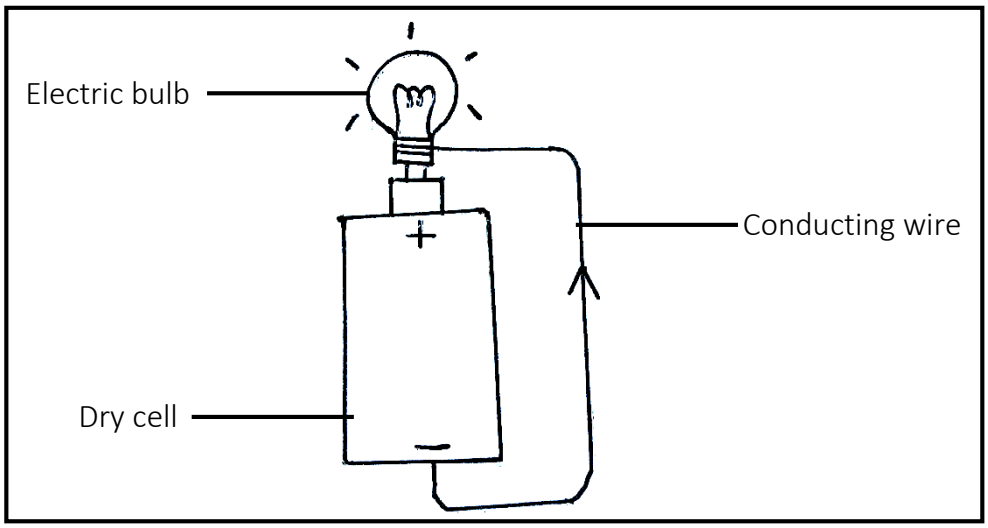
A diagram showing the flow of current (electricity)



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

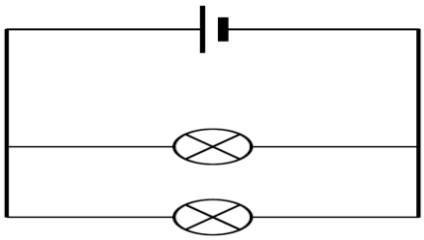
TYPES OF CIRCUITS

- Parallel circuit
- Series circuit

PARALLEL CIRCUIT

- This is the circuit where components are connected on separate loops of wires

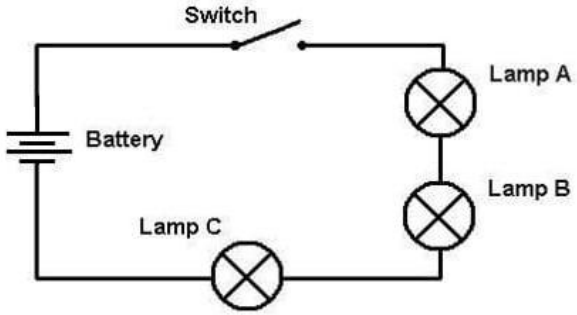
A DIAGRAM SHOWING A PARALLEL CIRCUIT



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

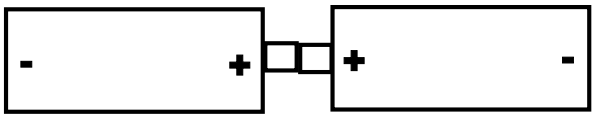
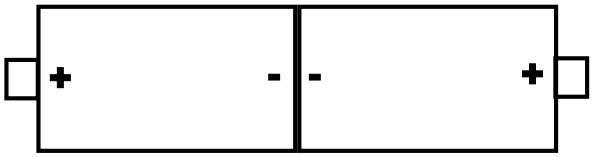


ILLUSTRATION II

- When a negative terminal of one dry cell is connected to the negative terminal of another dry cell



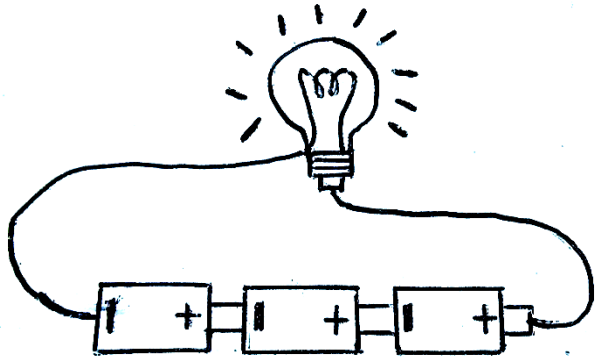
CORRECT ARRANGEMENT (CONNECTION) OF DRY CELLS

- 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

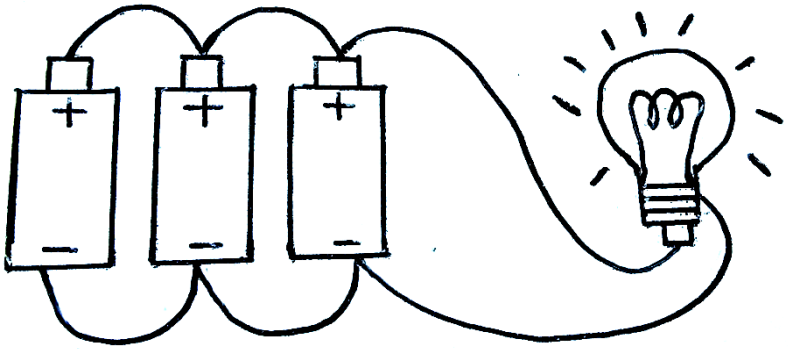
A DIAGRAM SHOWING SERIES CONNECTION OF DRY CELLS



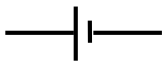
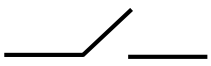
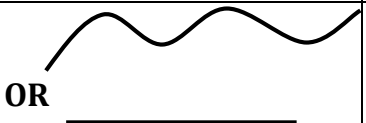
PARALLEL CONNECTION

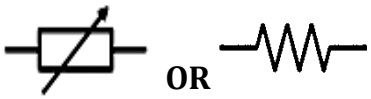
- This is when all positive terminals of dry cells are joined and all negative terminals are also joined in the circuit

A diagram showing parallel connection of dry cells



COMPONENTS (PARTS) OF AN ELECTRIC CIRCUIT, THEIR SYMBOLS AND FUNCTIONS.

COMPONENT	SYMBOL	FUNCTION
Dry cell (battery)		▪ It produces electricity ▪ It changes chemical energy to electrical energy
Bulb		▪ It produces light ▪ It changes electrical energy to heat and light energy
Switch		▪ It breaks or completes the circuit at one's will
Fuse	 OR	▪ It breaks the circuit in case of high voltage (too much flow of current)
Wire/conductor	 OR	▪ It conducts electricity in the circuit

Ammeter		▪ It measures electric current
Voltmeter		▪ It measures voltage (potential difference/electromotive force)
Ohmmeter		• It measures electrical resistance
Resistor	 **OR**	▪ It regulates electric current that flows in the circuit

DIAGRAMS SHOWING ELECTRIC CIRCUITS

DIAGRAM 1

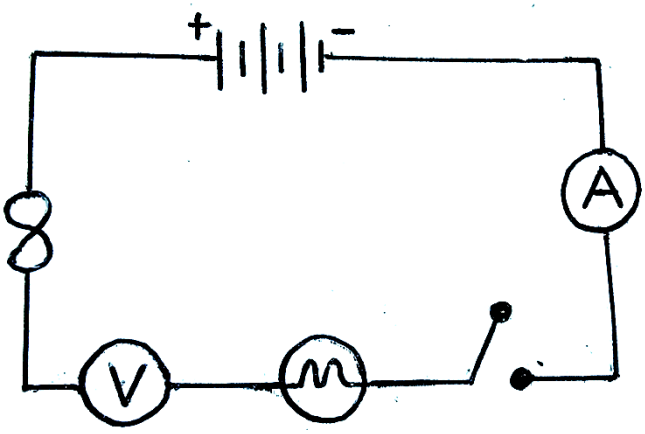
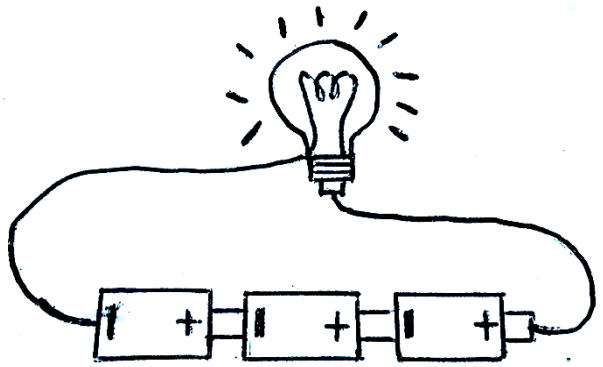


DIAGRAM 2



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 **Amperes (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

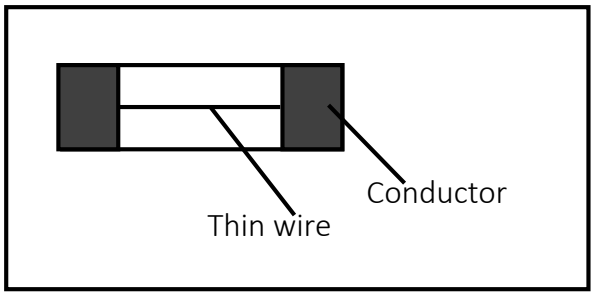
CIRCUIT BEAKER

- ✓ 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

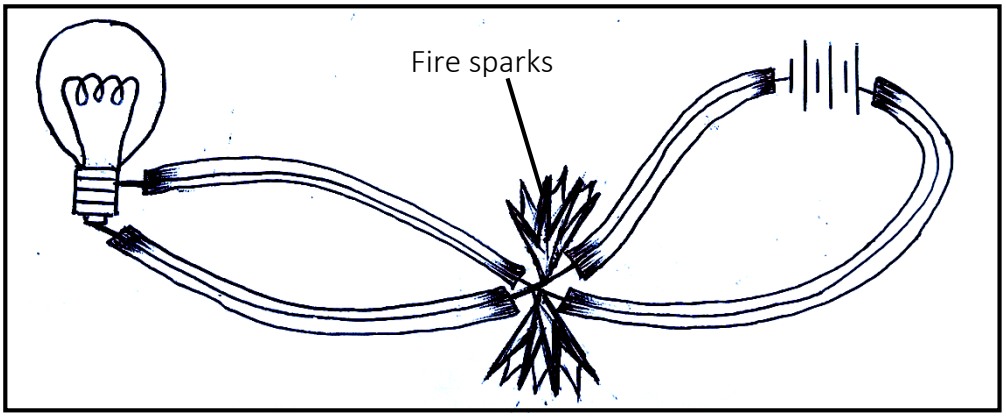
SHORT CIRCUIT

- 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
- Copper
- Gold
- Aluminium
- Zinc
- Brass
- Tin
- Iron
- Lead
- Tungsten
- Steel
- 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
- Hard water (undistilled water)
- Salt solution
- Alkalis
- Lemon juice
- Ammonium chloride paste

Examples of dilute acids used as electrolytes

- Dilute sulphuric acid
- Dilute hydrochloric acid
- Dilute nitric 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 cooking utensils
- They are used to make flat irons
- 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 wood
- Plastic
- Air
- Cotton wool
- Dry clothes
- Dry paper
- Porcelain
- Ceramic
- Diamond
- Asbestos
- Glass
- Gold
- Silk
- Distilled/pure water
- Quartz

- ✓ **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

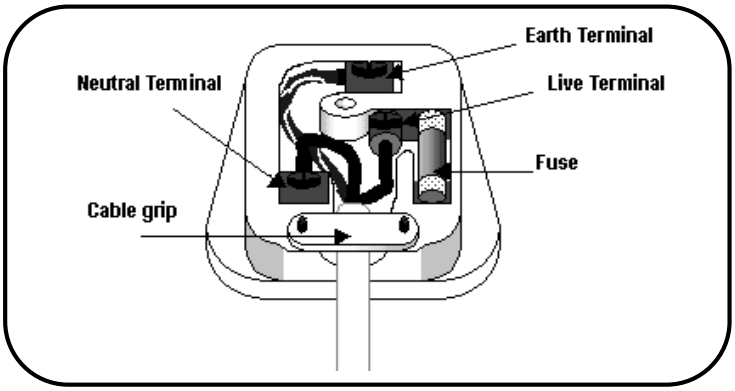
TYPES OF ELECTRIC PLUGS

- 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

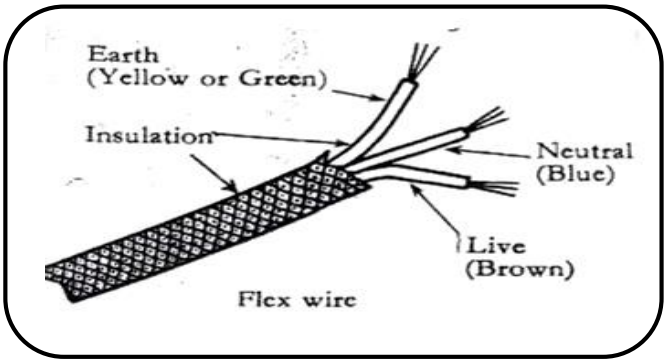
Cable grip

- 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 prevents 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

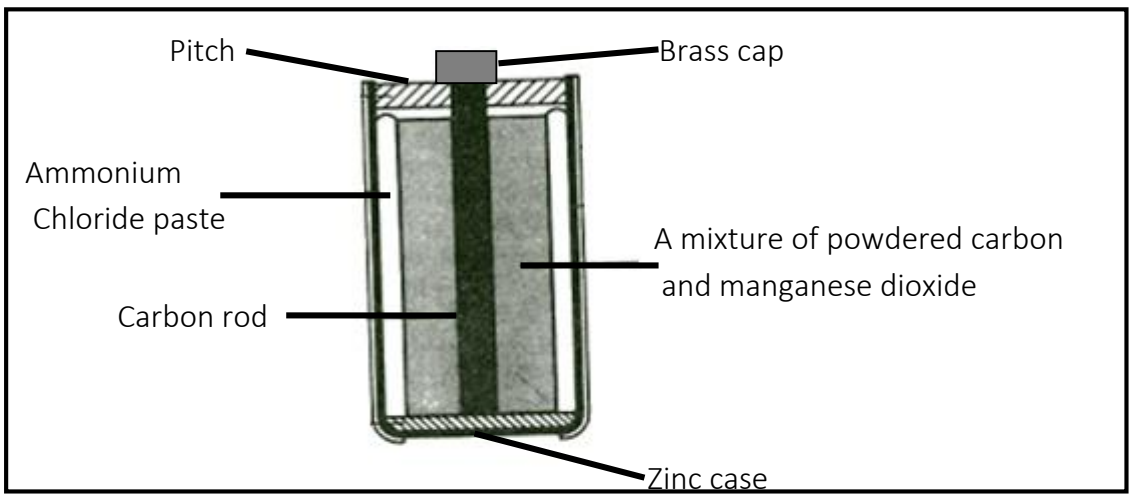
A DRY CELL

- 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

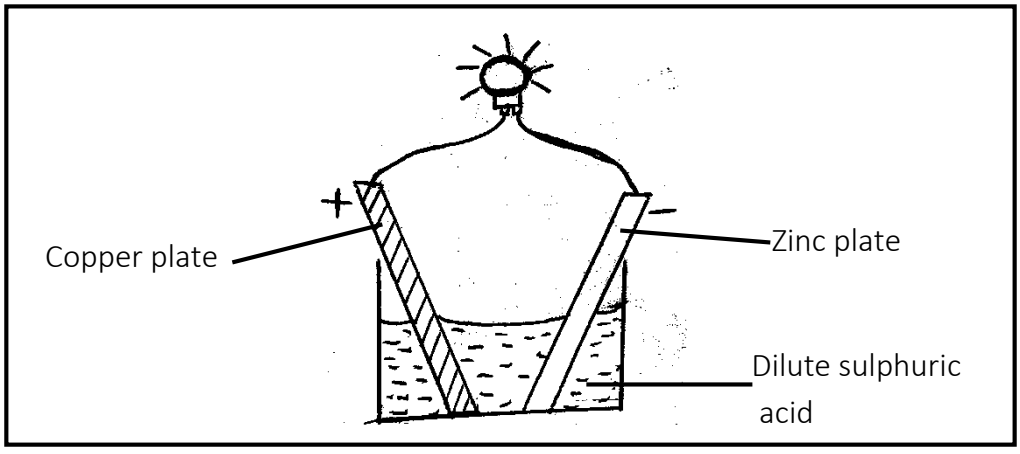
Functions of carbon powder in the dry cell

- 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



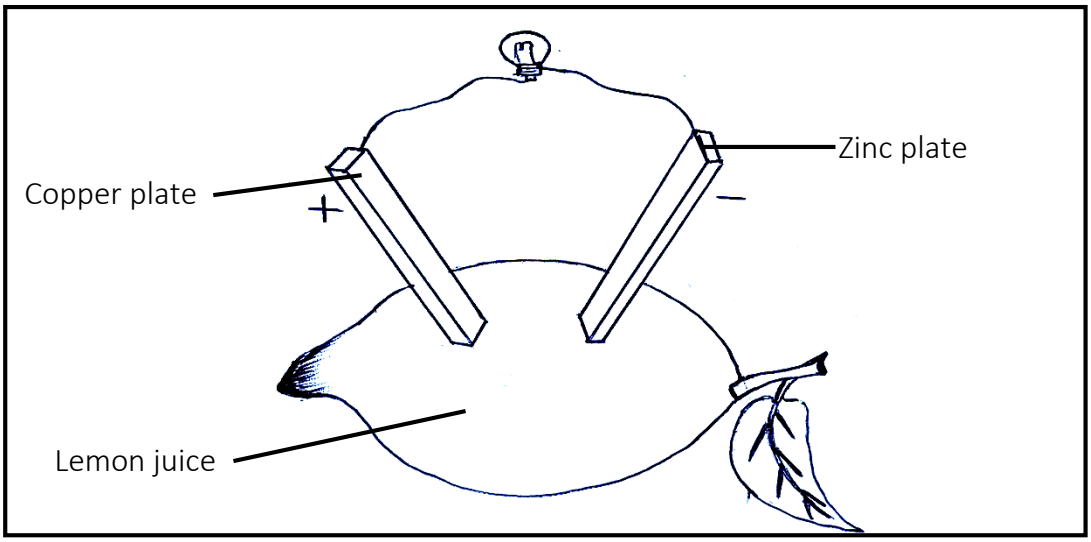
Fruits that can be used to make a simple cell at home

- 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 aid

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.

1 dry cell = 1.5 volts
7 dry cells = 7 X 1.5 Volts.
= 10.5 volts

Example II

If a torch uses 2 dry cells, calculate its voltage.

1 dry cell = 1.5 Volts
2 dry cells = 2 X 1.5 Volts.

= 3 Volts

Example III

A torch uses 9 Volts. Find the number of dry cells required to light its bulb.

1.5 V = 1 dry cell
9 V = 9 ÷ 15 dry cells
10
= 9 X 10 dry cells
15
= 6 dry cells

Example IV

A radio uses 24 Volts. How many pairs of dry cells does it use?

24 V = 1 dry cell
24 V = 24 ÷ 15 dry cells
10
= 24 X 10 dry cells
15
= 8 dry cells

2 dry cells = 1 pair
8 dry cells = 8 X 1 pairs
2

= 4 pairs of dry cells

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

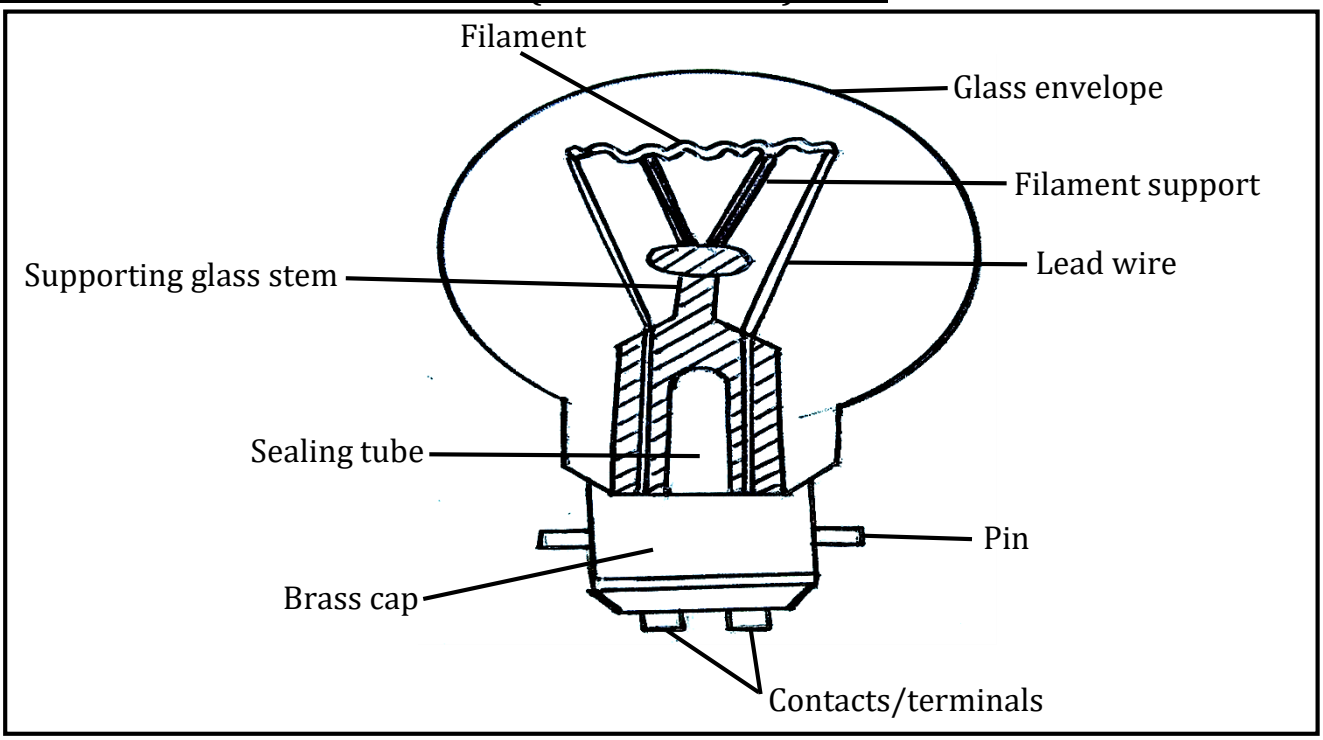
Advantages of using fluorescent bulbs

- 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
- Xenon
- Krypton
- Helium
- Radon

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

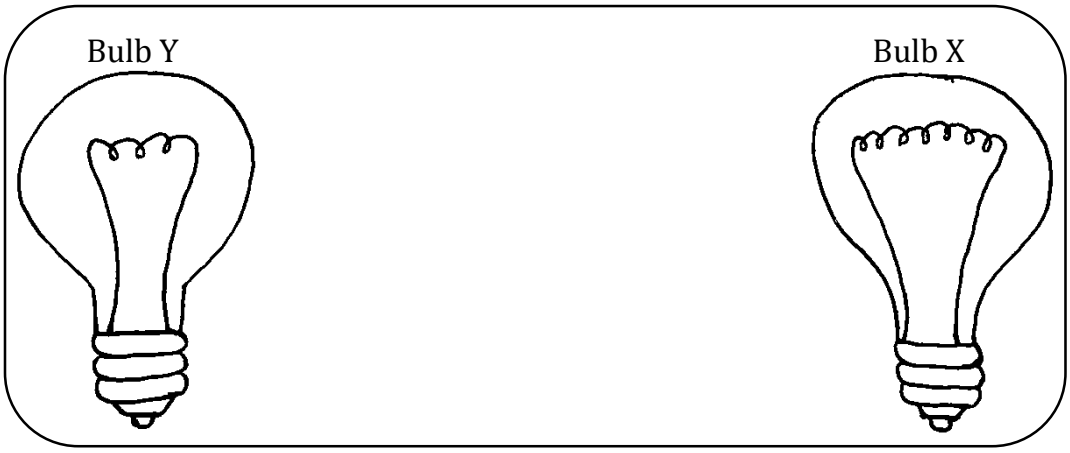
What energy change occurs on the filament of an electric bulb?

- 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

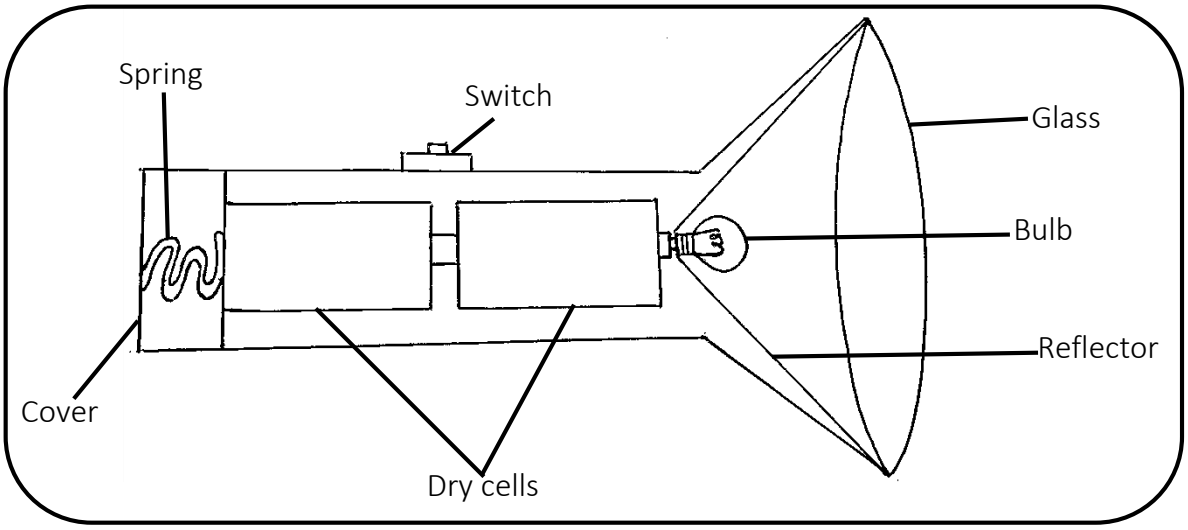
On which principle does a torch work?

- 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)

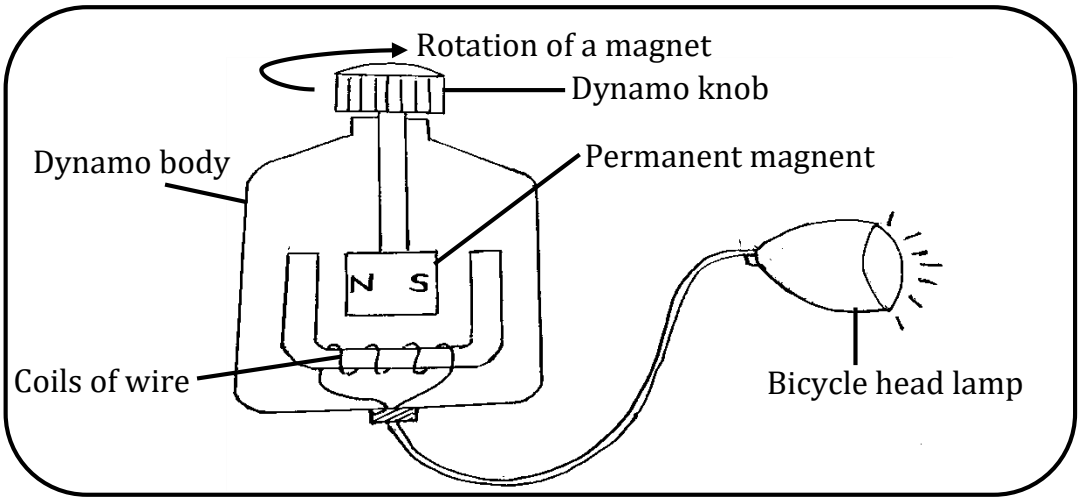
USES OF DYNAMOS

- 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
- Juice blender
- Washing machine
- CD player
- Cassette player
- Milling machine
- Electric car

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

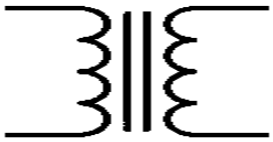
How does a motor differ from a dynamo/generator/alternator?

- 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

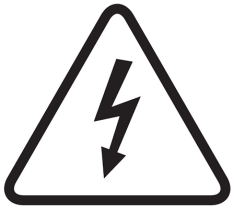
- It reduces electricity in an area

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 trees during thunderstorm

ELECTRIC APPLIANCE

- This is a device that uses electricity to work.

DOMESTIC DEVICES THAT USE ELECTRICITY (ELECTRIC APPLIANCES)

- Electric flat iron
- Refrigerator
- Water heater
- DVD player
- Television
- Computer
- Electric flat iron
- Electric fan
- Electric charger
- Electric hair dryer
- Air conditioner
- Electric torch
- Electric cooker
- Electric kettle
- Microwave oven
- Electric bulb
- Juice blender
- 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 **S**ee **N**ow

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
- Plastic
- Wood
- Paper
- Glass
- Cloth
- Aluminum
- Copper
- Silver
- Brass

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

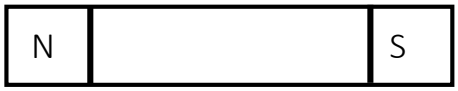
POLES OF A MAGNET (MAGNETIC POLES)

- 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

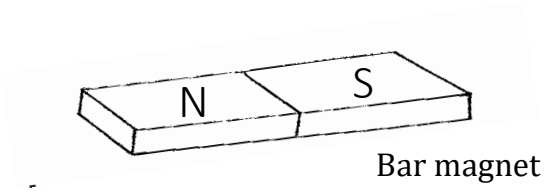
MATERIALS USED TO MAKE PERMANENT MAGNETS

- Steel
- Nickel
- Cobalt

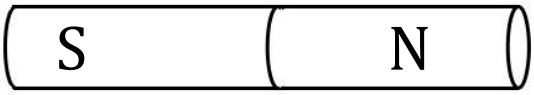
Why is steel used to make permanent magnets?

- Steel is difficult to be demagnetized

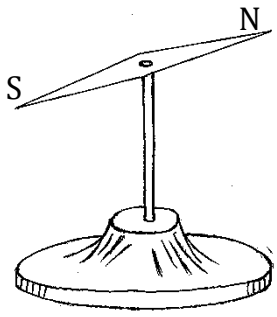
EXAMPLES / TYPES (SHAPES) OF PERMANENT MAGNETS



Bar magnet

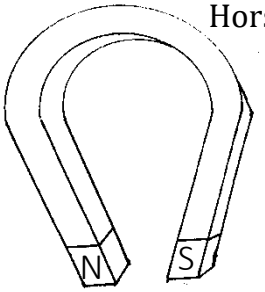


Cylindrical magnet

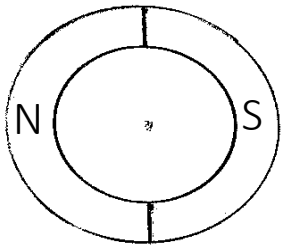


Needle shaped magnet

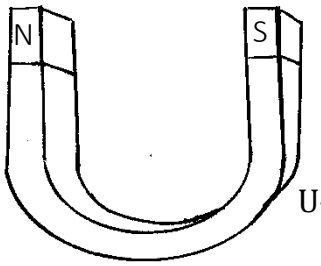
(Magnetic compass needle)



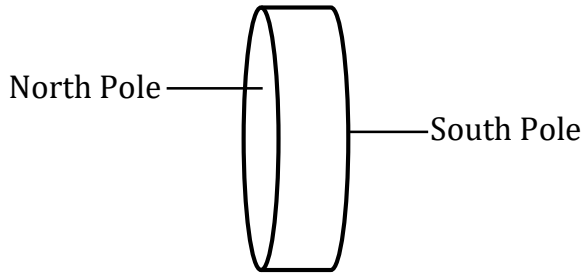
Horseshoe magnet



Ring magnet



U-shaped magnet



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

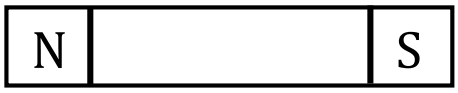
- Iron makes temporary magnets while steel makes permanent magnets
- Iron is easy to magnetize while steel is difficult to magnetize
- Iron loses magnetism in a short time while steel keeps magnetism for a long time

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

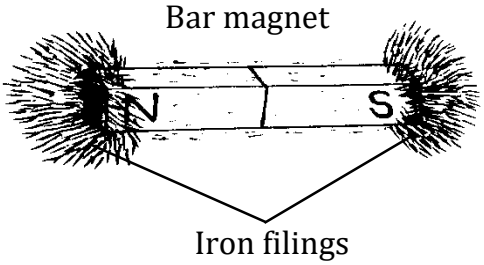
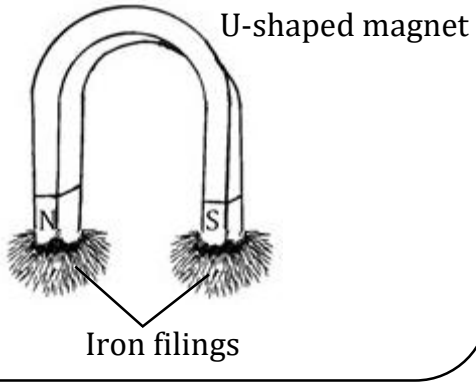


ILLUSTRATION II



3. A freely suspended bar magnet rests in the north-south direction.

ILLUSTRATION I

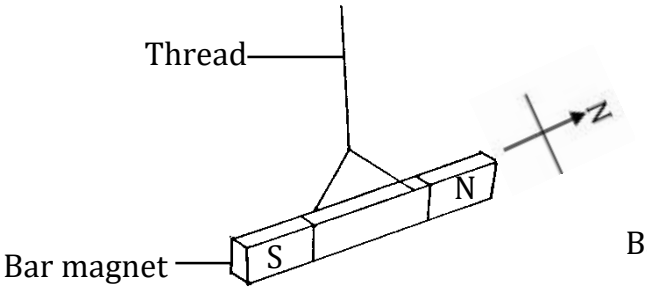
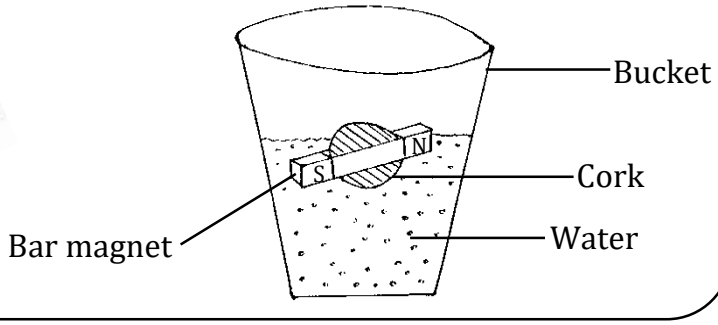


ILLUSTRATION II



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?

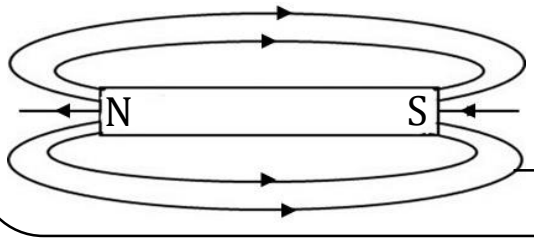
- It points towards the south when a bar magnet is suspended freely

State the importance of a thread in the experiment above.

- It holds the bar magnet when suspended freely

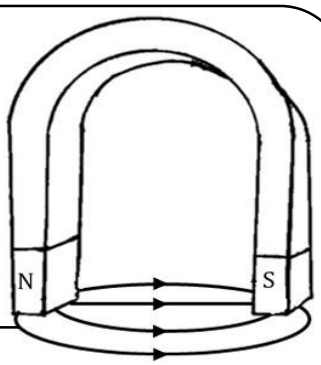
4. Magnetic lines of force run from North Pole to South Pole.

ILLUSTRATION I



Magnetic lines of force
(Magnetic field lines)

ILLUSTRATION II



5. Like poles of magnets repel.

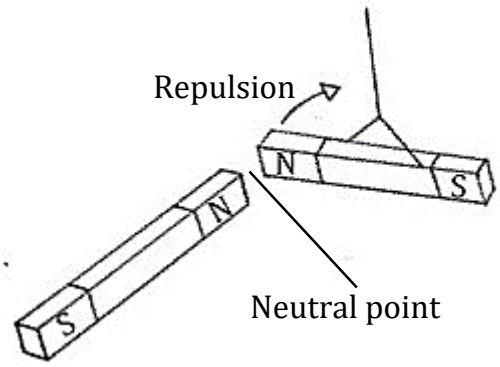
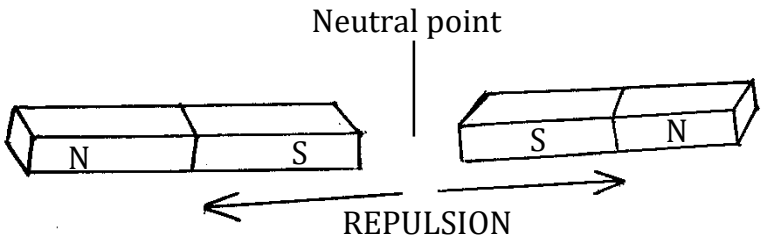


ILLUSTRATION I



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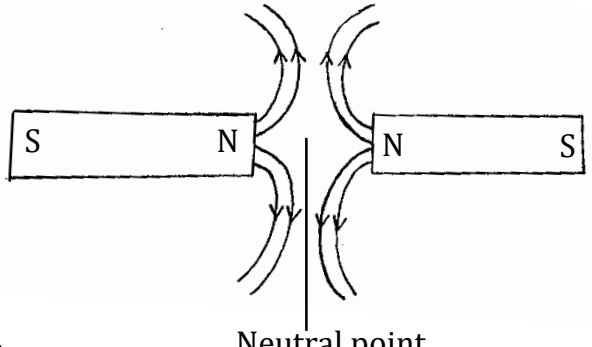


ILLUSTRATION III

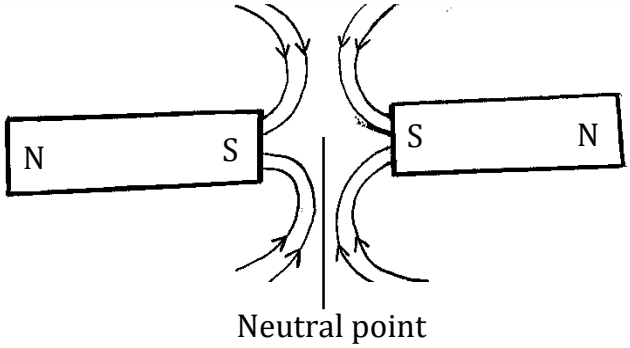


ILLUSTRATION IV

What is a neutral point?

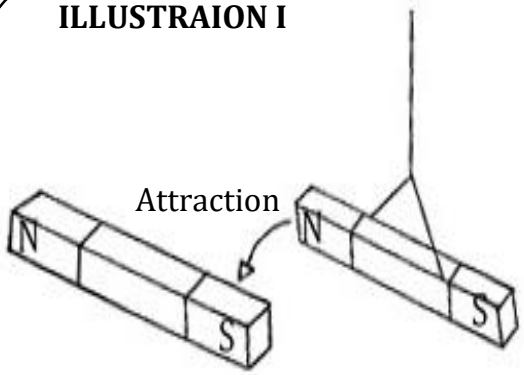
- This is the point where the resultant magnetic field is zero
- This is a point between like poles of magnets at which magnetism is not felt

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.

ILLUSTRAION I



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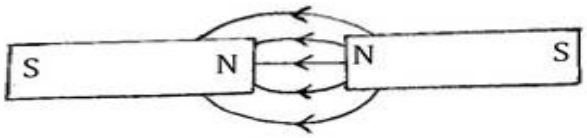
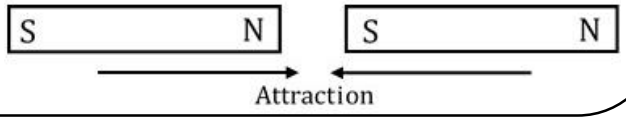


ILLUSTRATION III



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

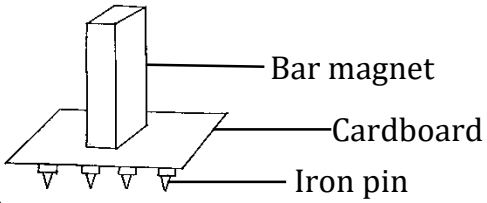
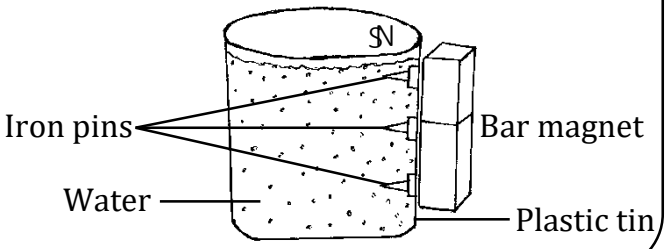


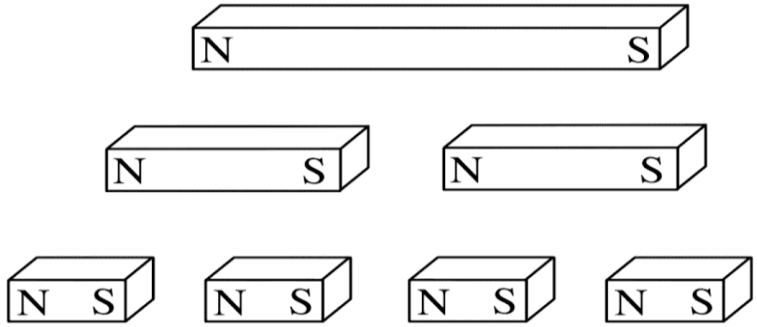
ILLUSTRATION II



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 KEEPERS

ILLUSTRATION I

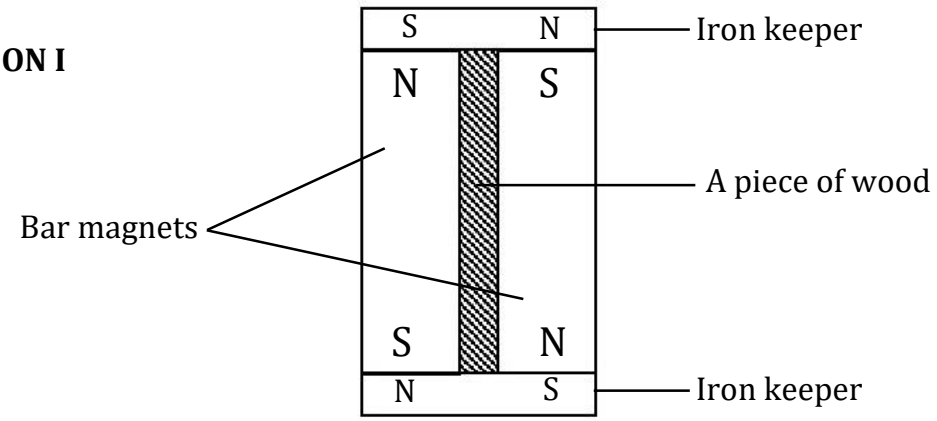


ILLUSTRATION II

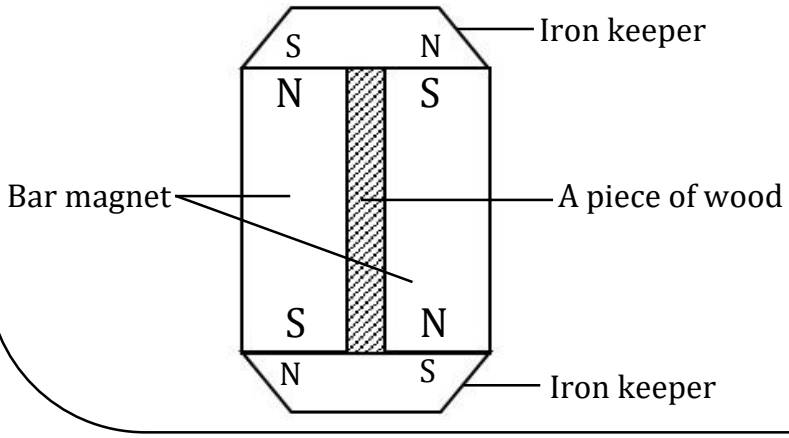
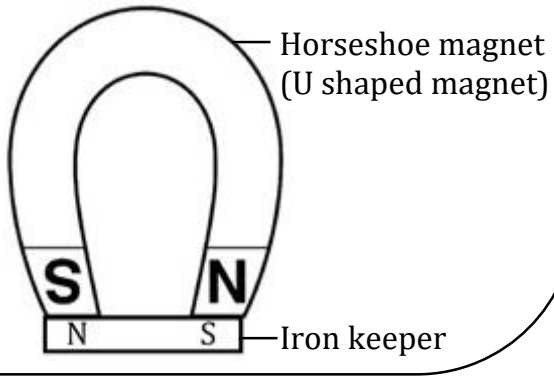


ILLUSTRATION III



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

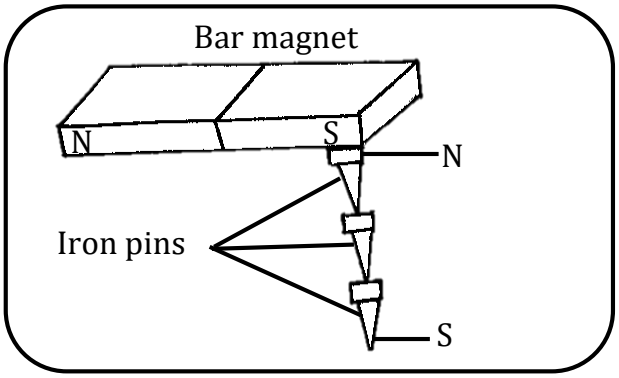
What type of magnets are made by induction method?

- 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)

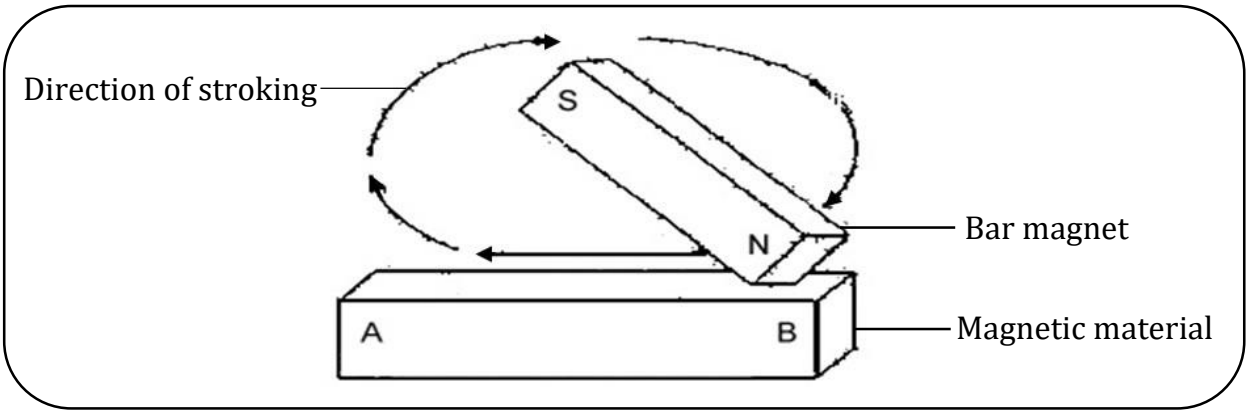
- Single stroke method/single touch method/single stroking
- Double stroke method/double touch method/double stroking

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

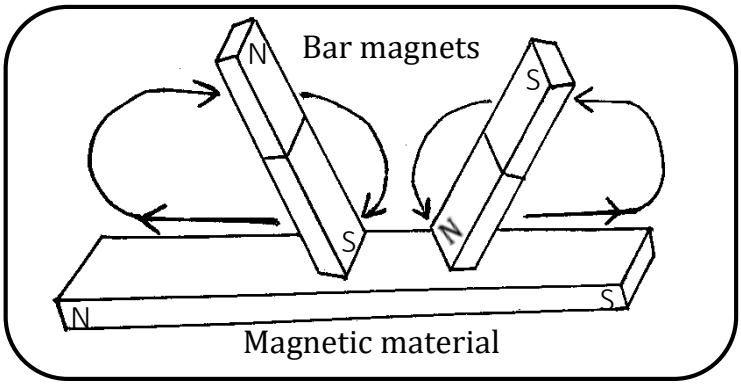
DOUBLE STROKING (DOUBLE TOUCH METHOD)

- 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

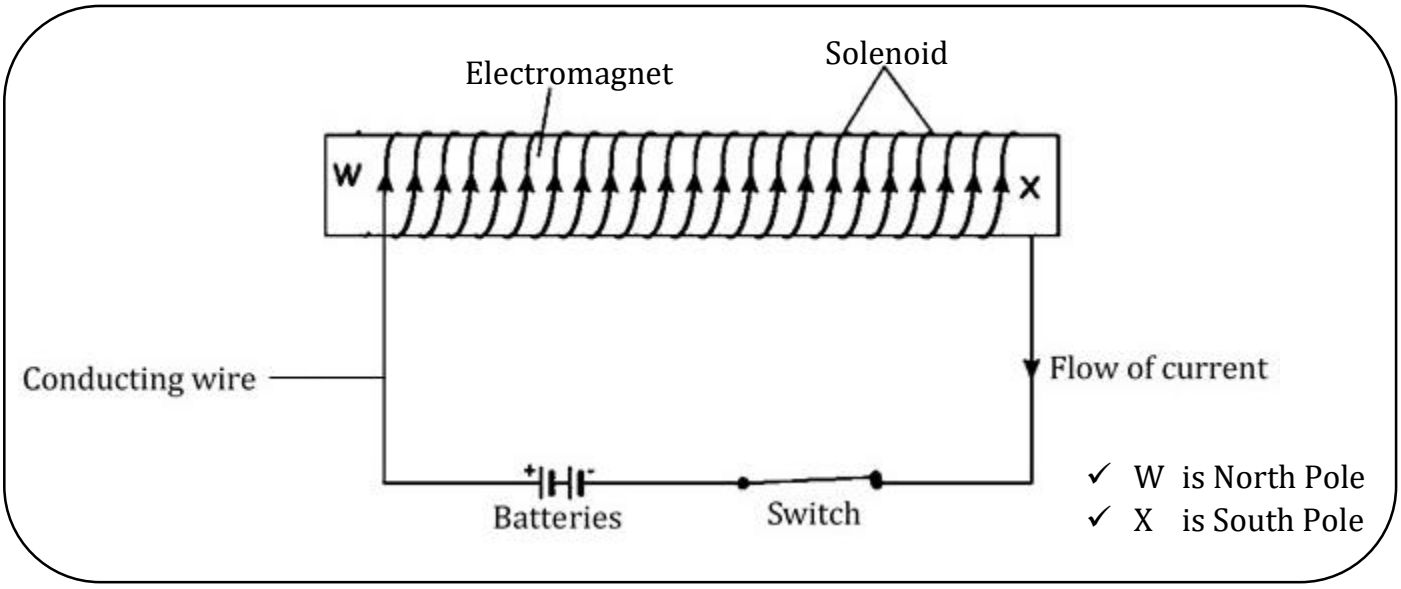
What is a solenoid?

- 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

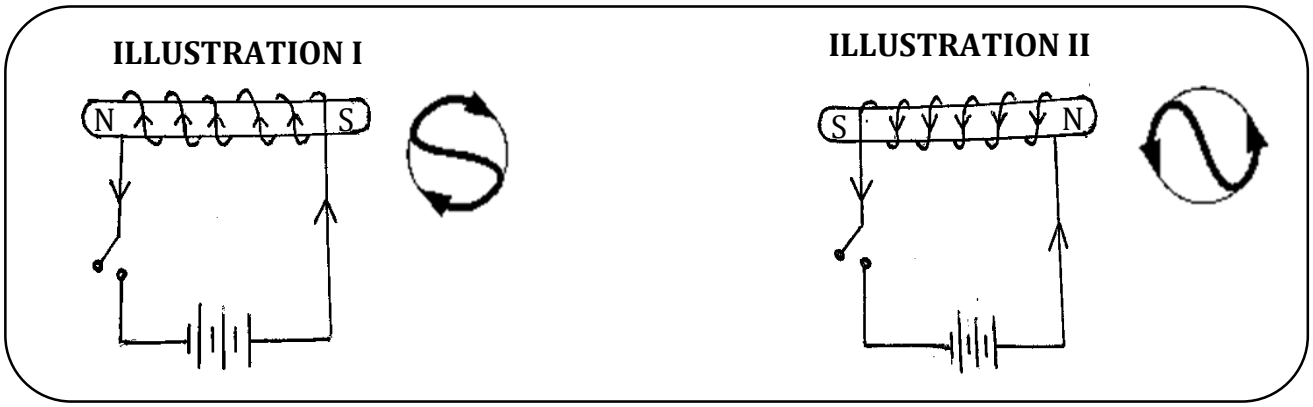
- Increasing the current or voltage
- Increasing the number of turns in the coil (Adding more coils in the solenoid)
- Using soft iron core in the solenoid (Using soft iron instead of steel in the solenoid)

Advantage of using electrical method of magnetization

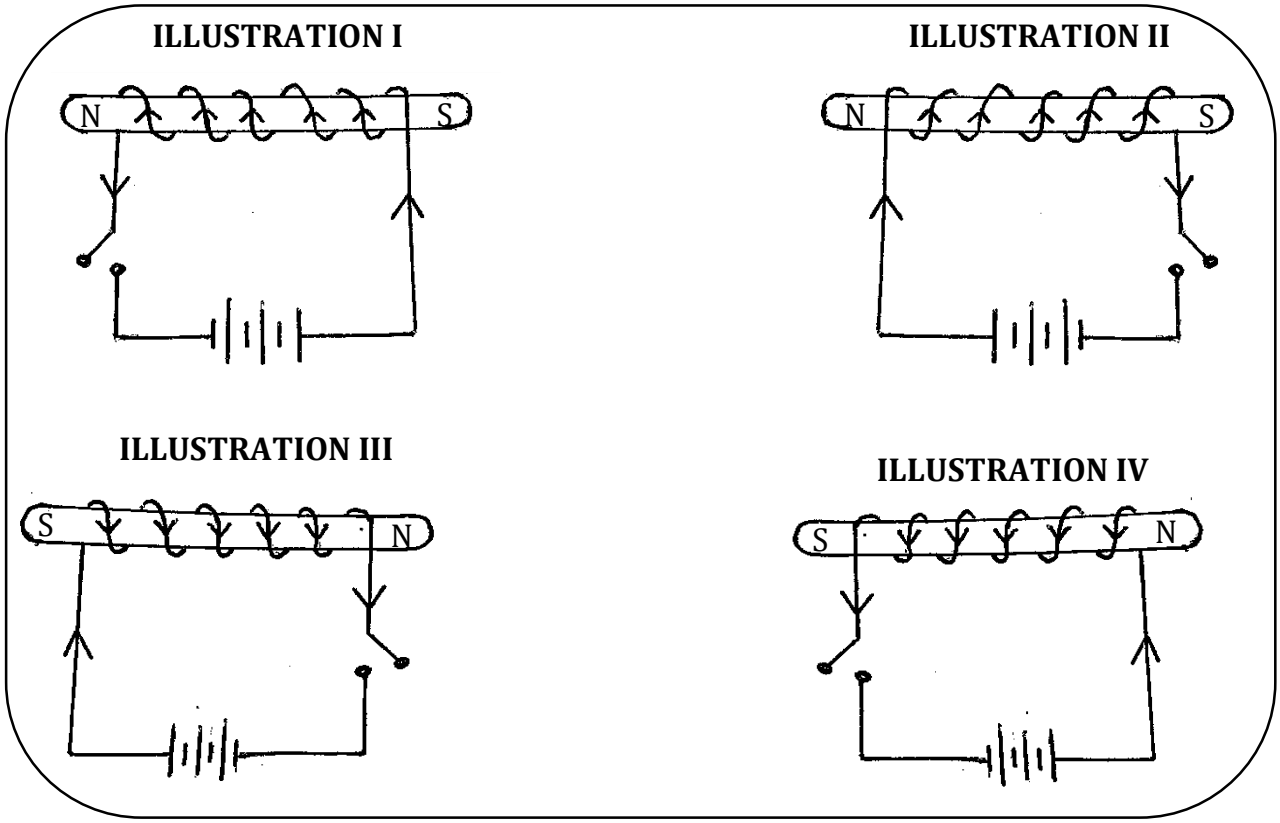
- The strength of an electromagnet can be increased

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.



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.



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
- Pilots
- Cobblers
- Electricians
- Chefs
- Meteorologists
- Doctors/oculists

DEVICES THAT USE MAGNETISM ONLY

- Magnetic tape
- Magnetic compass

DEVICES THAT USE BOTH ELECTRICITY AND MAGNETISM

- Electric bell
- Electric motor
- Generator
- Refrigerator
- Microphone
- Loudspeaker
- MRI scanners

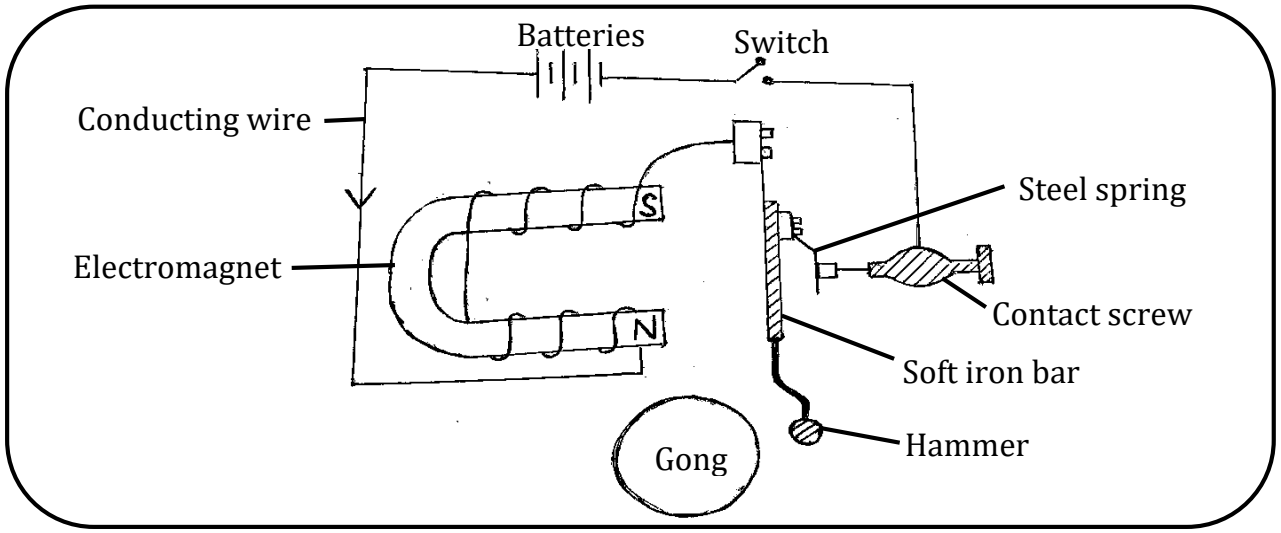
ELECTRIC BELL

- 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
- Animals
- Sun
- Air or wind
- Water

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
- Charcoal
- Saw dust
- 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 increases the rate of deforestation
- It puts soot on utensils
- 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

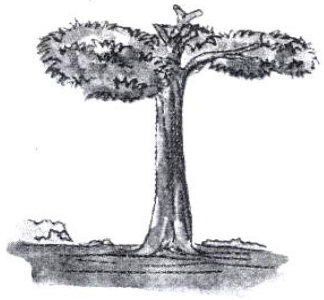
BETTER METHODS OF HARVESTING WOOD

- 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 fruits 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. 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 not grow new branches

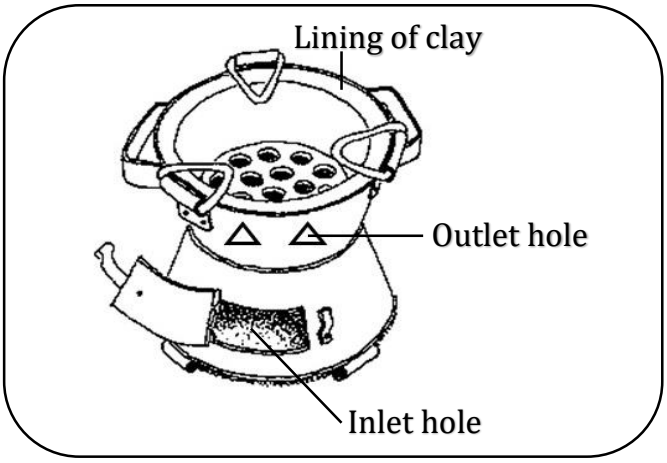
NOTE:

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

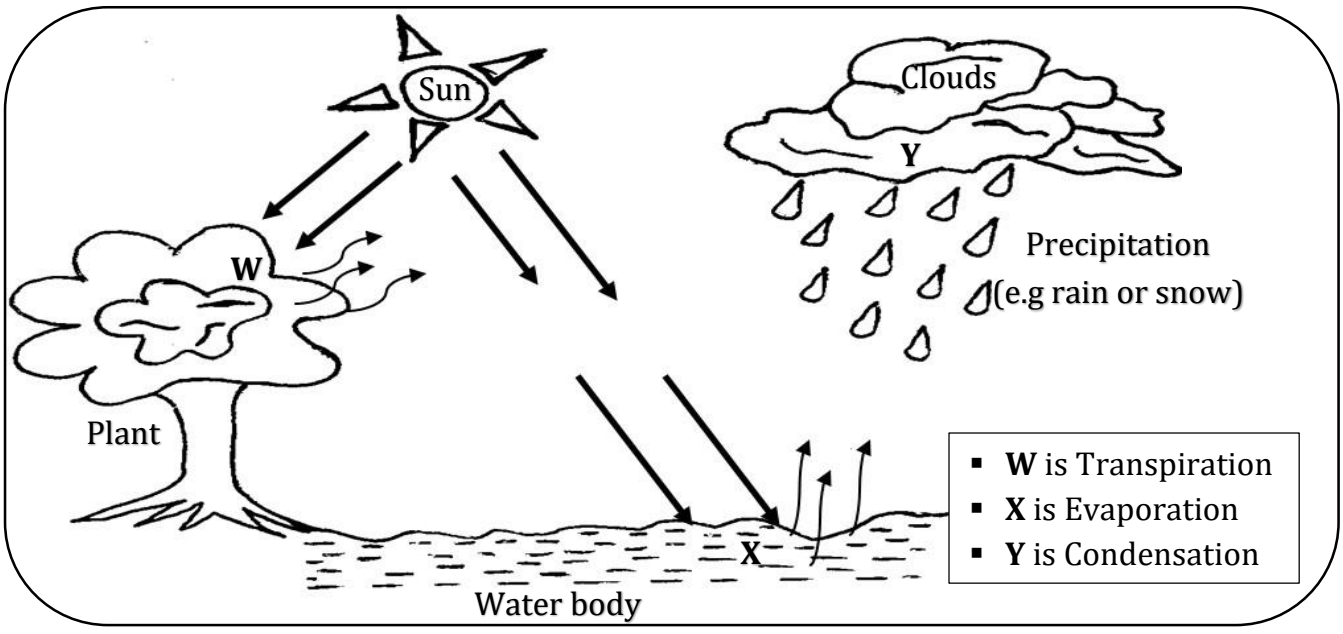
Name the three processes involved in the water cycle

- 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 avoiding bush burning
- By planting trees to help in rain formation

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 for heating
- It is used as fuel in some vehicles

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?

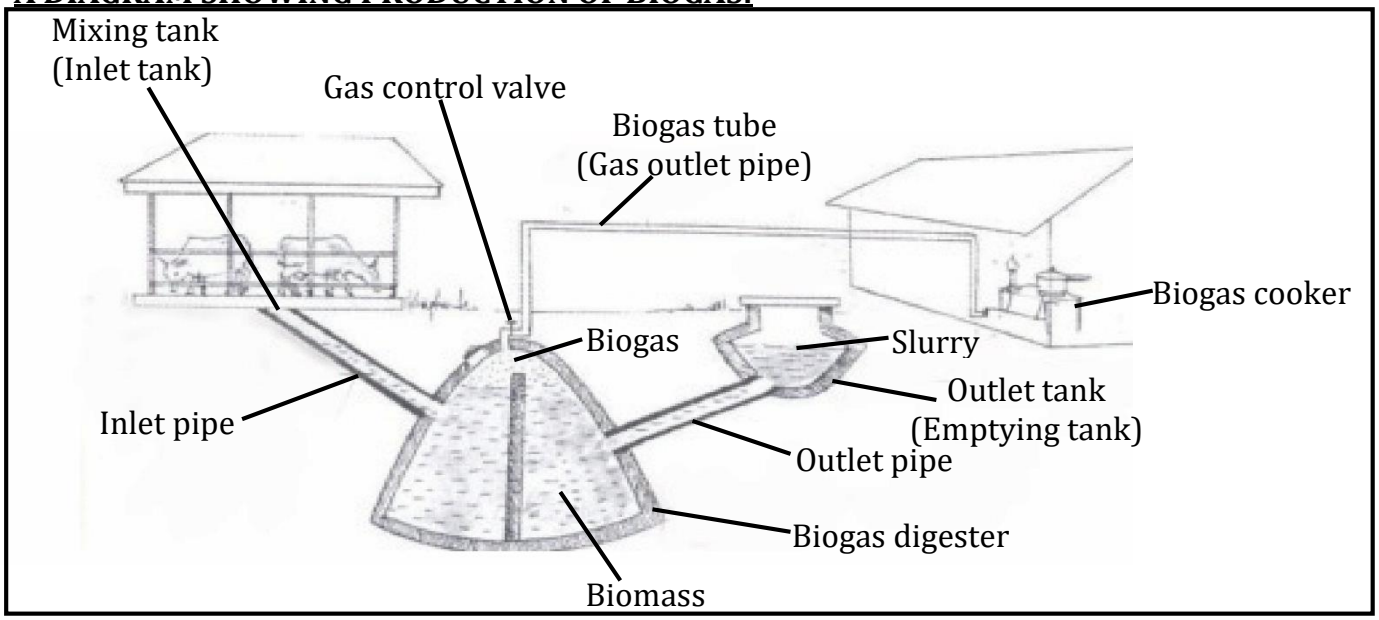
- They do not need oxygen for respiration.

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 heating
- It is used for lighting

Examples of equipment that uses biogas

- Biogas stoves (biogas cooker)
- Biogas incubators
- Biogas lamps

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
- Retention time
- PH value
- Stirring (mixing) intensity
- Loading rate (Nutrient supply)

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%
- Oxygen: 21%
- Rare gases: 0.97%
- 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 turns windmills
- It is used to fly kites
- It sails boats and dhows
- It helps in pollination
- It helps in drying of clothes
- It helps in seed dispersal

How does wind help in drying of clothes?

- By increasing the rate of evaporation
- By blowing away moisture from clothes

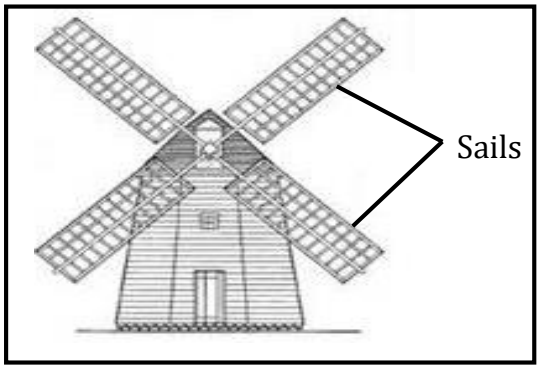
Which property of air enables wind to dry wet clothes at night?

- 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
- Silting
- 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 destroy 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 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
- 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
- Deformations of the objects
- Molecular adhesion (attractive forces between surfaces in contact)

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 boy sitting on a desk
- A stone resting on ground

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 ball rolling on ground
- A tyre of moving car on the road

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?

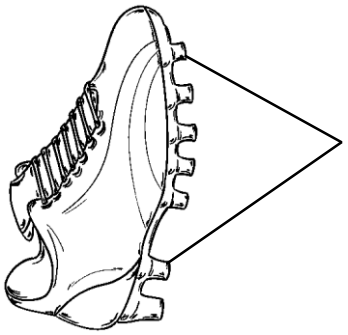
- By putting grips on motorcycle handles

Of what importance are the rough surfaces in palms of hands and soles of feet?

- To increase friction

DIAGRAMS SHOWING THINGS THAT INCREASE FRICTION

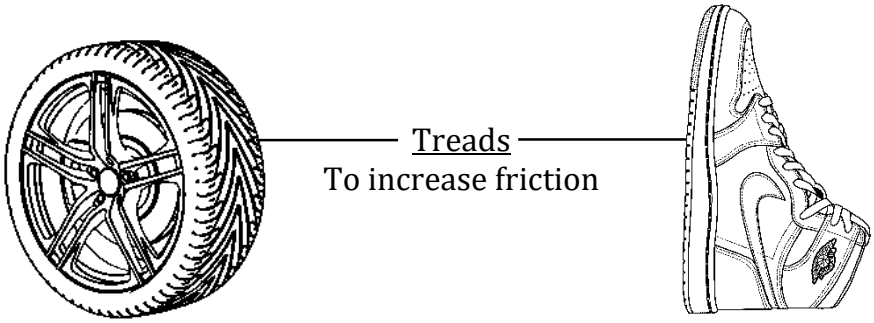
SPIKES ON SPORTS SHOE



Spikes

✓ To increase friction

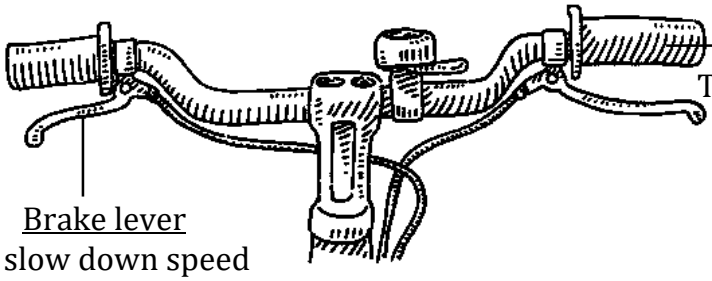
TREADS ON CAR TYRE AND SCHOOL SHOE



Treads

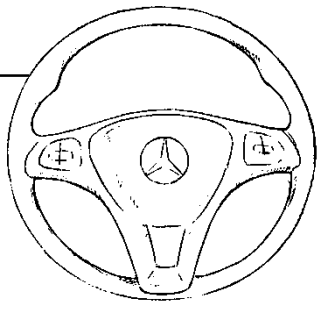
To increase friction

GRIPS ON CAR STEERING WHEEL AND BICYCLE HANDLES



Grips

To increase friction



Brake lever

To slow down speed

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

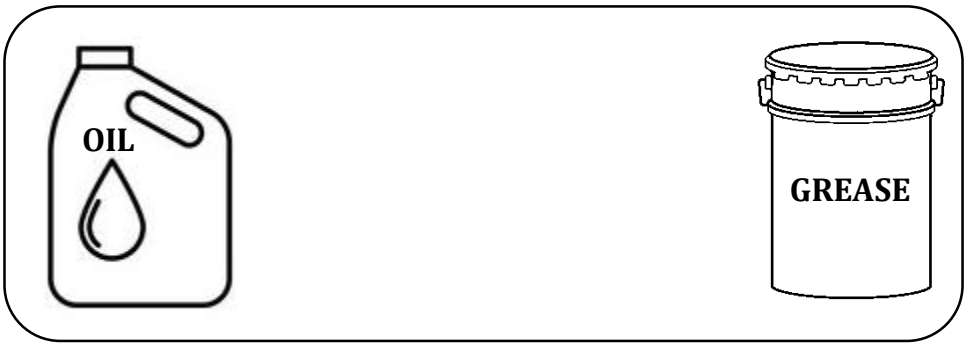
LUBRICANTS

- 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

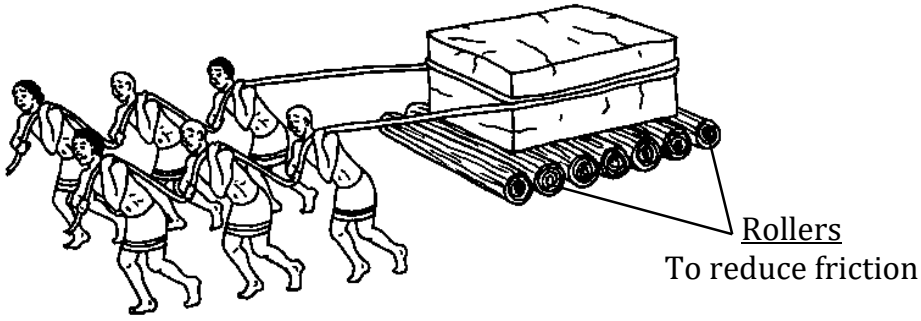
Besides reducing friction, give other reason why moving parts (e.g. door hinges) should be lubricated?

- To prevent rusting

Why is it bad to lubricate brake pads of bicycles?

- It reduces friction hence making braking of bicycle difficult.

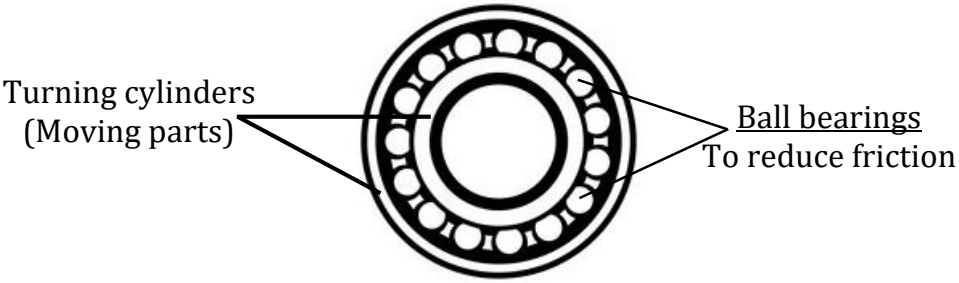
A DIAGRAM SHOWING ROLLERS



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

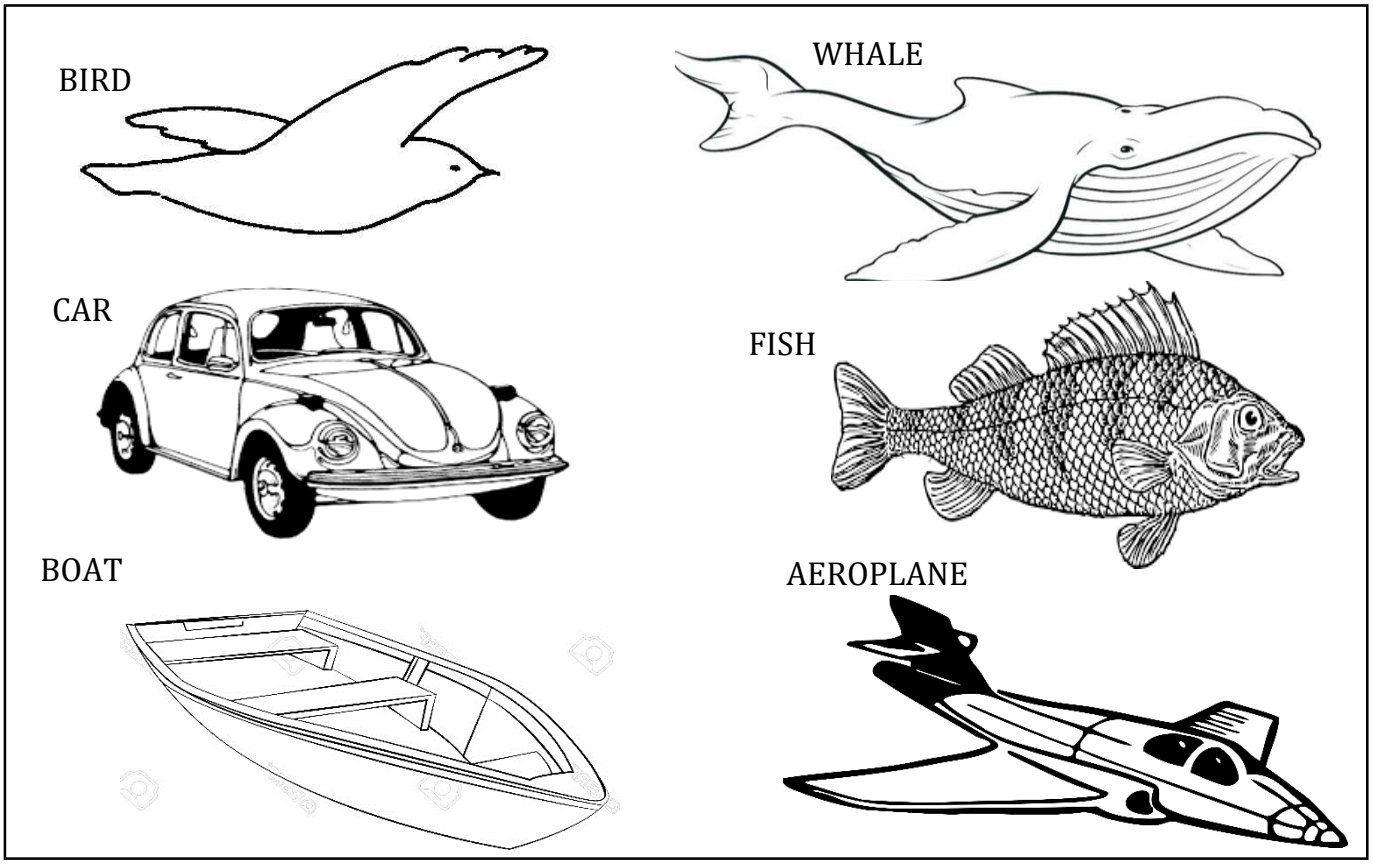
EXAMPLES OF STREAMLINED NON- LIVING OBJECTS

- Aeroplane
- Car
- Boat
- Ship
- Rocket
- Jet fighter

Examples of streamlined animals

- Fish
- Bird
- Bat
- 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
- Panga
- Hoe
- Axe
- Ladder
- Broom
- Borehole
- Nut cracker
- 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

- Levers
- Inclined planes (slopes)
- Wedges
- Screws
- Pulleys
- Wheel and axle

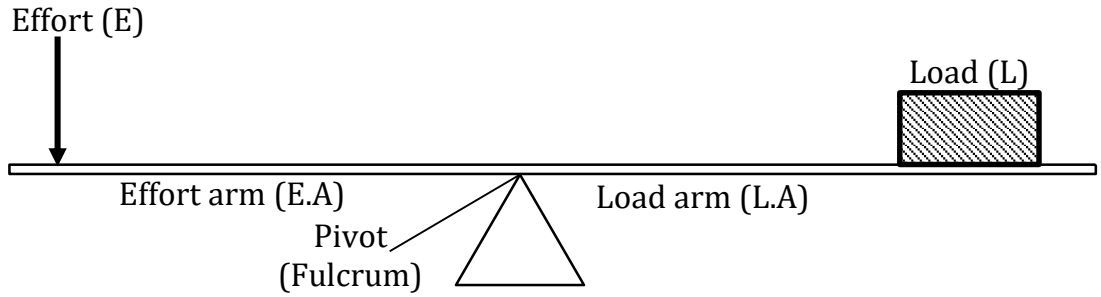
LEVERS

- 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

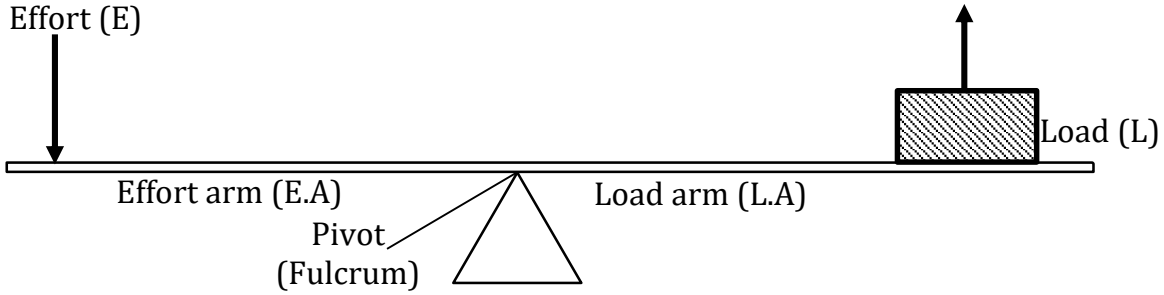
What factor determines the class of lever?

- 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

- See-saw
- Beam balance
- Scissors
- Pliers
- Crowbar
- Pincers
- Lid opener
- Shears
- Claw hammer
- Borehole
- Secateurs

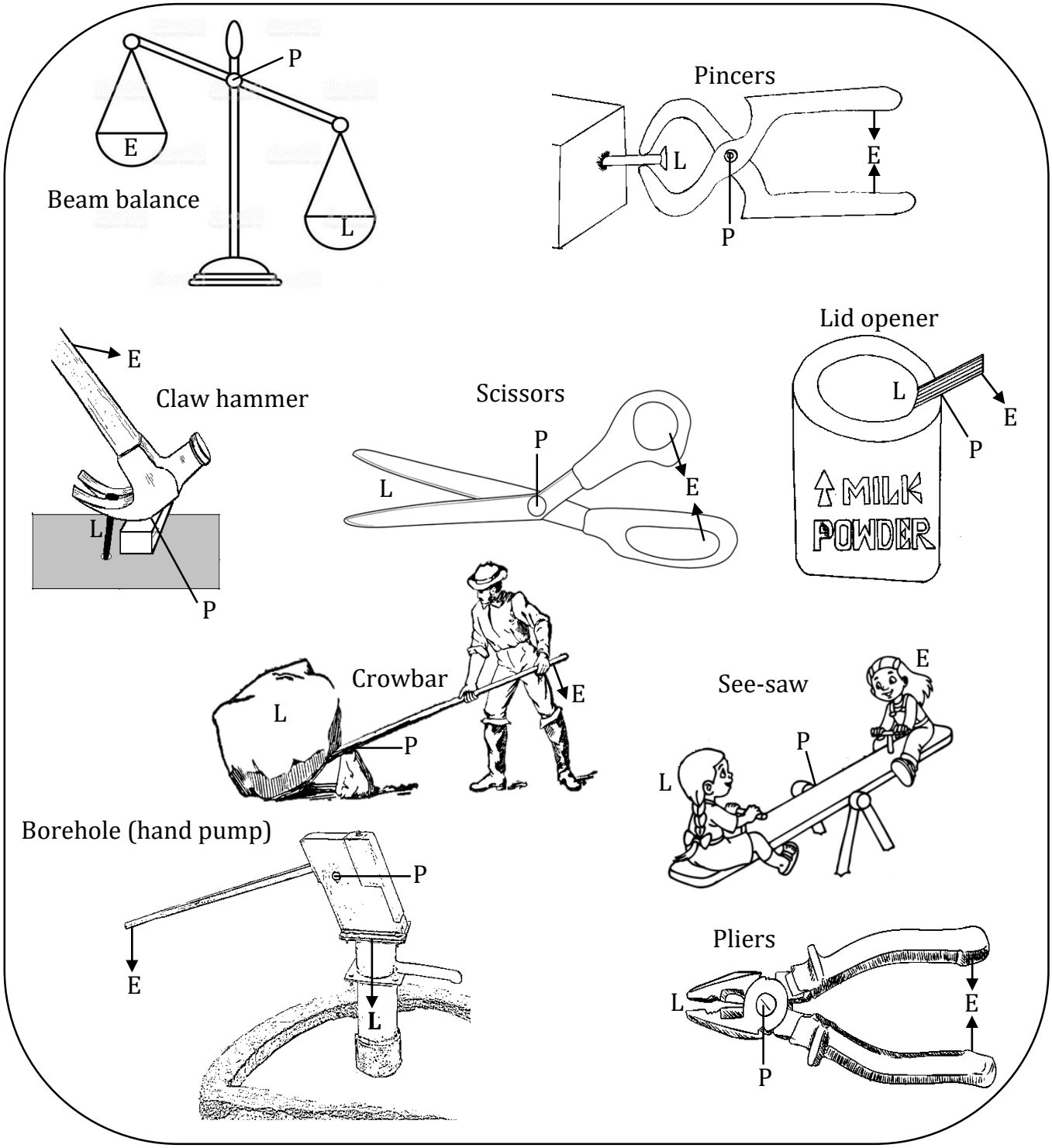
How do first class levers simplify work? (Advantages of using first class levers)

- 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



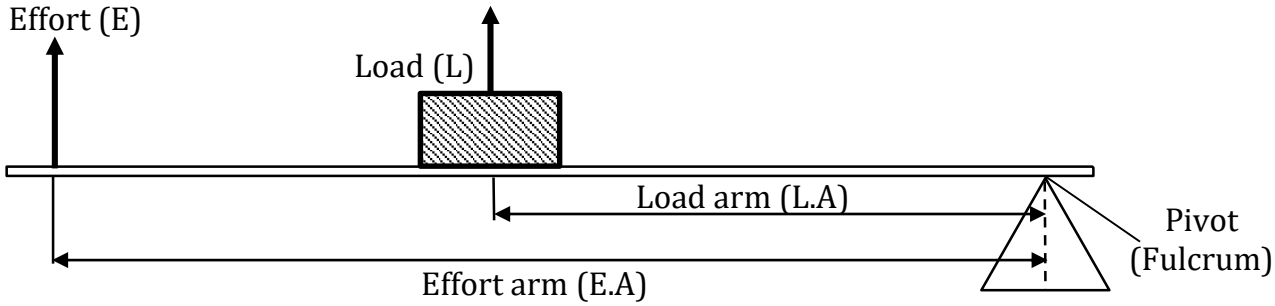
Uses of first class levers in our daily life

- 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)

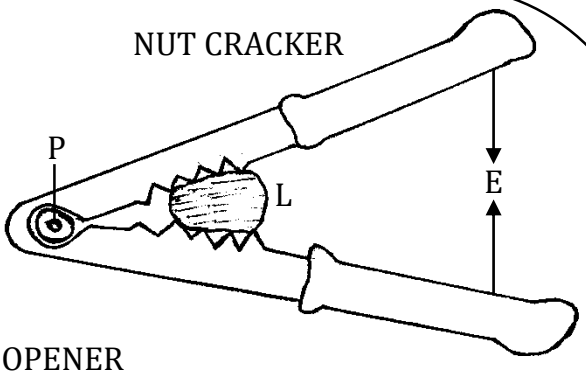
How do second class levers reduce the effort needed to do work?

- By increasing effort arm (By making effort arm longer than load arm)

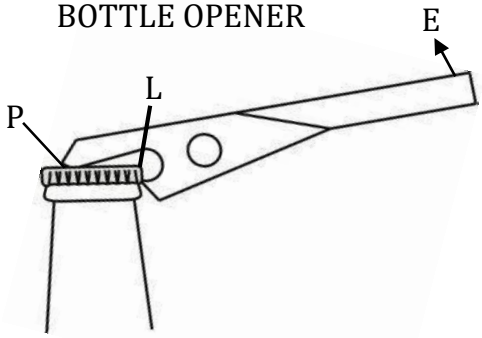
DIAGRAMS SHOWING SECOND CLASS LEVER MACHINES

WHEELBARROW

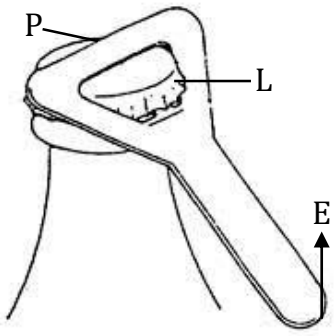
NUT CRACKER



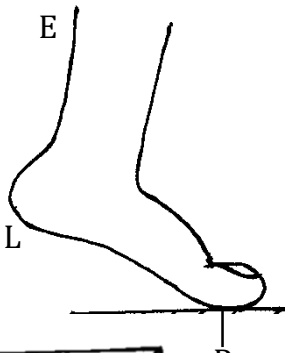
BOTTLE OPENER



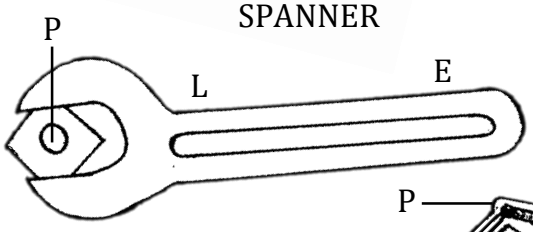
BOTTLE OPENER



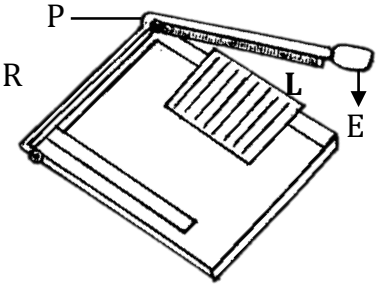
HUMAN FOOT



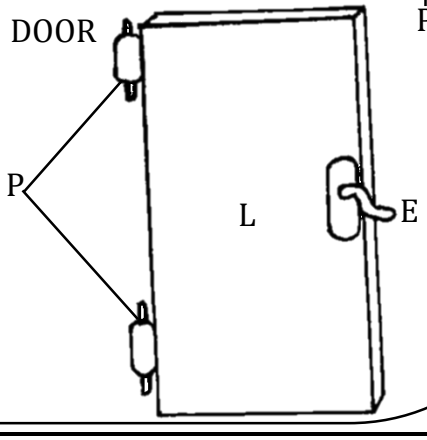
SPANNER



PAPER CUTTER



DOOR



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

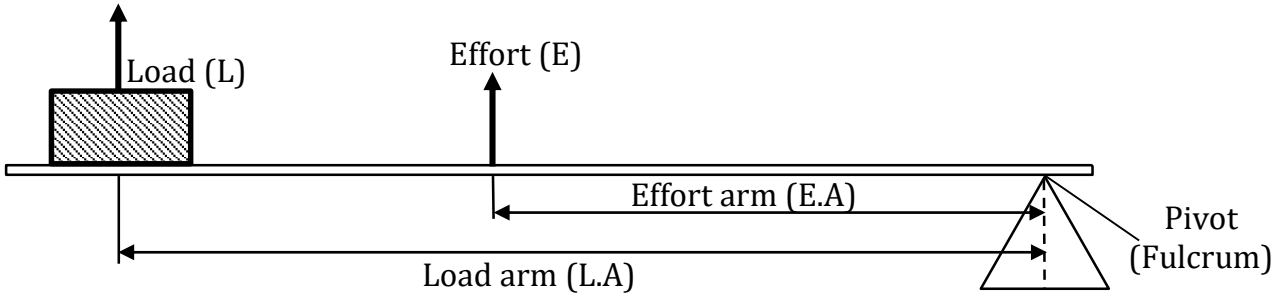
Why are scissors, pliers, pincers, shears, secateurs and nut crackers called double levers?

- 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?

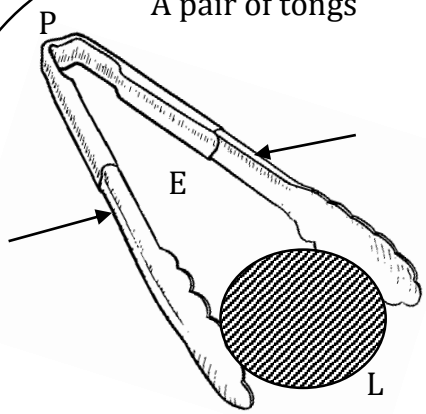
- It reduces the effort distance and increases load distance to increase the speed of doing work

Disadvantage of using third class levers

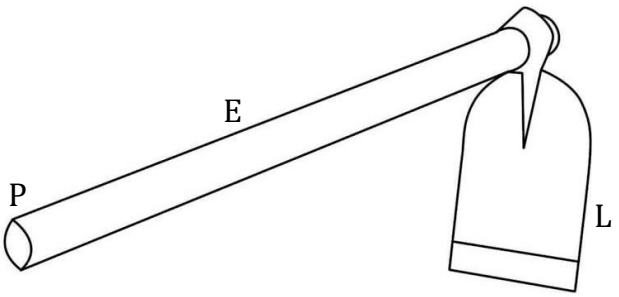
- They use much effort to do work

DIAGRAMS SHOWING THIRD CLASS LEVER MACHINES

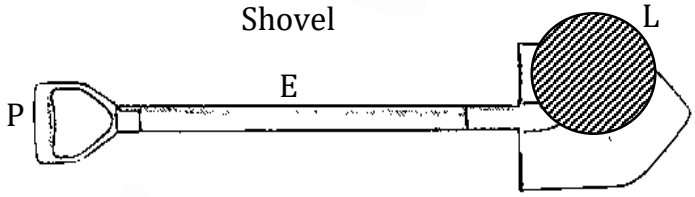
A pair of tongs



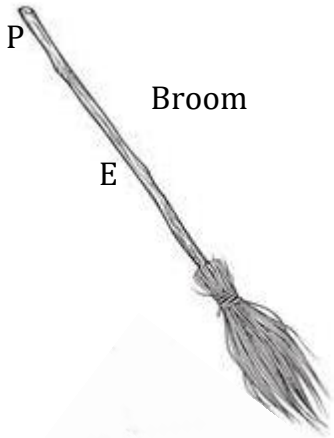
Hoe



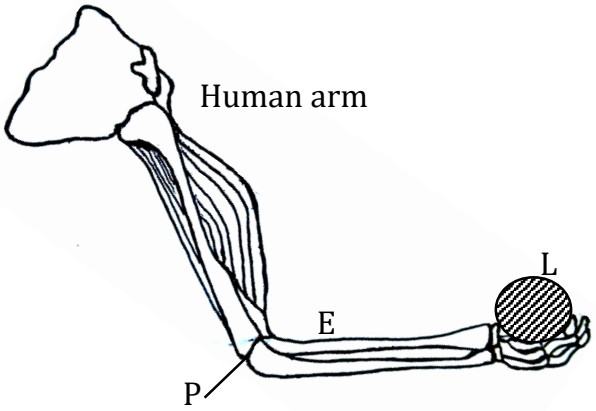
Shovel



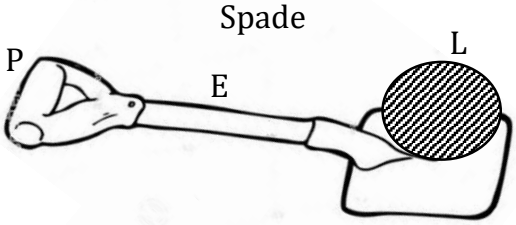
Broom



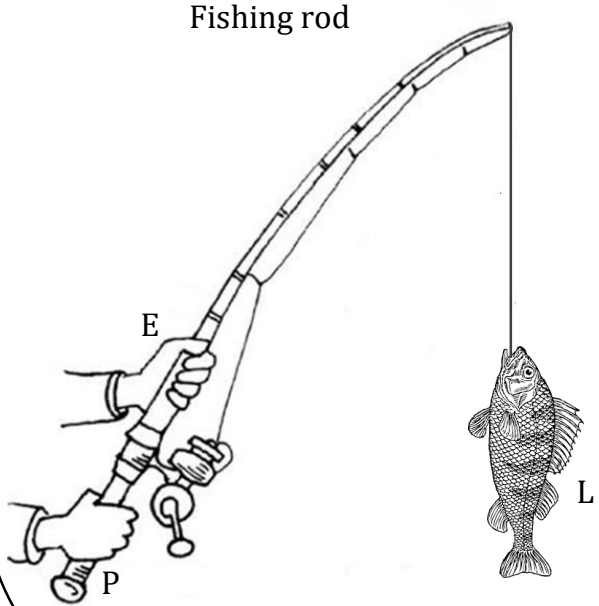
Human arm



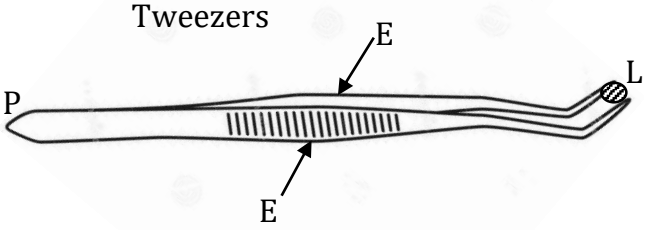
Spade



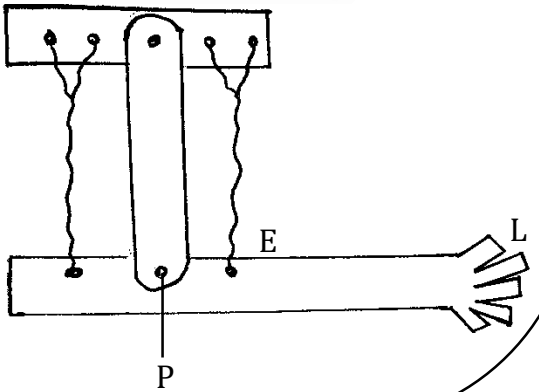
Fishing rod



Tweezers



Artificial arm



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

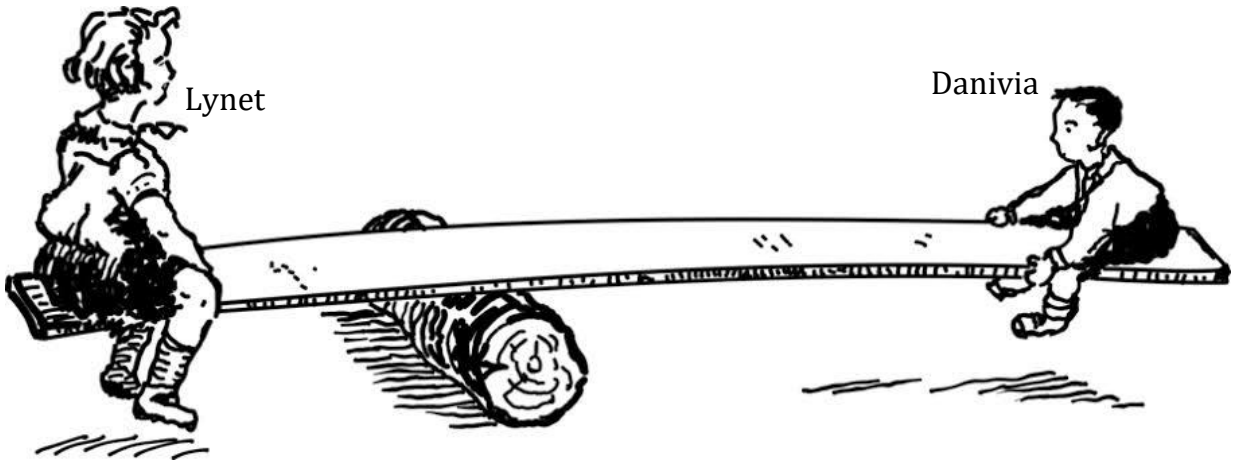
Effort x Effort arm = Load X Load arm

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

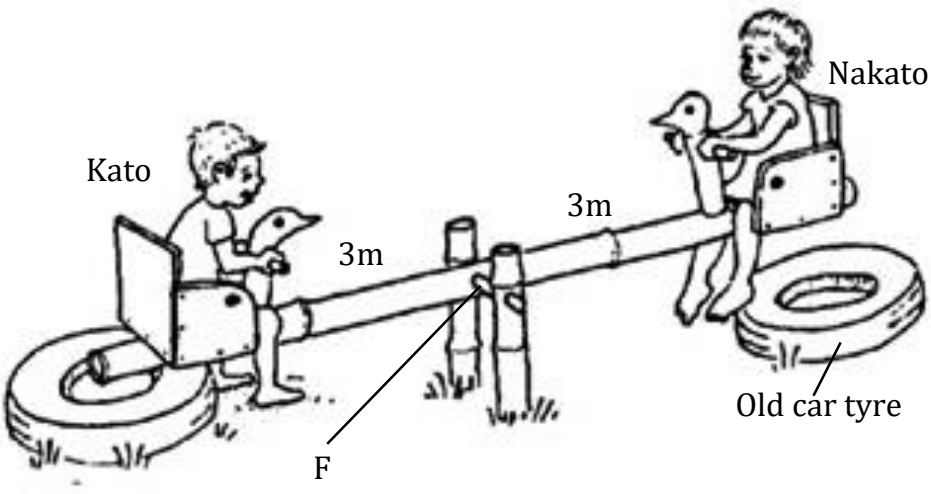
iii) **Who is lighter?**

- Danivia

iv) **Give a reason for your answer above.**

- Danivia is farther from the pivot than Lynet

2. It two bodies are at the same distance on opposite sides of the pivot, the heavier body lifts up the lighter one.



<u>Study the diagram of a seesaw shown above and answer questions that follow.</u>

i) <u>Of the twins on the seesaw above, who is heavier?</u>
- Kato

ii) <u>Give a reason for your answer above.</u>
- Kato has lifted up Nakato

iii) <u>What should Kato do in order to balance with Nakato?</u>
- Kato should sit nearer the pivot than Nakato

iv) <u>What should Nakato do in order to balance with Kato?</u>
- Nakato should sit farther from the pivot than Kato

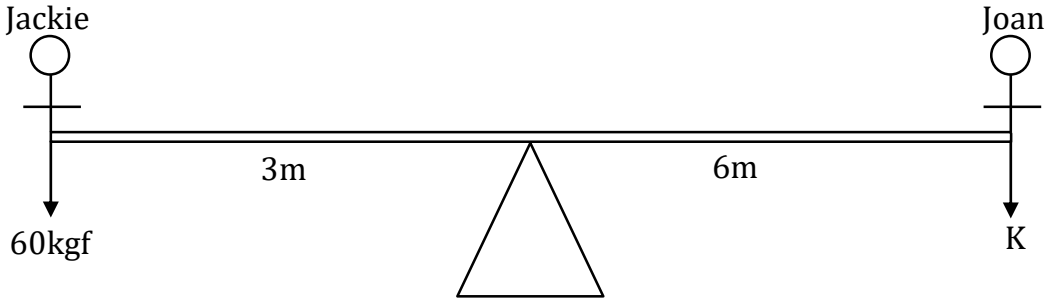
v) <u>Name the part marked F</u>
- Pivot / Fulcrum

vi) <u>State the importance of the old car tyres put at the ends of a seesaw?</u>
- Old car tyres act as shock absorbers / To absorb shock

<u>CALCULATIONS ON MOMENTS</u>

<u>EXAMPLE I</u>

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
<u>Sketch</u>



✓ Let Joan's weight be K

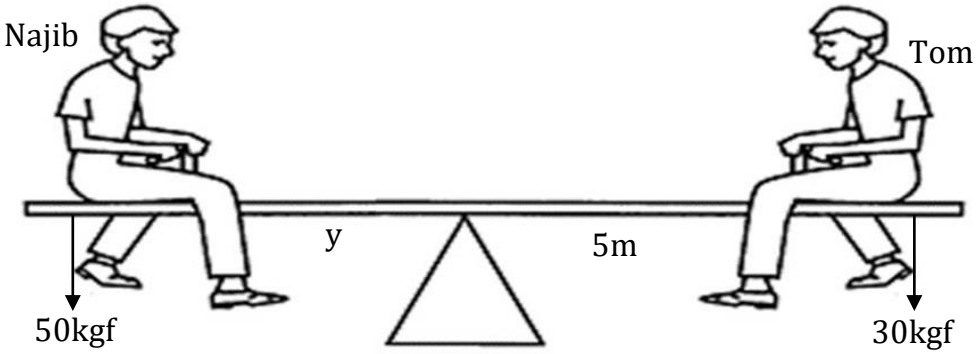
<u>Apply the law of levers</u>

L x LA	=	E x EA
(6 x K)	=	60 x 3
6K	=	180
<u>6K</u>	=	<u>180</u>
6		6
K	=	30Kgf

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

L x LA	=	E x EA
(50 x y)	=	30 x 5
50y	=	150
50y	=	150
50		50
y	=	3m

iii) **How far is Najib from Tom?**

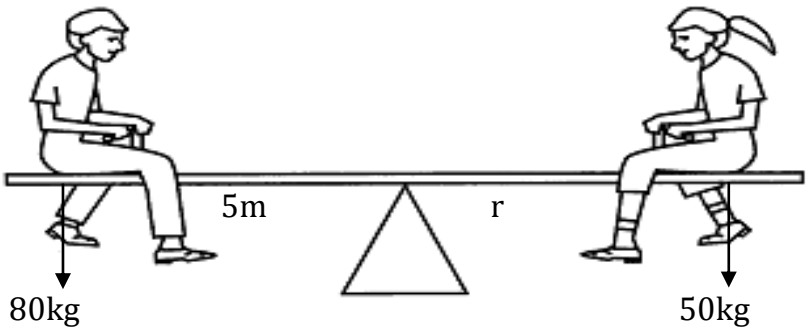
3m + 5m = 8m

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

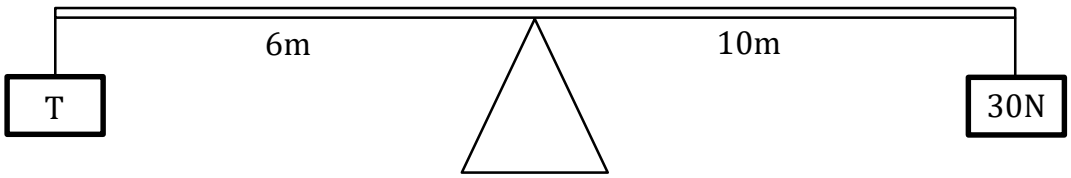
Apply the law of levers

E x EA	=	L x LA
(50 x r)	=	80 x 5
50r	=	400
50r	=	400
50		50
r	=	8m

ii) **How far is the man from his wife?**
8m + 5m = 11m

Example IV

Find the value of T in the figure below



Apply the law of levers

E x EA	=	L x LA
(T x 6)	=	10 x 3
6T	=	30
$\frac{6T}{6}$	=	$\frac{30}{6}$
T	=	5N

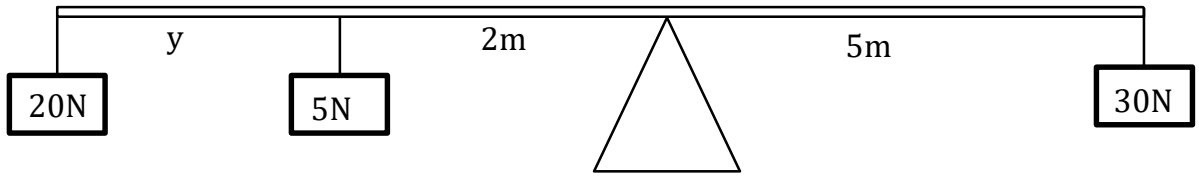
Activity

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

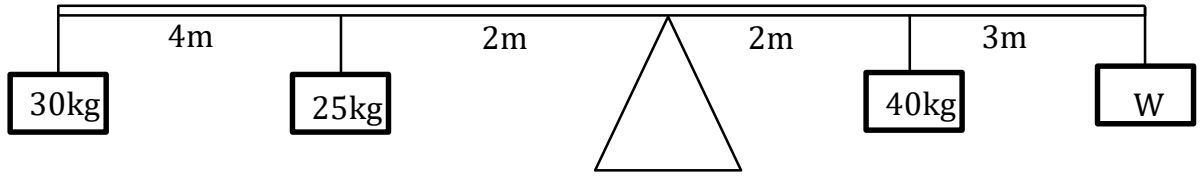


Apply the law of levers

E x EA	=	Lx LA
20(y + 2) + (5 x 2)	=	30 x 5
20y + 40 + 10	=	150
20y + 50	=	150
20y +50 – 50	=	150 - 50
20y	=	100
$\frac{20y}{20}$	=	$\frac{100}{20}$
y	=	5m

EXAMPLE II

Find the W in kg



Apply the law of levers

E x EA	=	L x LA
W(3 + 2) + (40 x 2)	=	30(4 + 2) + (25 x 2)
3W + 2W + 80	=	120 + 60 + 50
5W + 80	=	230
5W + 80 - 80	=	230 - 80
5W	=	150
5W / 5	=	150 / 5
W	=	30kg

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)**

  1kg = 10N

  1kgf = 1N

Note

Force = Mass x gravity

F = M x 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 x d

Example I

Calculate the work done to push a wheelbarrow with an effort of 10N through a distance of 5m.

W = F x d
W = 10 x 5
= 50J

Example II

A block was moved using an effort of 7kg through a distance of 5m. Calculate the work done

1kg = 10N
70 kg = 7 x 10N
= 70N
W = F x d
W = 70 x 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

$$W = F \times d$$
$$W = 4 \times 2.5$$
$$= \frac{4 \times 25}{10}$$
$$= \frac{100}{10}$$
$$= 10J$$

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.

$$\text{M.A} = \frac{\text{Load (L)}}{\text{Effort (E)}}$$

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.

$$MA = \frac{L}{E}$$

$$MA = \frac{200N}{40N}$$

$$= 5$$

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

$$\textbf{V.R} = \frac{\textbf{Effort distance}}{\textbf{Load distance}}$$

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

$$\textbf{E} = \frac{\textbf{L x L.D}}{\textbf{E x E.D}} \textbf{ x 100\%}$$

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

Efficiency = Load x Load distance x 100%
Effort x Effort distance
= 120N x 3m x100%
30N x 15m
= 4 x 100%
5
= 80%

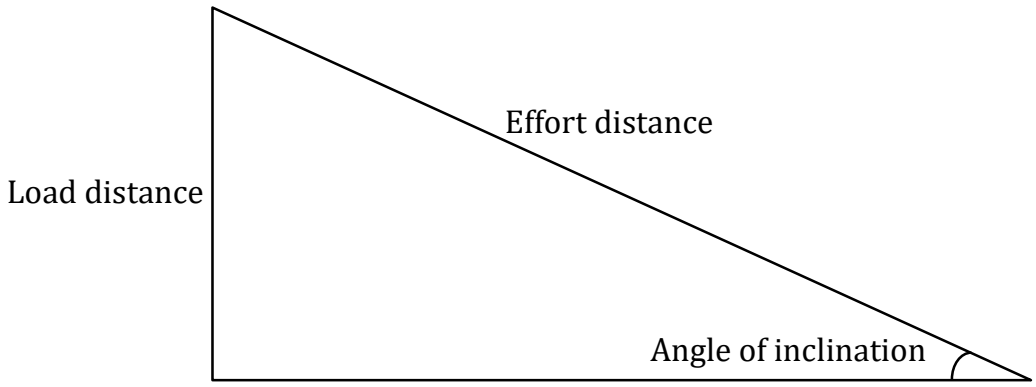
POWER

- 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

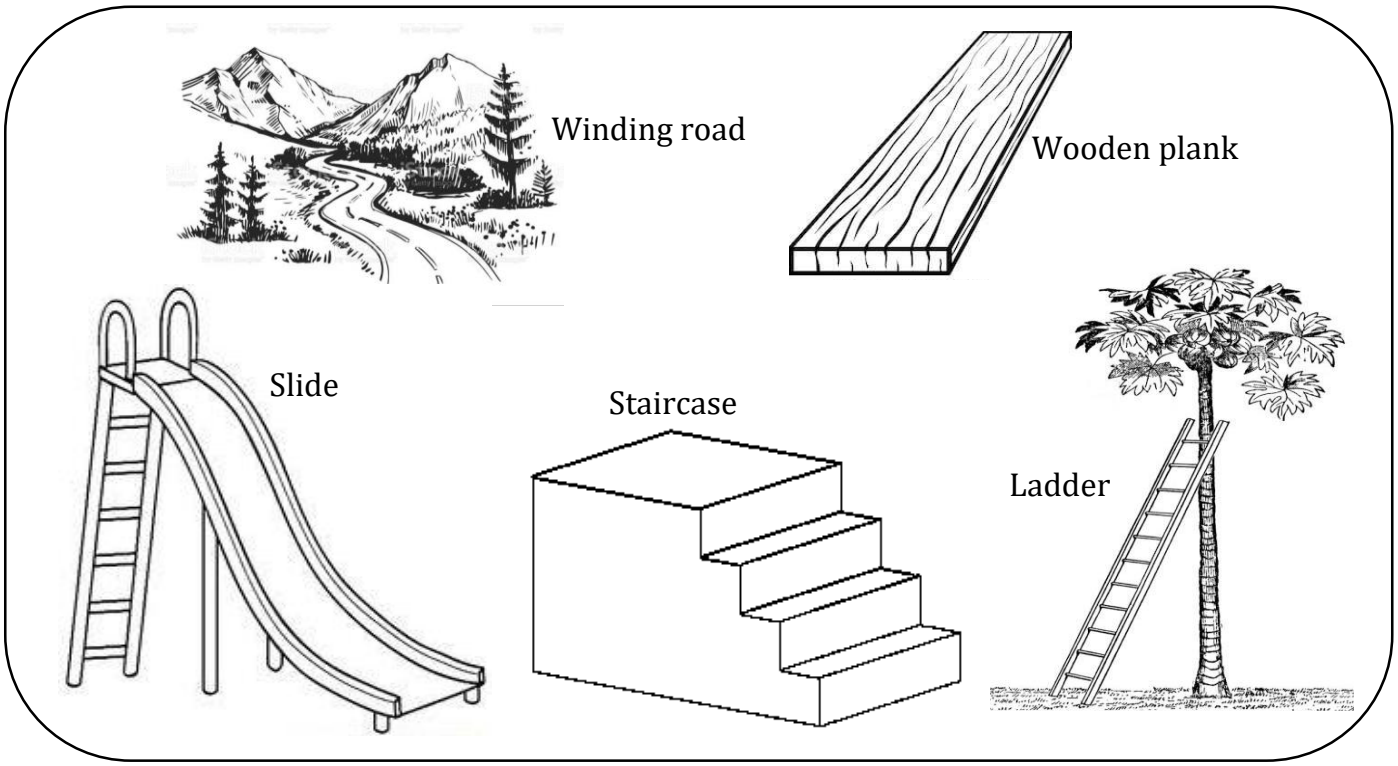
EXAMPLES OF INCLINED PLANES

- 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)



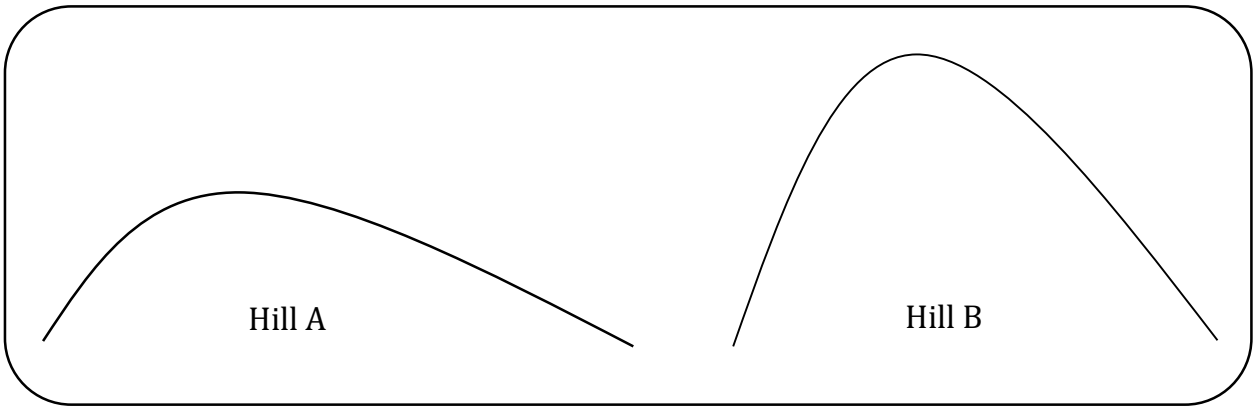
Why is it easier to climb up stairs than to use a ladder?

- 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

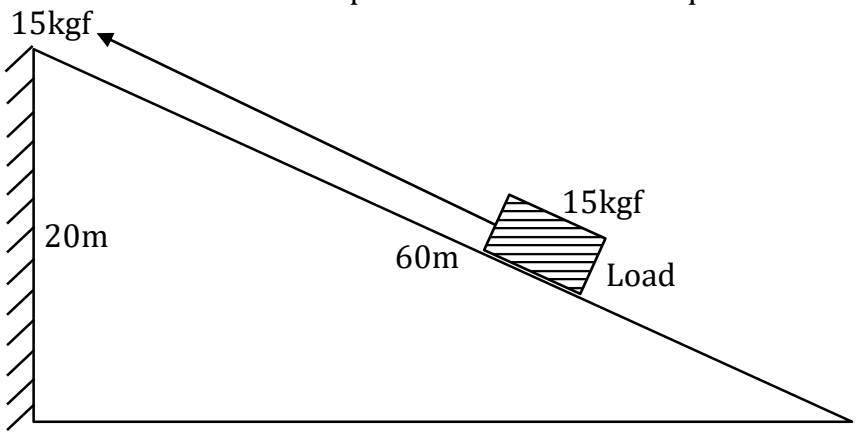
- Winding road

CALCULATING THE MECHANICAL ADVANTAGE OF SLOPES (INCLINED PLANE)

$$MA = \frac{L}{E} \quad \textbf{OR} \quad MA = \frac{ED}{LD}$$

EXAMPLE I

The diagram below shows an inclined plane. Use it to answer questions.



Calculate the work done on the load and Mechanical advantage

Work done = force x distance
= 15 x 2
= 30Joules

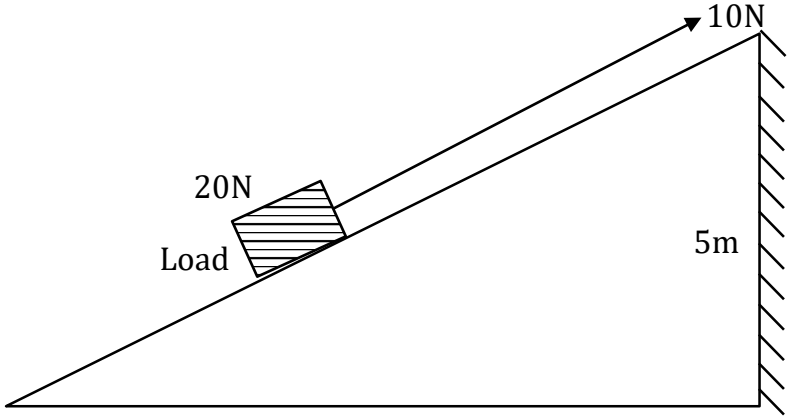
$MA = \frac{ED}{LD}$

$= \frac{6m}{2m}$

= 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

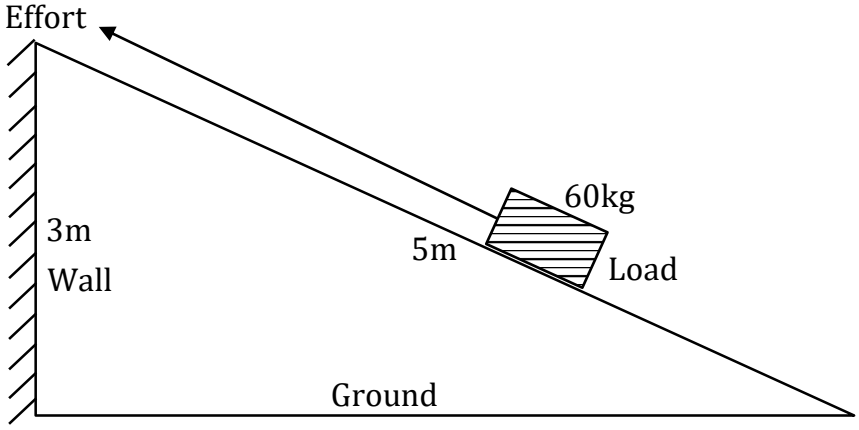
MA = ED / LD

5m x 2 = ED x 5m / 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,

a) Calculate the mechanical advantage
b) 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
- Panga
- Spear
- Sword
- Needle
- Razorblade
- Bullet
- Knife
- Nail
- Chisel
- Wooden wedge
- Safety pin
- Hoe

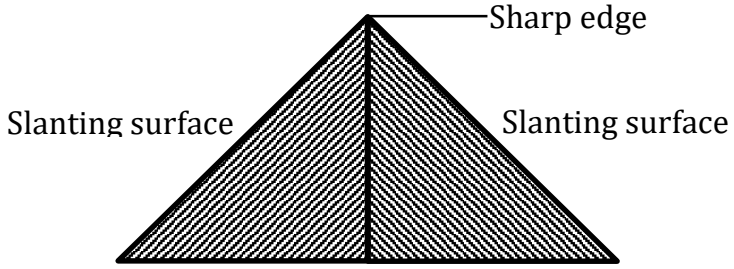
APPLICATIONS (USES) OF WEDGES

- 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
- Cutting
- Splitting firewood
- Peeling food
- Digging

AN ILLUSTRATION SHOWING A WEDGE



How do wedges simplify work?

- They have a sharp edge which makes the crack bigger.

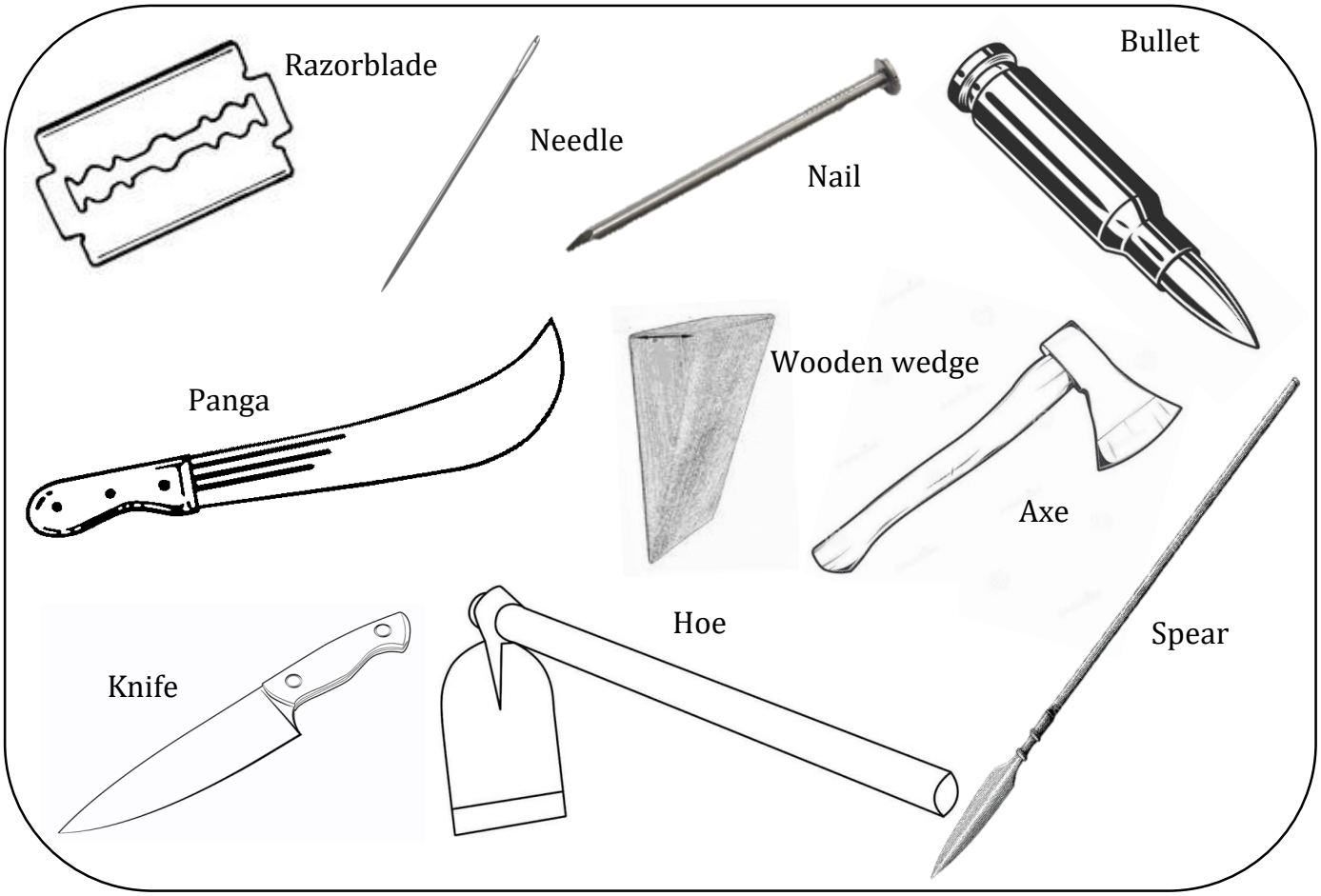
How can wedges be improved?

- By sharpening them

FACTORS THAT AFFECT THE EFFICIENCY OF WEDGES

- Rusting
- Friction
- Sharpness

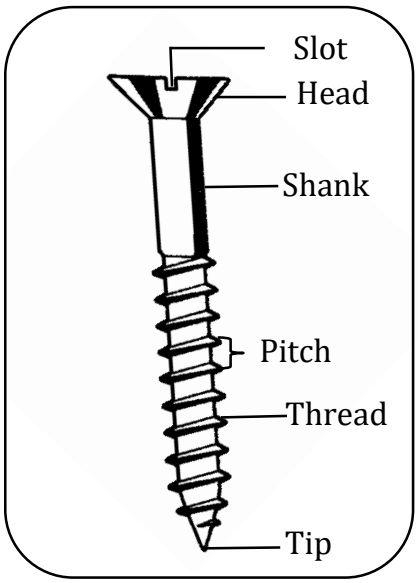
DRAWINGS SHOWING WEDGES



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

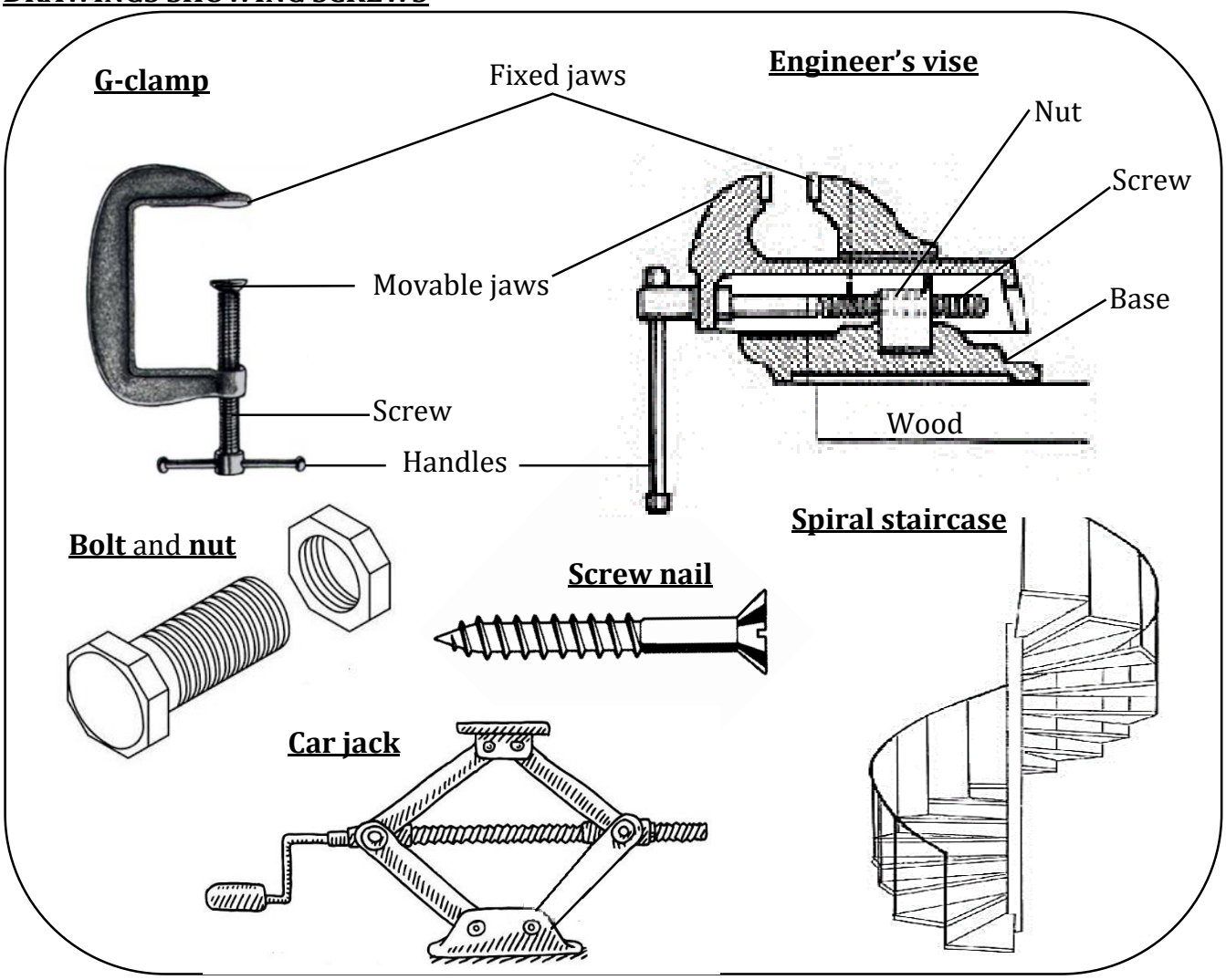
EXAMPLES OF MACHINES THAT USE SCREWS

- 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

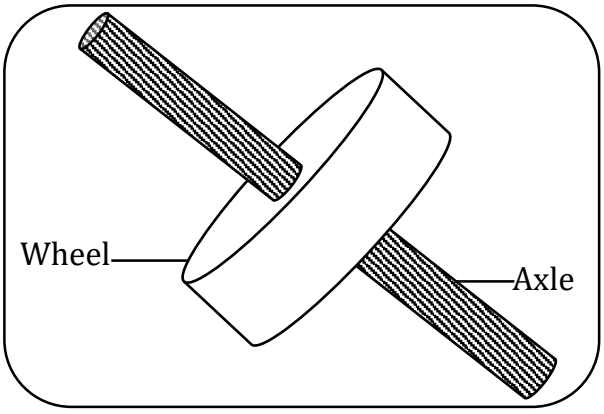
- Car jack is used to lift vehicles
- Screw nails are used to fasten(hold) wood or metals together
- Drilling machine is used to drill holes in wood or metals
- Screw caps are used to tighten bottle tops
- Spiral staircase make movement upstairs easier
- Engineer's vise is used to hold metals when filing 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

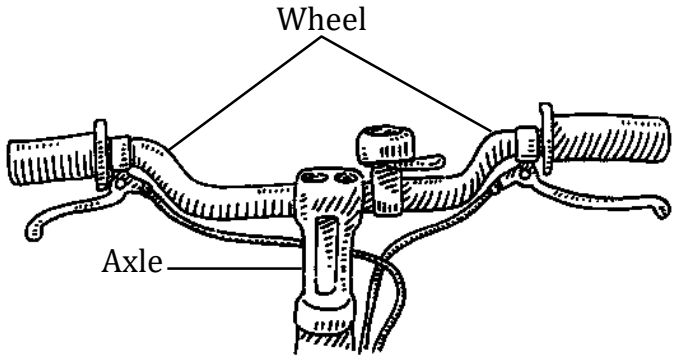
- Car steering wheel
- Doorknob
- Bicycle handles
- Bicycle pedal wheels
- Egg beater
- Windlass (winch)
- Brace
- Sewing machine
- Screw driver
- Windmill

APPLICATION (USES) OF WHEELS AND AXLE IN DAILY LIFE

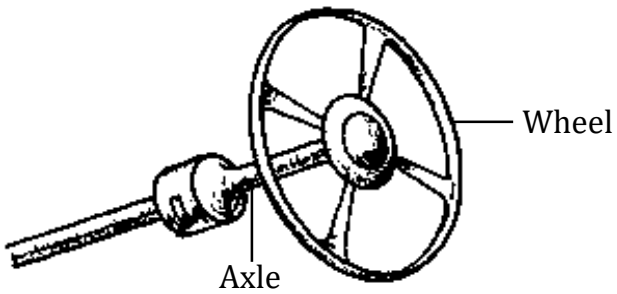
- Egg beater is used to prepare eggs for frying
- Windlass is used to draw water from deep wells
- Doorknob is used to open doors
- Steering wheel is used to turn cars
- Bicycle pedal wheels are used to ride bicycles
- Door knobs used to open doors
- Brace is used to drill holes in wooden materials
- Screw drivers are used to turn screw nails

DRAWINGS SHOWING WHEELS AND AXE MACHINES

HANDLES OF A BICYCLE

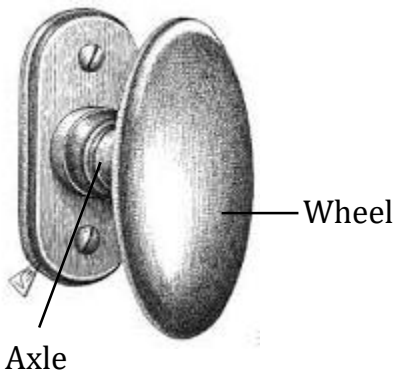


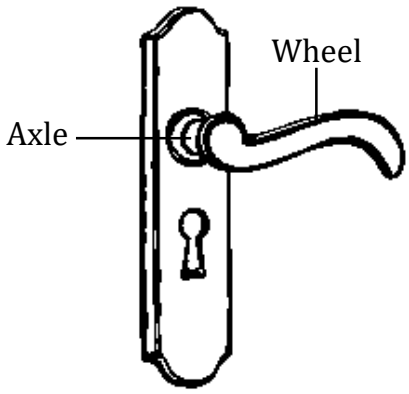
CAR STEERING WHEEL



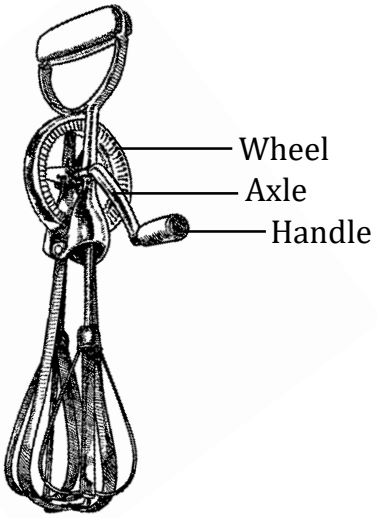
- ✓ The longer the steering wheel, the easier the turning of the wheel

DOORKNOB

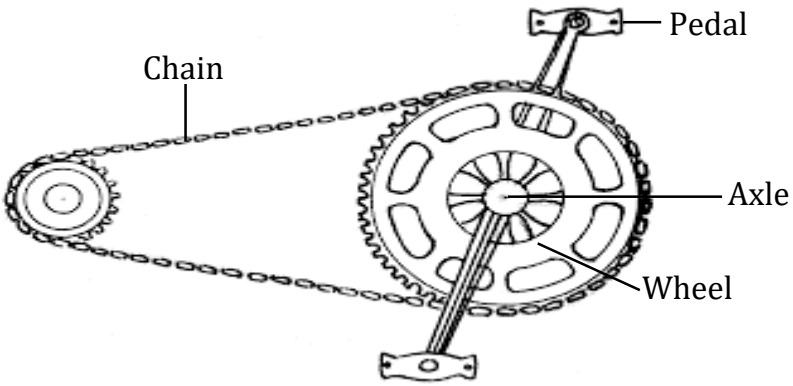




EGG BEATER

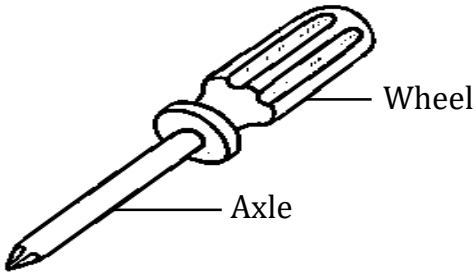


PEDAL WHEELS OF A BICYCLE

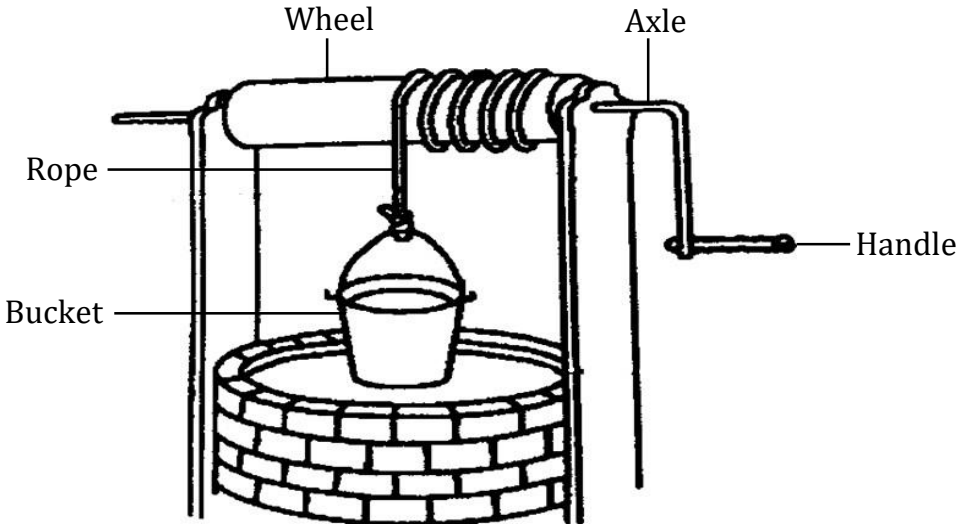


BRACE

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

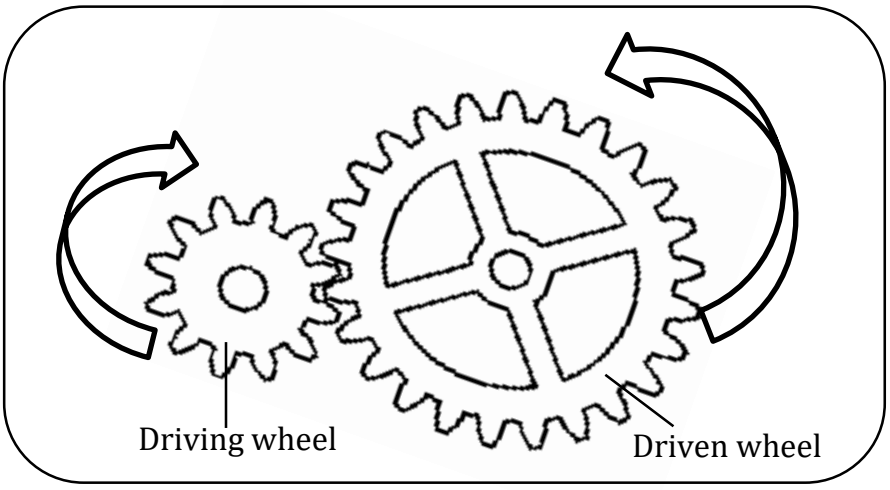
GEAR WHEELS AND BELT DRIVES

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**



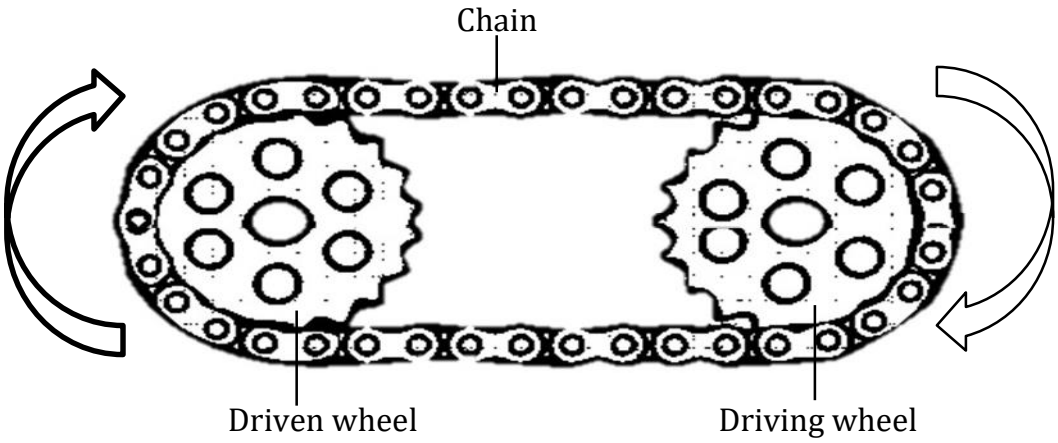
- If cogwheels are fixed, their teeth interlock and they move in opposite directions

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?

No. of revolutions = No. of teeth on driven wheel
No. of teeth on driving wheel
= 48
12
= 4 revolutions

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

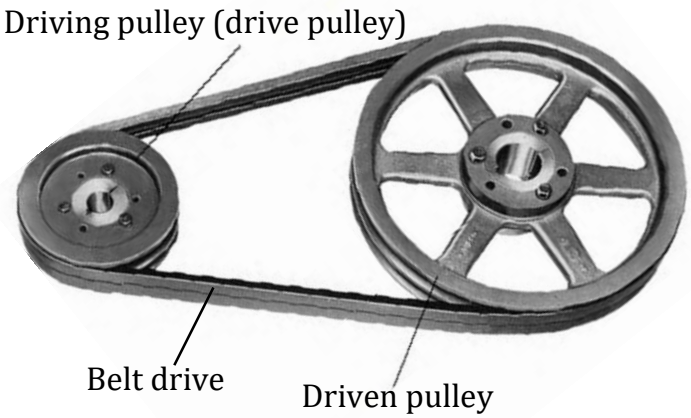
APPLICATIONS OF BELT DRIVE:

- 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
- Rubber
- Cotton
- Plastic
- Balata

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

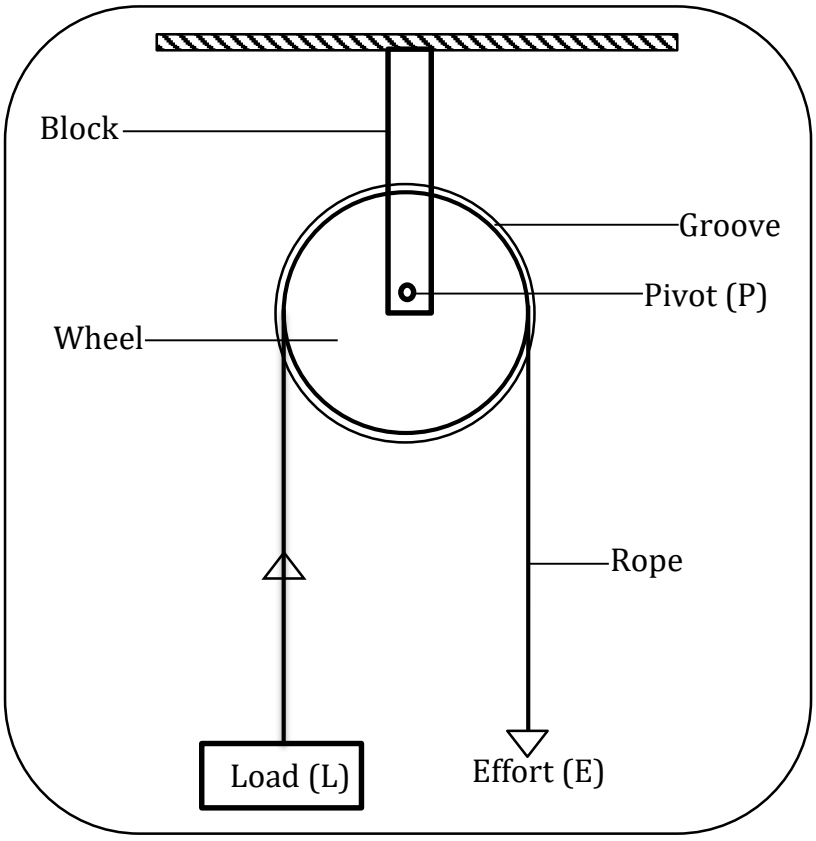
USES OF BELT CONVEYOR

- 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

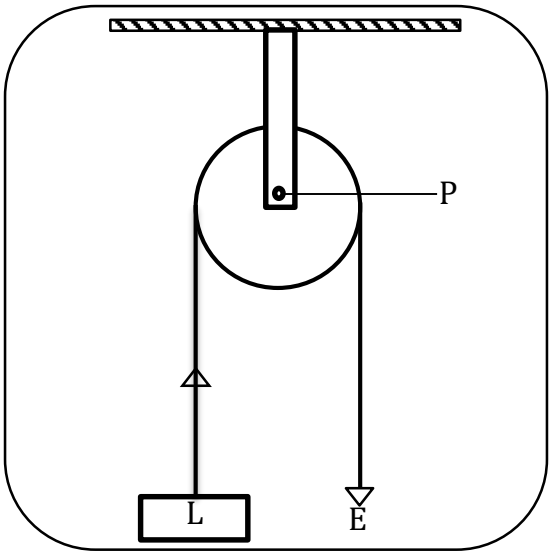
Rope/chain

- 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)

$$MA = \frac{L}{E} \quad \text{but; } L = E$$

$$= \frac{E}{E}$$

$$M.A = 1$$

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

$$MA = \frac{Load}{Effort}$$

$$1 = \frac{50kgf}{E}$$

$$E = 50kgf$$

Example II

Find the effort applied to pull a load of 85N using a single fixed pulley.

$MA = \frac{L}{E}$ but; $MA = 1$, $L = 85N$

$1 = \frac{85N}{E}$ $E = ?$

$E \times 1 = \frac{85}{E} \times E$

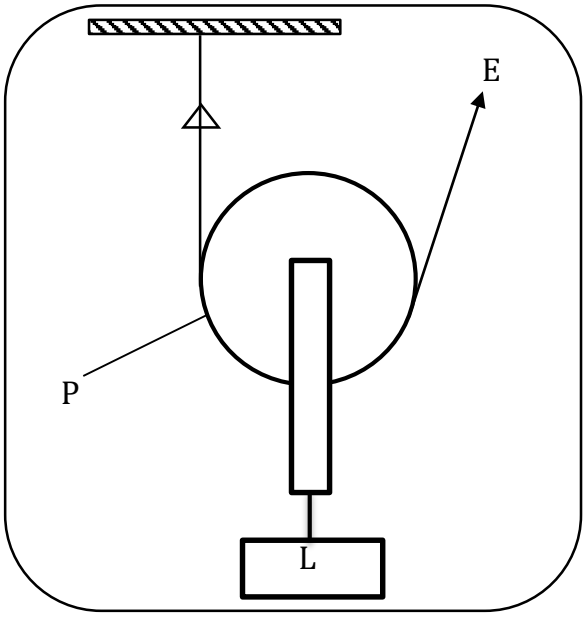
$E = 85N$

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)

$MA = \frac{L}{E}$ but; $L = 2E$

$= \frac{2E}{E}$

$M.A = 2$

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?

$$M.A = \frac{L}{E}$$

$$2 = \frac{50kgf}{E}$$

$$E \times 2 = \frac{50kgf}{E} \times E$$

$$2E = 50kgf$$

$$\frac{2E}{2} = \frac{50kgf}{2}$$

$$E = 25kgf$$

EXAMPLE II

If a single movable pulley is used to lift a load of 90N, find the value of effort.

$$M.A = \frac{L}{E}$$

$$2 = \frac{90N}{E}$$

$$E \times 2 = \frac{90N}{E} \times E$$

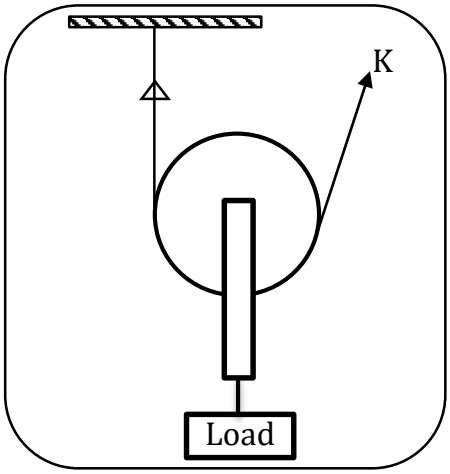
$$2E = 90N$$

$$\frac{2E}{2} = \frac{90N}{2}$$

$$E = 45N$$

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

$$M.A = \frac{ED}{LD}$$

$$40m \times 2 = \frac{ED}{40m} \times 40m$$

$$80m = ED$$

b) What does letter K represent?

- Effort

ACTIVITY

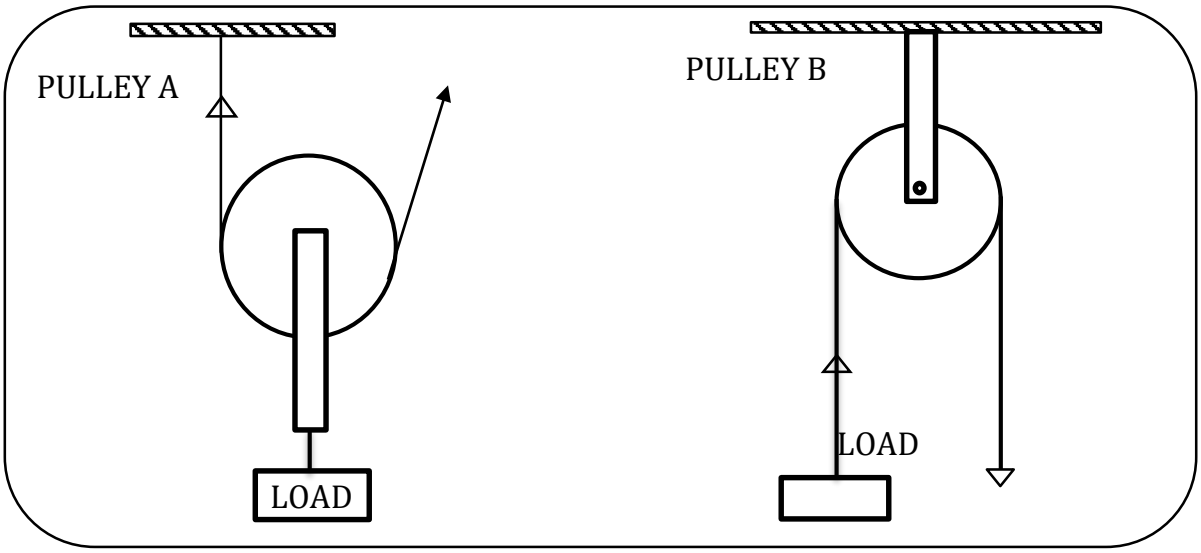
1. Calculate the effort needed to lift a load of 600N up the building using a single movable pulley
2. If the load is raised through a height of 50m using a single movable pulley, find the distance moved by the effort
3. A man used 40N to pull a load of 80N
   a) What type of pulley did he use?
   b) 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

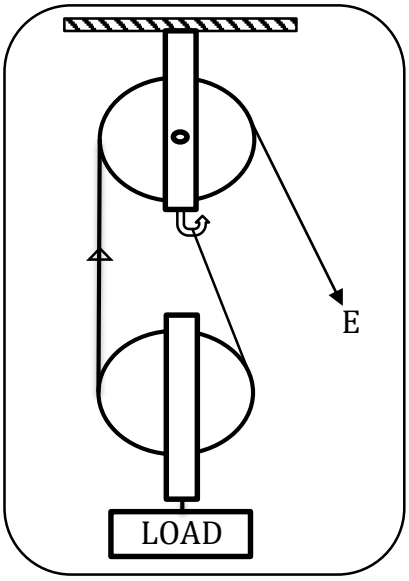


a) Identify the type of pulley system shown in each diagram
b) In which of the two pulley systems is less effort needed to raise the load
c) Give a reason to support your answer in (b) above
d) How can the pulley system in diagram B be useful at school?
e) If the load of 200N is raised from the ground 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

- Digestive system
- Reproductive system
- Muscular system
- Skeletal system
- Nervous system
- 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

- Respiration
- Deamination
- Synthesis of proteins

Organs of the excretory system (examples of excretory organs)

- The skin
- The kidney
- The lungs
- Liver

EXCRETORY ORGANS AND THEIR EXCRETORY PRODUCTS

EXCRETORY ORGAN	EXCRETORY (WASTE) PRODUCTS
Skin	Sweat ▪ Excess salts ▪ Excess water ▪ Urea ▪ Lactic acid
Kidney	Urine ▪ 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

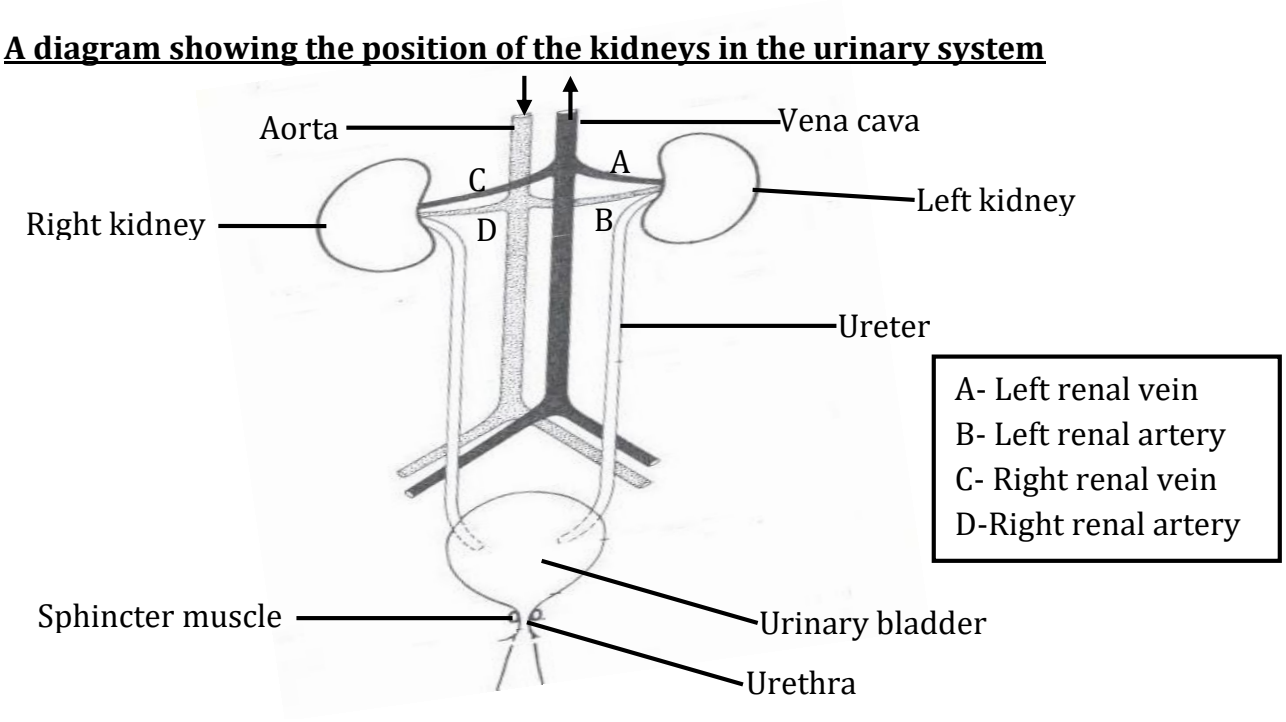
Name the nitrogenous compounds in urine/filtered by kidneys from blood

- 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



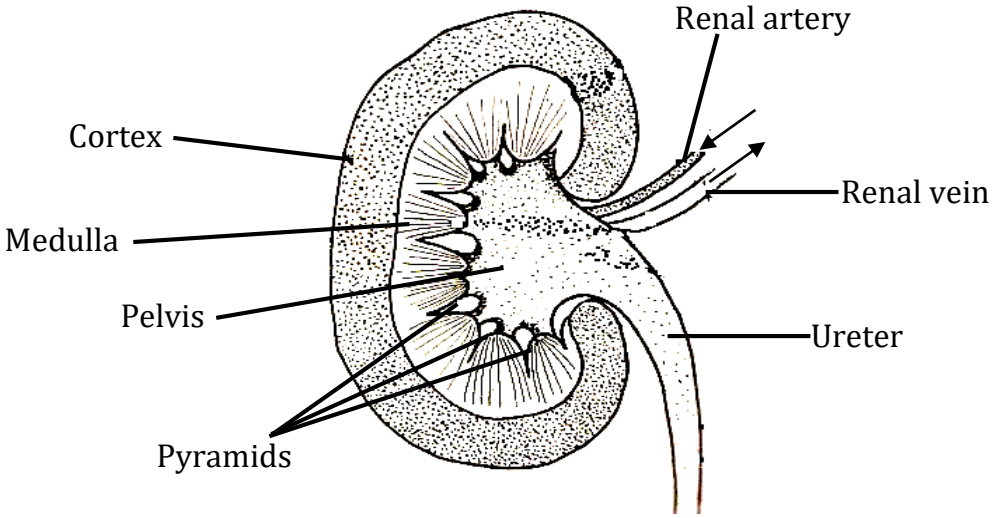
NOTE

- **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
- Mineral salts
- Glucose
- 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
- Bilharziasis
- Nephritis
- Kidney cancer

KIDNEY STONES

- These are hard deposits of salts that form inside the kidneys

Causes of kidney stones

- Dehydration
- Eating too much raw salt
- Obesity

Signs of kidney stones

- Bloody urine
- Smelly urine
- Frequent urination

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

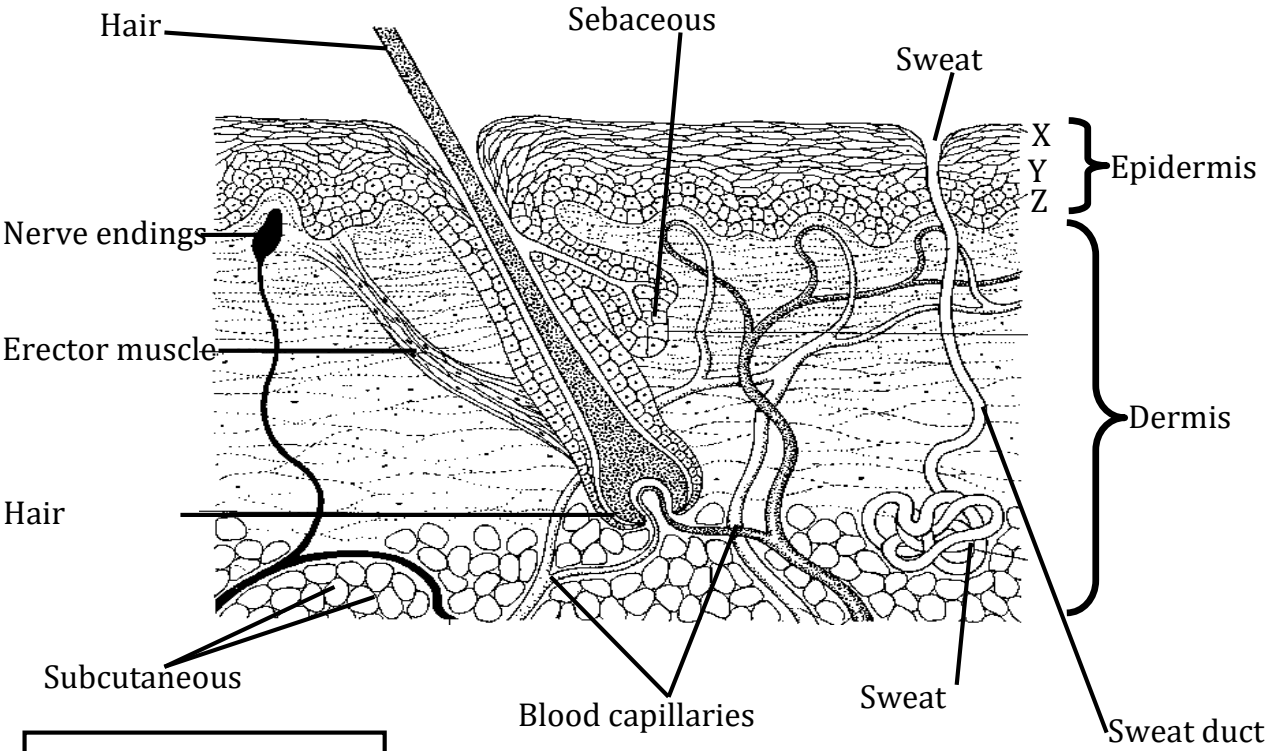
Ways of promoting proper working of the kidneys and the urinary system

- 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



X- Cornified layer
Y- Granular layer
Z- Malpighian layer

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
- sweat duct
- hair follicle
- erector muscle
- sebaceous glands (oil glands)
- blood capillaries
- nerve endings
- 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
- Water
- Urea
- 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
- Palms of the hands
- The lips

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
- Taking cold drinks
- Wearing light clothes
- Moving under the shade
- Turning on an electric fan

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) <u>HOW DOES THE SKIN REGULATE HUMAN BODY TEMPERATURE ON COLD DAYS?</u>

- 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)

<u>Vasoconstriction</u>

- This is the narrowing of blood vessels at the skin surface
- It occurs when the smooth muscles of blood vessels contract

<u>How does vasoconstriction keep the human body warm on cold days?</u>

- Little blood flows at the skin surface to prevent heat loss

<u>How does shivering keep the body warm on cold days?</u>

- Muscles contract rapidly to produce heat

<u>What causes goose pimples on cold days?</u>

- Contraction of erector muscles

<u>Mention the practices people use to regulate their body temperature on cold days</u>

- Taking hot drinks
- Putting on thick clothes
- Sitting near fire
- Doing body exercises

<u>Ways through which water is lost from the body (causes of dehydration)</u>

- Severe diarrhoea
- Severe vomiting
- Severe sweating
- Severe burns and scalds

<u>DISEASES WHICH AFFECT THE SKIN</u>

<u>Bacterial skin diseases</u>

- Leprosy
- Impetigo
- Boils
- Cellulitis

<u>Fungal skin diseases (mycosis/tinea infections)</u>

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

<u>Viral skin diseases</u>

- Chicken pox (Varicella)
- Measles (Rubeola)
- German measles (Rubella)
- Smallpox (Variola)

<u>Deficiency skin diseases</u>

- Pellagra (caused by lack of vitamin B_3)
- 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

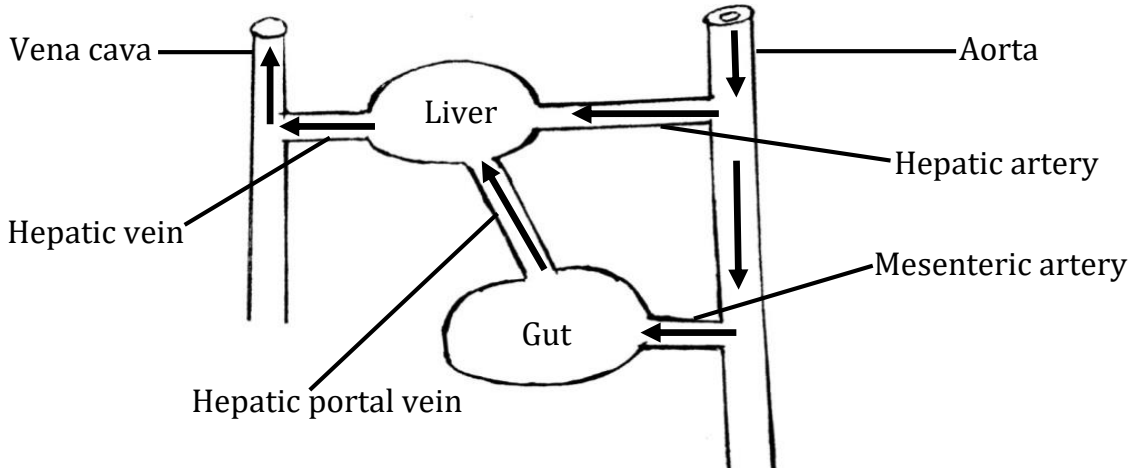
THE LIVER

- 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
- Jaundice (the skin and sclera turn yellow)
- Vomiting

Prevention and control of hepatitis B

- Immunize using Hep B vaccine
- Avoid sharing needles with an infected person
- Use latex gloves during fisting or fingering
- Use condoms during sex

CARE FOR THE LIVER

- Avoid taking a lot alcohol
- Avoid drug abuse
- Feed on balanced diet
- Always drink safe water
- Make regular body exercises

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

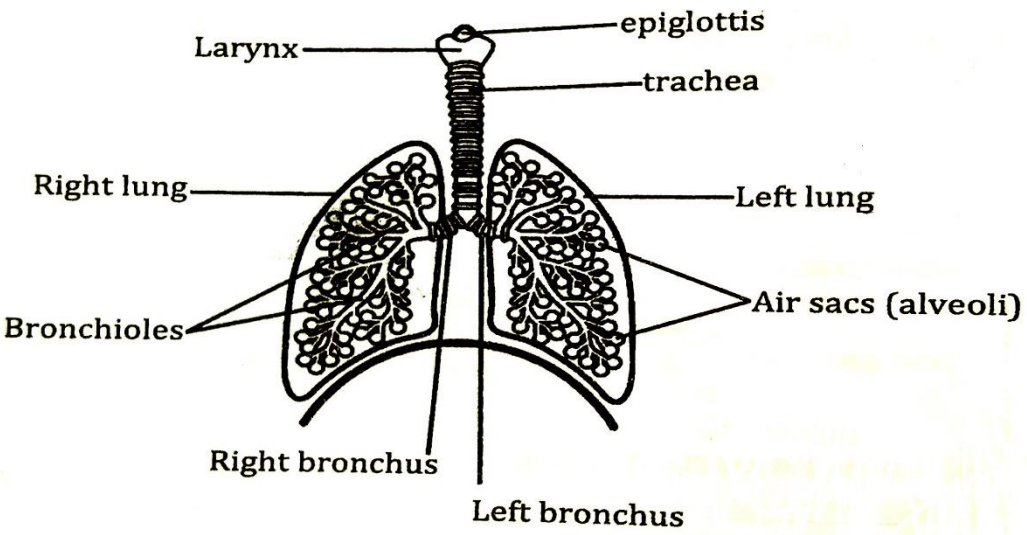
Of what importance is the pleural cavity?

- 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)
- Hay fever
- Nasal polyp

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

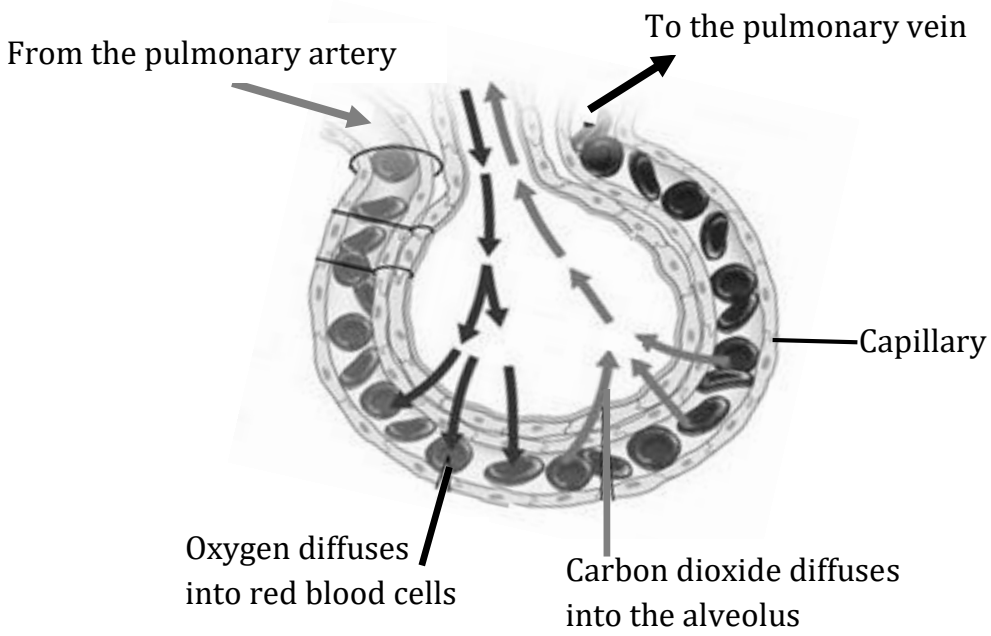
What is meant by the term diffusion?

- 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

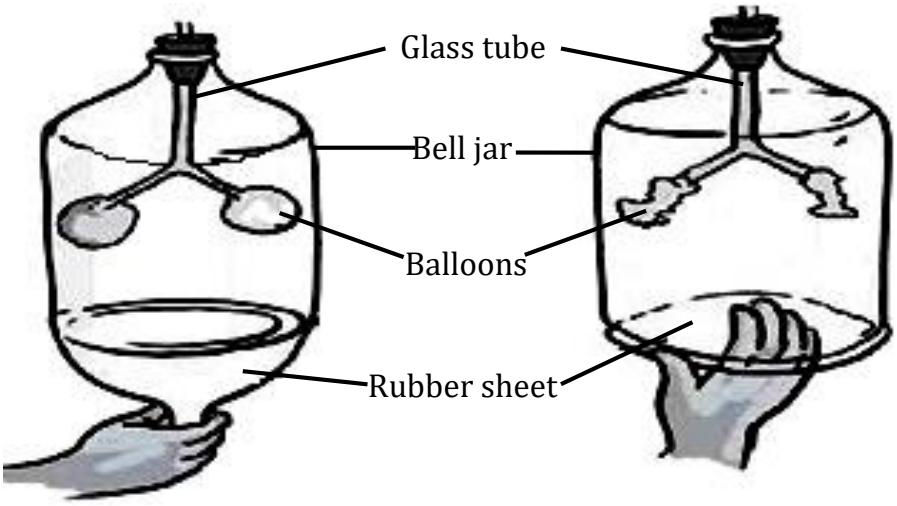
- Diaphragm and intercostal muscles relax
- Volume of chest cavity decreases (size of the chest and lungs decreases)
- Air pressure inside increases
- Air moves out of the lungs

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 0_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

Glucose (Food) + Oxygen ⟶ Energy + Carbon dioxide + Water vapour

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
- Taking too much alcohol
- Sudden excitement
- Swallowing air along with food
- Overeating

DISEASES OF THE RESPIRATOTY SYSTEM (RESPIRATORY DISEASES)

1. **COMMUNICABLE (INFECTIOUS) RESPIRATORY DISEASES**
   - Tuberculosis (TB)
   - Diphtheria
   - Whooping cough (Pertussis)
   - Pneumonia
   - Influenza (Flu)
   - Common cold
   - Acute bronchitis
   - COVID-19
2. **NON-COMMUNICABLE (NON-INFECTIOUS) RESPIRATORY DISEASES**
   - Lung cancer
   - Asthma
   - Emphysema
   - Chronic bronchitis
   - Asbestosis: it is caused by too much exposure to asbestos

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
- Difficulty in breathing
- Wheezing
- 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
- Sound energy
- Electricity
- Heat energy
- Chemical energy
- Mechanical energy
- Solar energy
- Magnetism

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

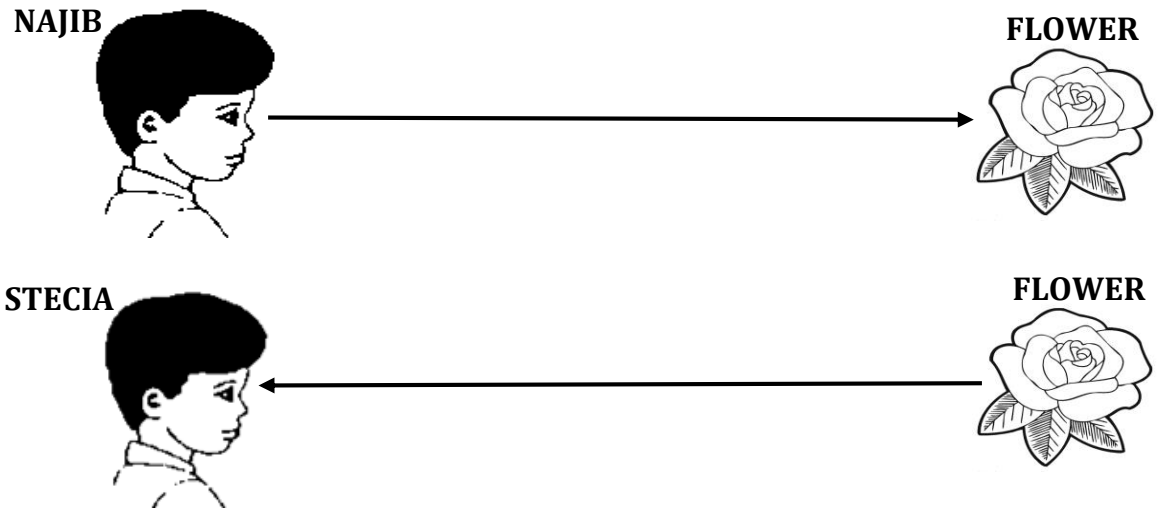
Importance (uses) of light/work done by light

- 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

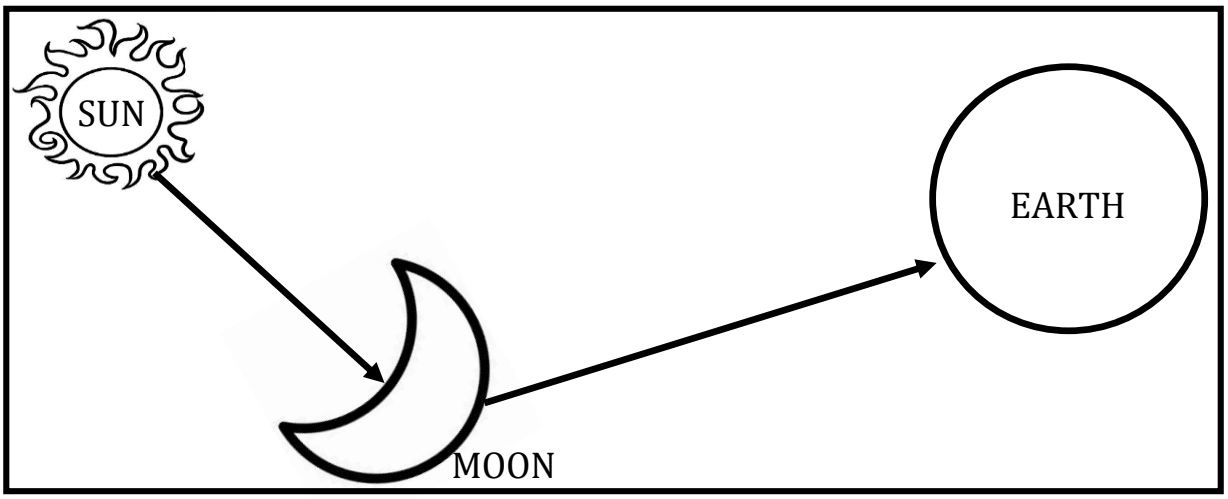
Why is the moon not called a luminous source of light?

- 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



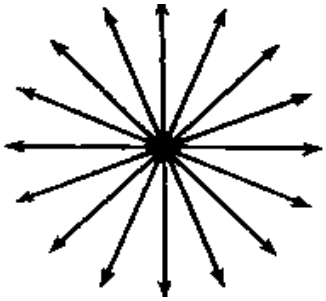
PROPERTIES OF LIGHT

- 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?)

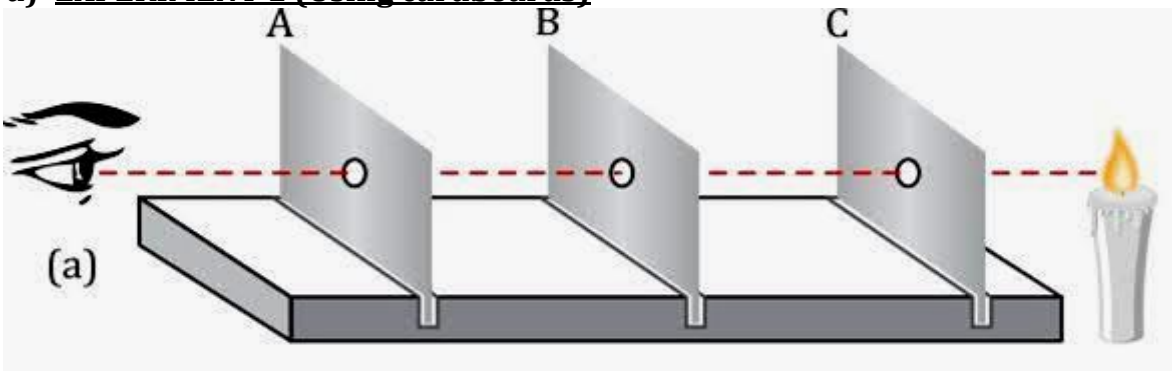
- Light travels in a straight line
- Light travels in all directions from the source

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)**



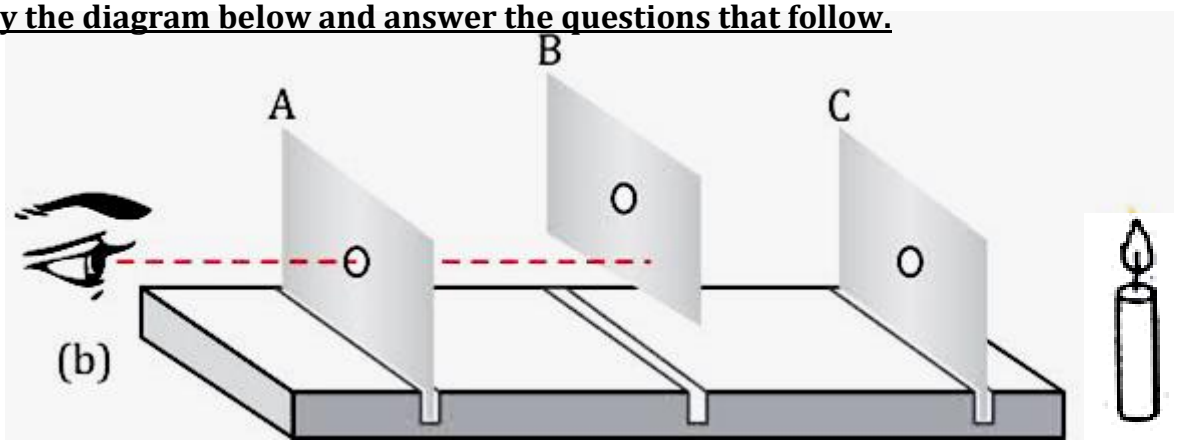
Why is the observer able to see candle light in figure (a) above?

- The holes in the cardboards are in a straight line

What does the experiment above represent?

- It shows that light travels in a straight light

Study the diagram below and answer the questions that follow.



Why is the observer unable to see candle light in figure (b) above?

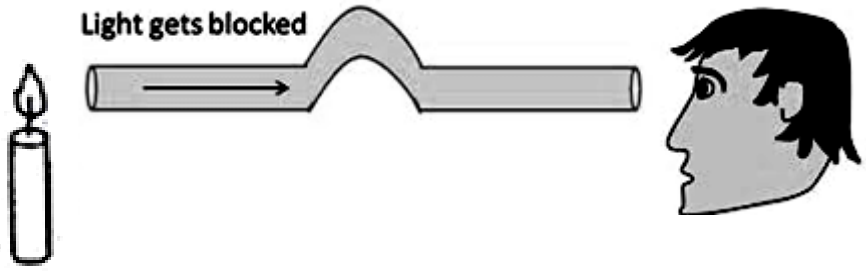
- The holes in the cardboards are not in straight line

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)

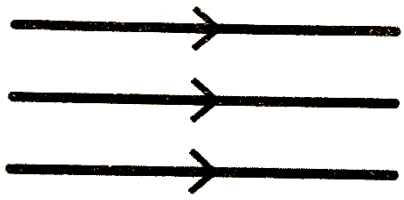
PARALLEL BEAM

- 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 from spread in different directions

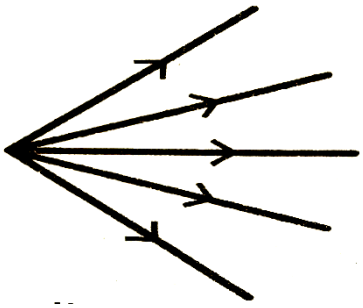
Use of diverging beam

- It enables us to see over a wider area

Devices that produce diverging beam

- Car headlamp
- Bicycle headlamp
- Torch
- Projector
- Electric bulb
- Sun
- Burning candle

An illustration of diverging beams of light



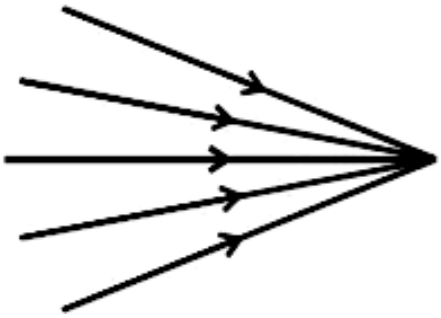
CONVERGING BEAM

- 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
- Translucent objects
- Opaque 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

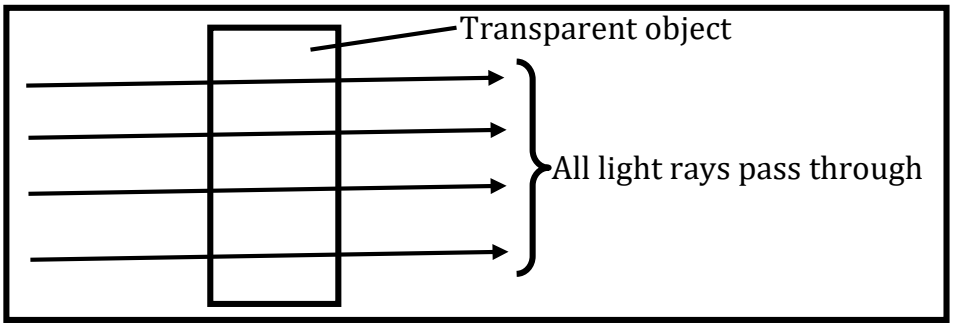
Examples of transparent objects

- Clear glass
- Clear water
- Clear air
- 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

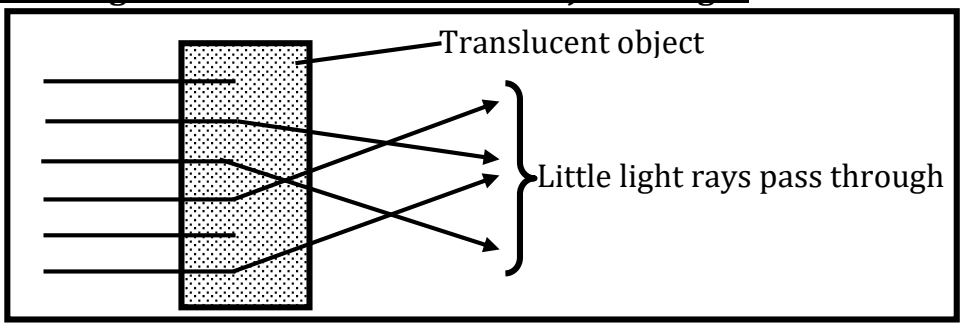
Why can a person behind a translucent material get a sunburn on a sunny day?

- Some sun rays can pass through it

Examples of translucent objects.

- Frosted glass
- Tinted glass
- Tracing paper
- Wax paper
- Oiled paper
- Sunglasses
- Stained glass
- Lampshade
- Smoky air
- Cloudy water
- Plastic skylight
- 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

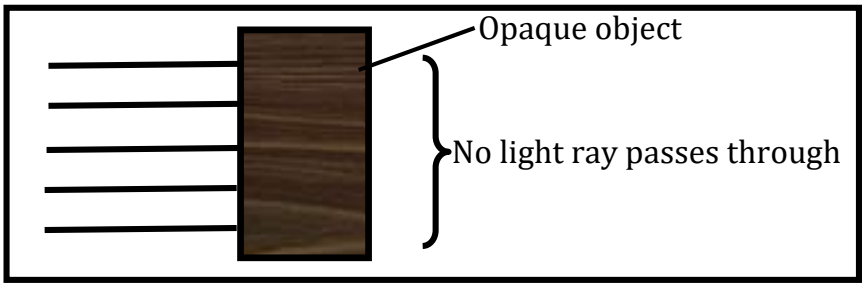
What happens when light strikes an opaque object?

- Light is blocked and a shadow is formed

Examples of opaque objects

- Wood
- Blackboard
- Human body
- Stone
- Metal
- Brick wall
- Blackout fabric

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

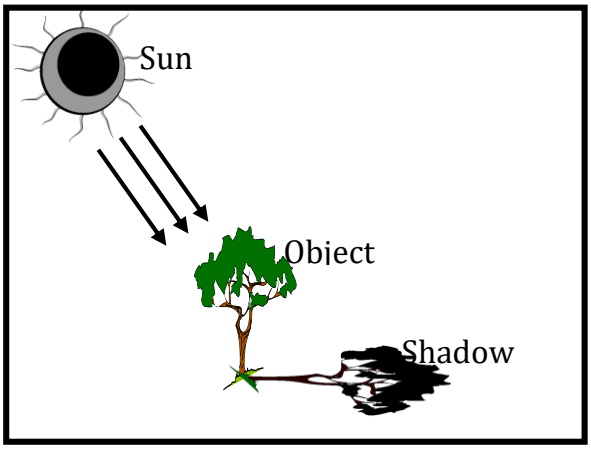
- Distance of the light source from the opaque object
- Size of the opaque object
- Size of the light source
- Position of the light source (angle at which light strikes an opaque object)

Note

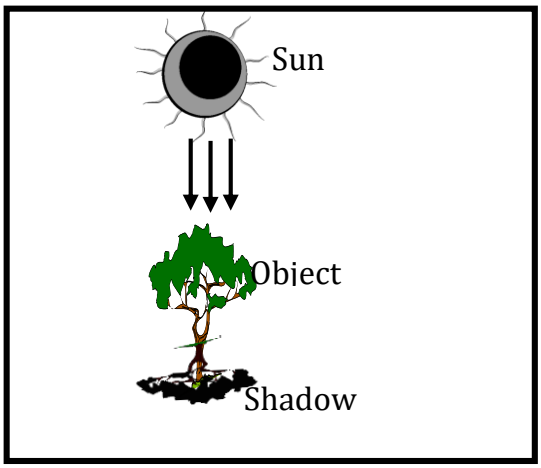
- The shadow is smaller when the light source is far and it is bigger when the light source is nearer to the opaque object

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

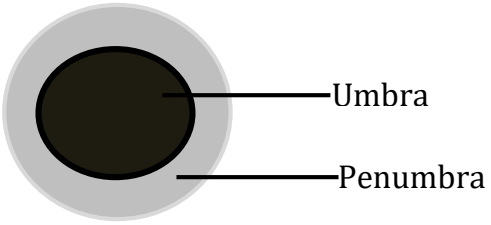
Why is the shadow longest at sunrise and sunset (in the early morning and early evening/late afternoon)?

- 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

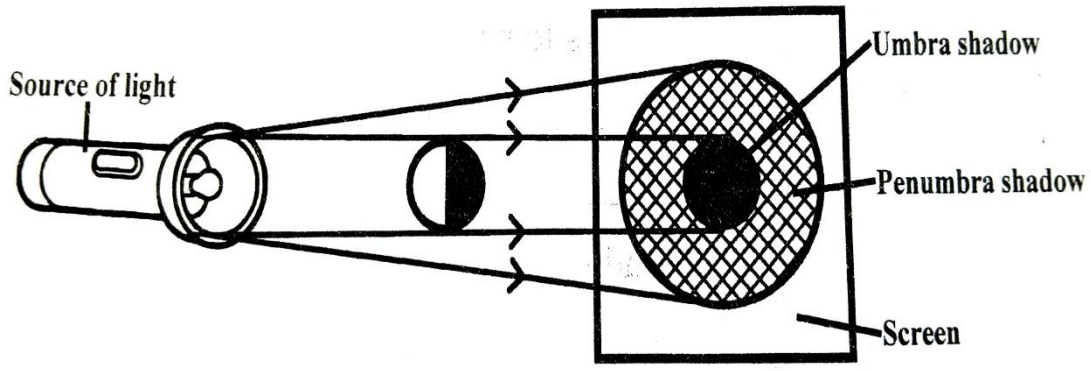
How is penumbra formed?

- 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

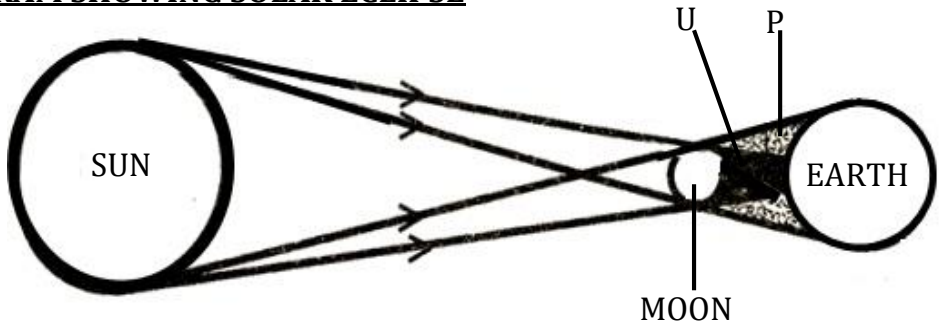
Why is it dangerous to expose the eyes directly to solar eclipse?

- 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

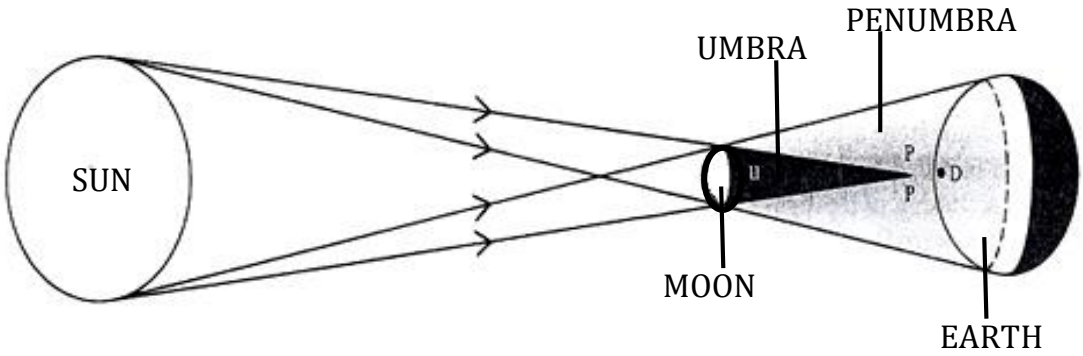
Partial solar eclipse

- 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
- It happens at full moon during the night
- The shadow is cast on the moon
- The moon is in total eclipse so it doesn't reflect any light

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

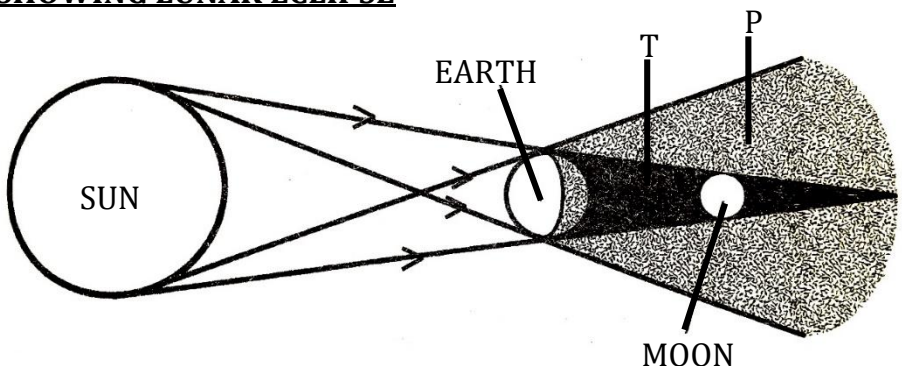
Where is the shadow cast during lunar eclipse?

- 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?

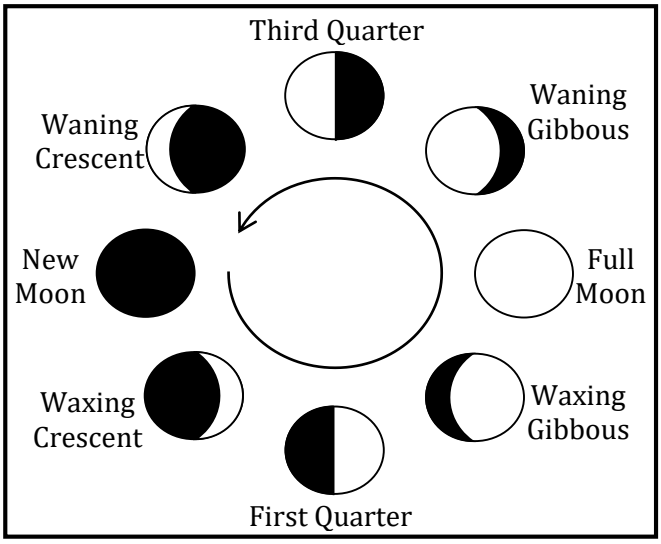
- Earth has enough oxygen in its atmosphere
- Earth has water on its surface
- Earth's temperature is not too hot or too cold

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)

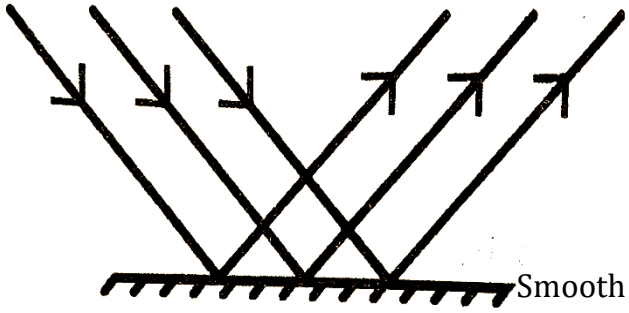
Why do we see clear images in plane mirrors and silvered metals?

- 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



Smooth shiny surface

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)

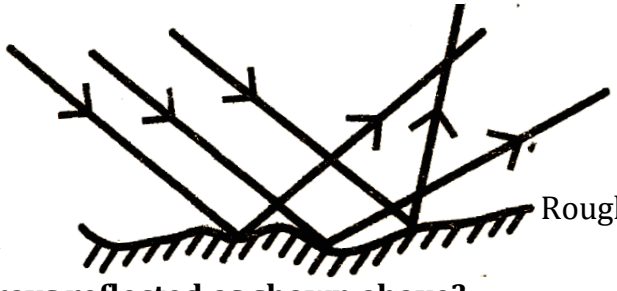
Why are we unable to see clear images on painted walls and iron sheets?

- 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



Rough shiny surface

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**

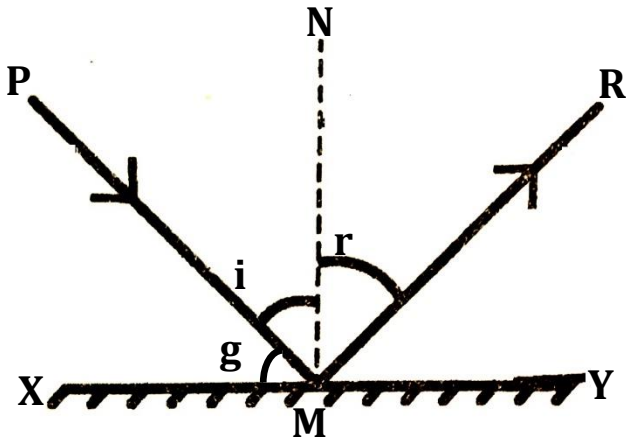
Why do we polish our shoes?

- 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

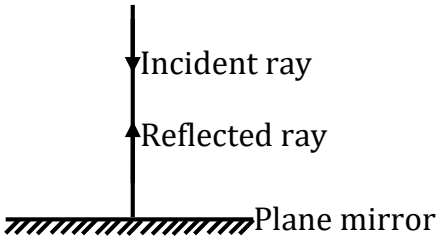
NOTE

- 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 0^0 while the glancing angle is 90^0

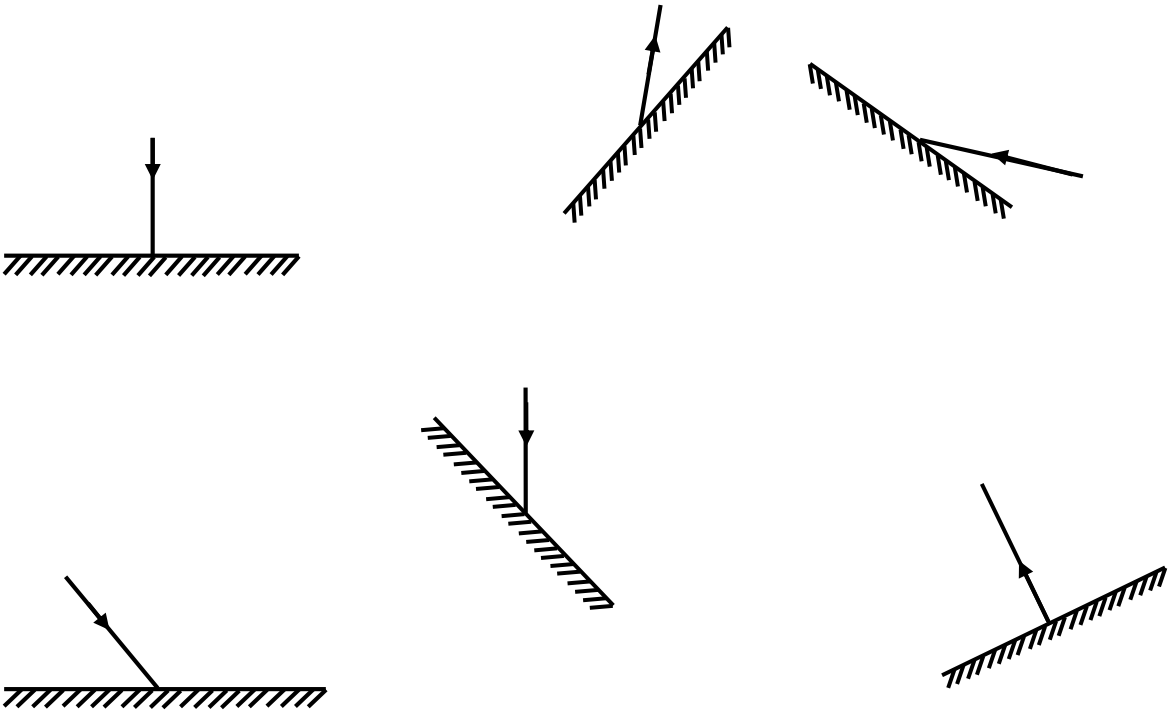
TOTAL INTERNAL REFLECTION

- 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



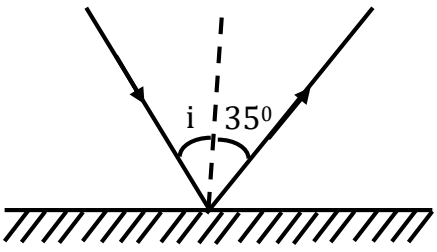
COMPLETE THE FOLLOWING DIAGRAMS



CALCULATIONS RELATED TO LIGHT REFLECTION

Example 1

Find the value of the angle of incidence in the figure below.



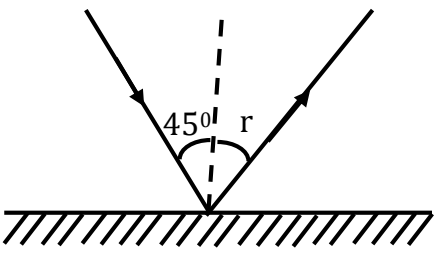
$i + 35^0 = 90^0$

$i + 35^0 - 35^0 = 90^0 - 35^0$

$i = 55^0$

Example 2

Find the value of the angle of reflection



Since; i = r

$r = 45^0$.

Example 3

The incident ray makes an angle of 60^0 to the mirror. What is the angle of reflection?

The normal makes 90^0 to the mirror

$60^0 + i = 90^0$

$60 - 60 + i = 90^0 - 60^0$

$i = 30^0$

Since; i = r

$r = 30^0$

Example 4

If the angle between the incident ray and the mirror is 32^0, what is the size of the reflected ray?

Let the angle of incidence be i

$i + 32^0 = 90^0$

$i + 32^0 - 32^0 = 90^0 - 32^0$

$i = 58^0$

Since; i = r

$r = 58^0$.

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
- Human eye
- Convex lens
- Telescope

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
- Projector
- Convex lens
- Microscope

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

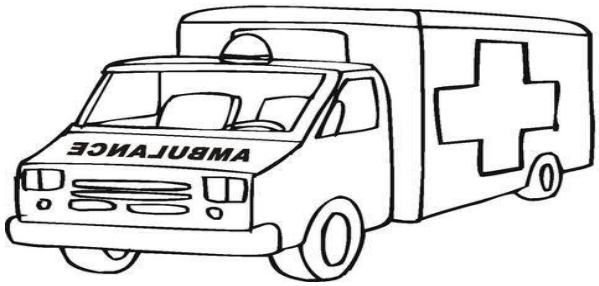
- This is the sideways reversal of images

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



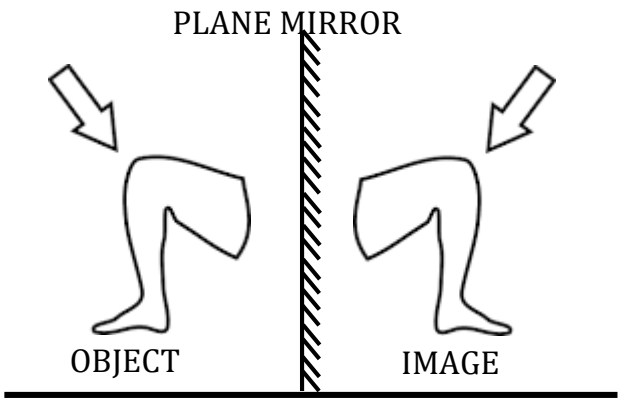
Why is the word AMBULANCE put in mirror writing?

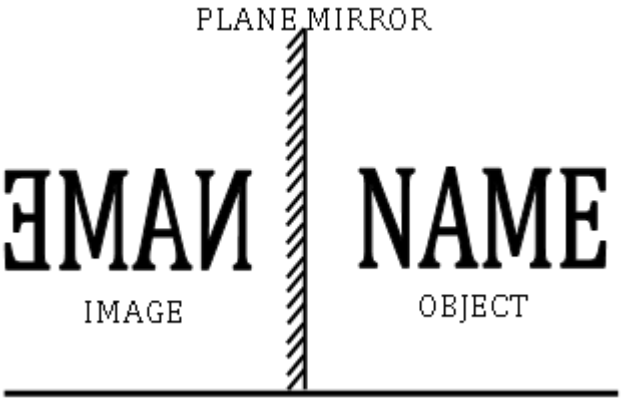
- For correct reading by other drivers in their side mirrors (rear-view mirrors)

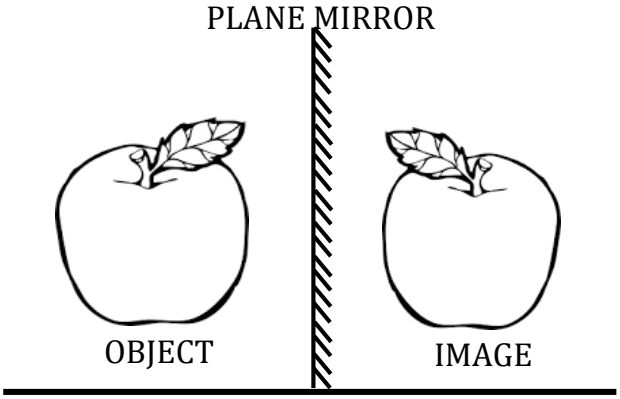
Why is it easier for drivers in front to read the word AMBULANCE in mirror writing on the vehicle?

- It is corrected by the driving mirror during reflection
- It is corrected by lateral inversion during reflection by the driving mirror

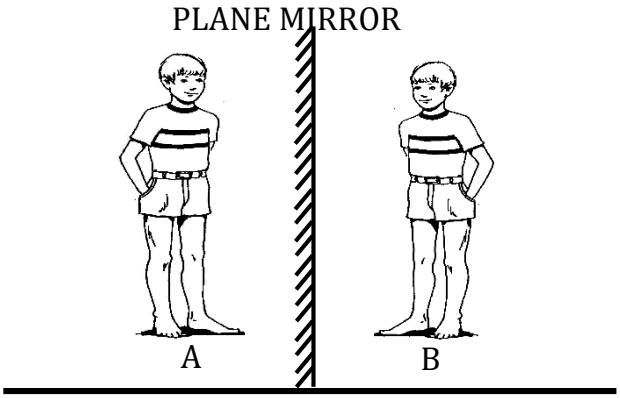
DRAWING IMAGES FORMED BY PLANE MIRRORS







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

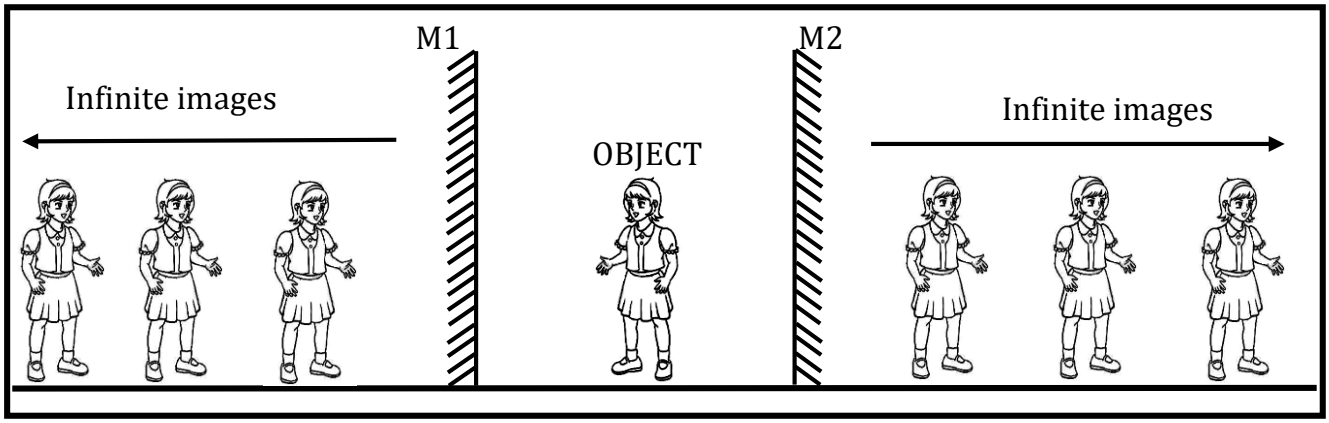
INFINITE IMAGES

- These are images which are endless

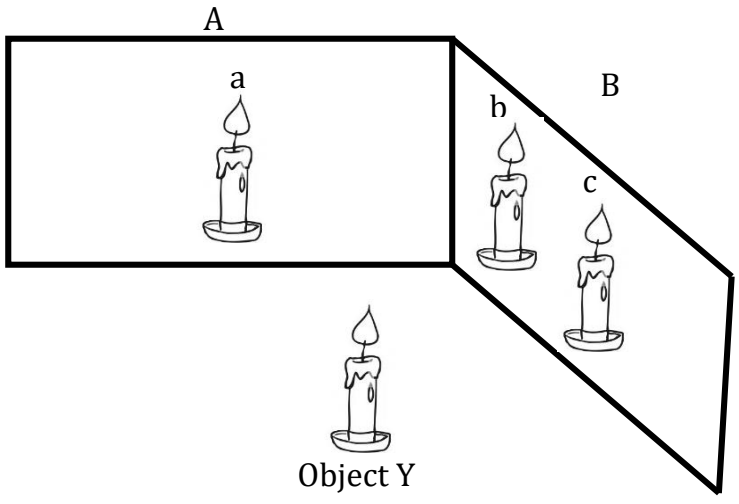
How are infinite images formed?

- 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 45^0 to the path of light rays

Why are plane mirrors fixed parallel to each other in a periscope?

- To reflect light

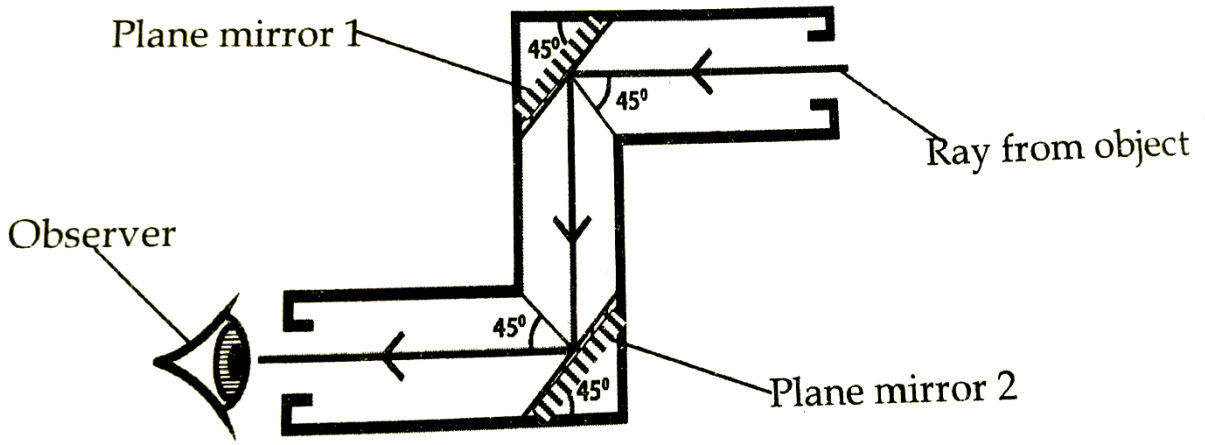
On which principle does a periscope work?

- It works on the principle of reflection of light

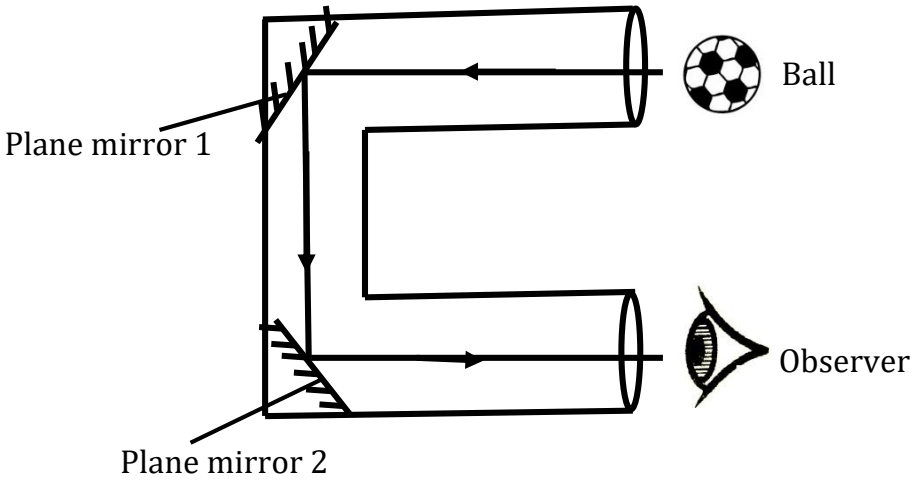
Why are we able to see around corners using a periscope?

- 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 45^0

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
- Marines
- Security guards
- 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

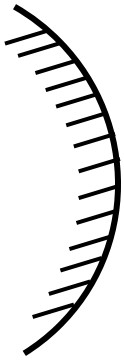
What happens to light rays when they strike a convex mirror?

- They are diverged

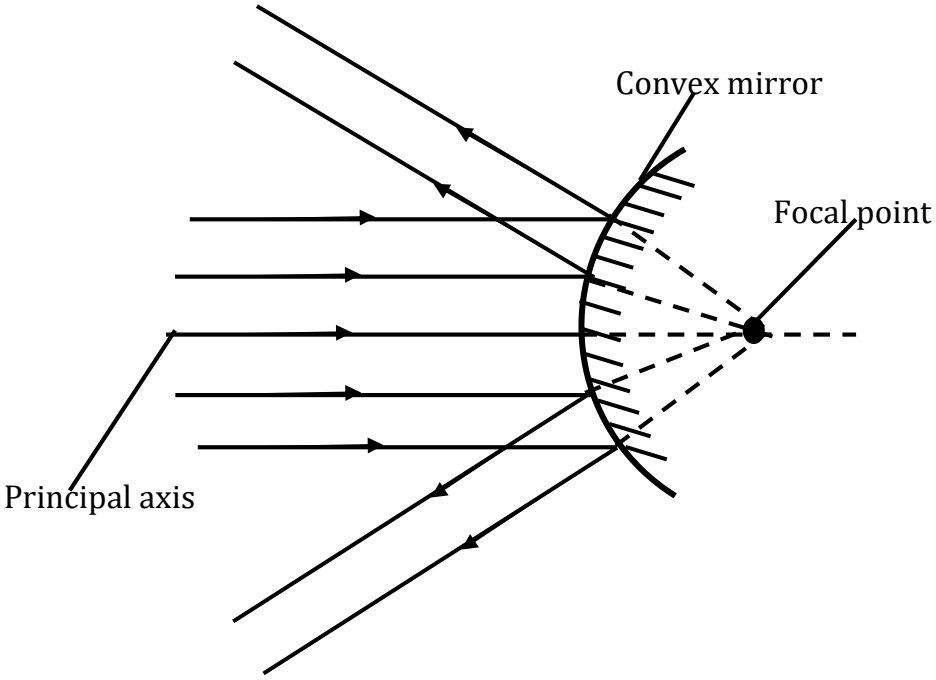
How does a convex mirror affect the beam of light?

- 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

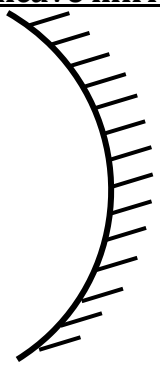
What happens to light rays when they strike a concave mirror?

- They are converge after reflection

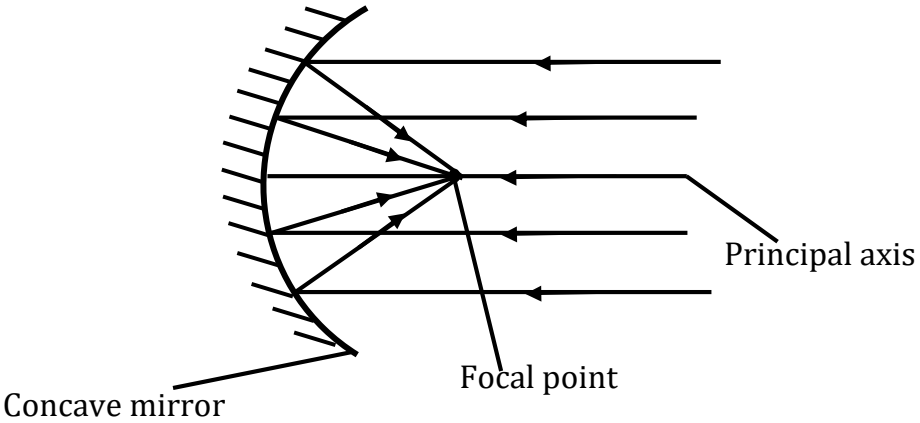
How does a concave mirror affect the beam of light?

- 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?

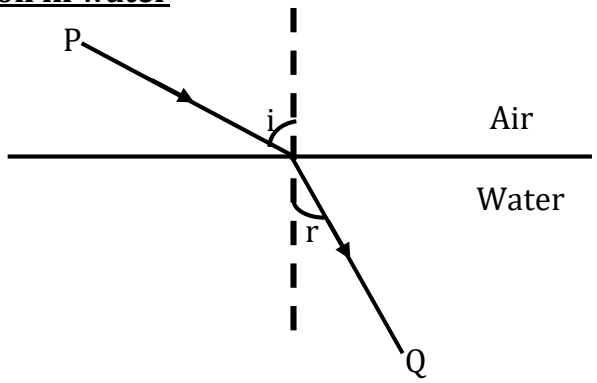
- When the incident ray strikes the boundary of another medium at an angle

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

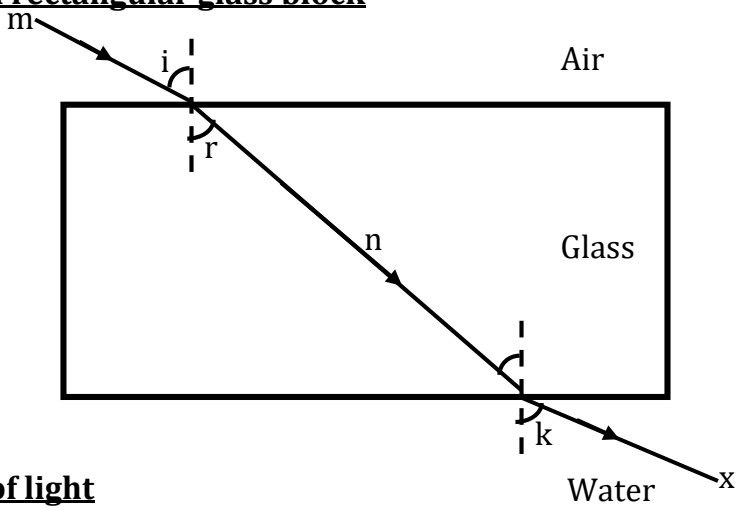
Q---- Refracted ray

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?

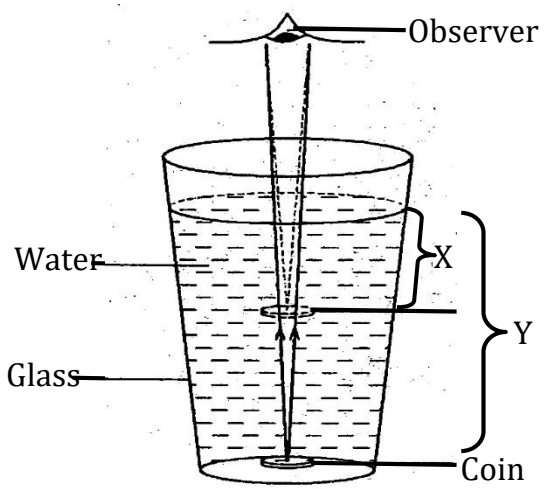
- Due to change in speed of light

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 REFRACTIONS

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?

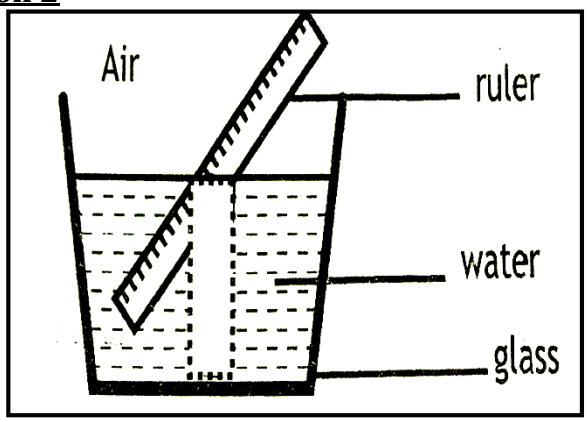
- Due to refraction

Qn. What causes real and apparent depth?

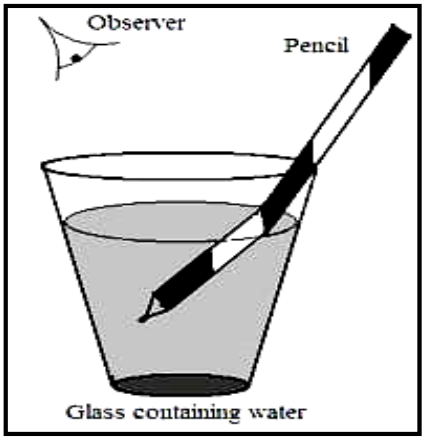
- Refraction

Illustration 2

A



B



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

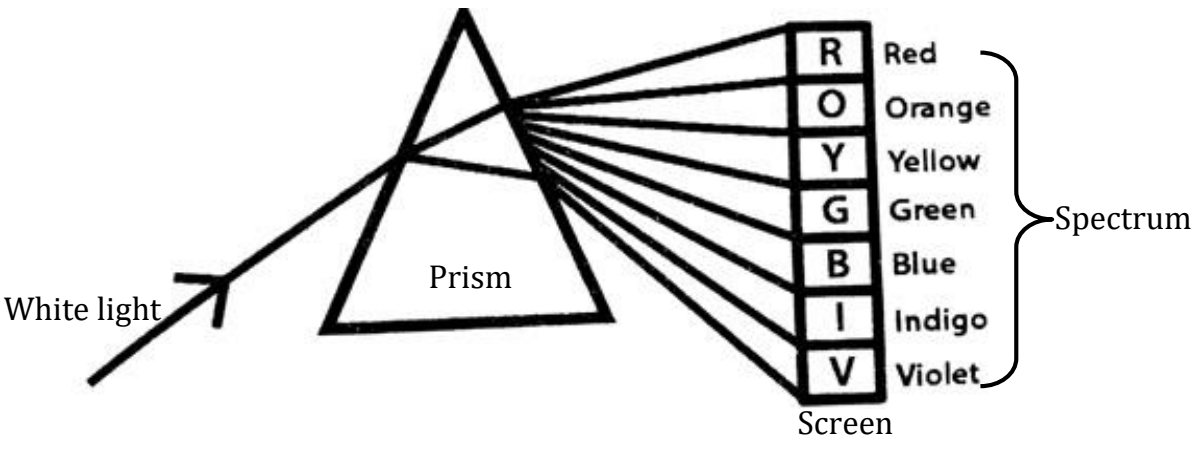
- Red
- Orange
- Yellow
- Green
- Blue
- Indigo
- Violet

MNEMONICS FOR THE ORDER OF SPECTRUM

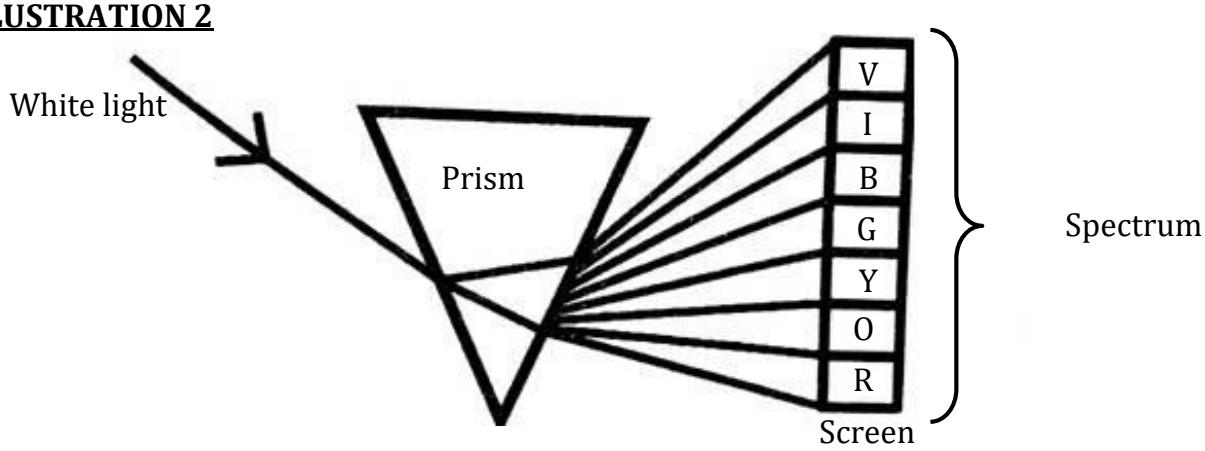
1. Richard Okello Your Girl Betty Is Vomiting
2. Richard Of York Gave Birth In Vain
3. Read Only Your Golden Book In Venus

DIAGRAMS TO SHOW DISPERSION OF WHITE LIGHT

1. ILLUSTRATION 1



2. <u>ILLUSTRATION 2</u>

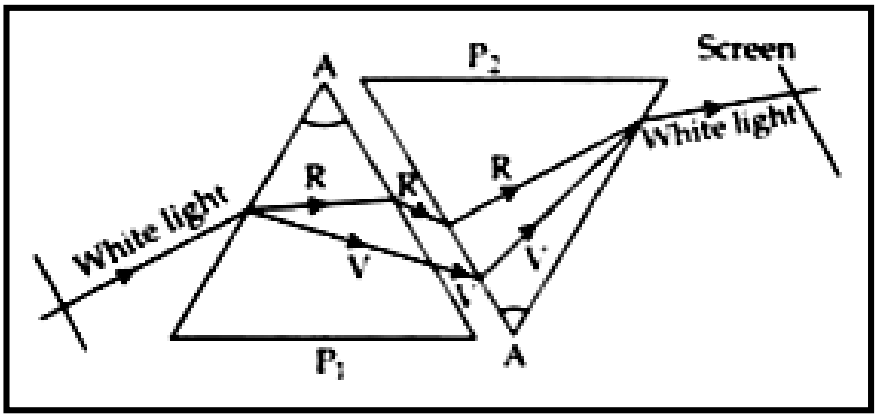


- Light rays in the prism bend at different angles because they move at different speed
- The fastest ray of light bends most and it has the shortest wavelength
- The slowest ray of light bends least and it has the highest wavelength
- **Red** colour bends the least and **violet** bends most.

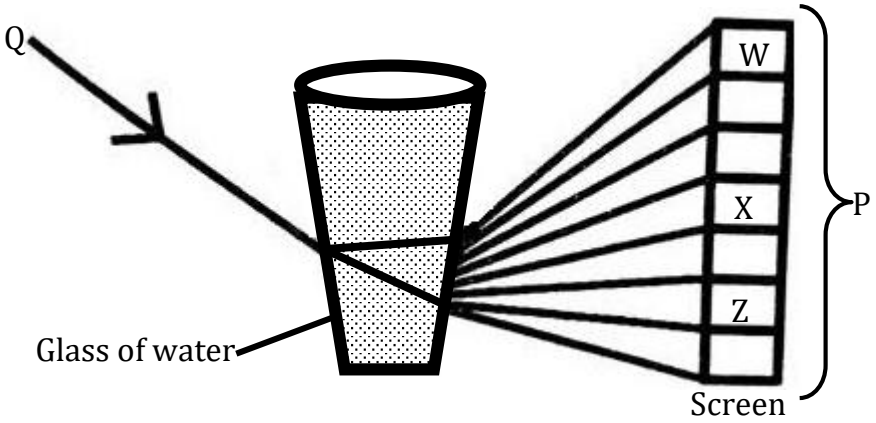
<u>NOTE</u>

- 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

<u>ILLUSTRATION</u>



<u>Study the diagram below and answer the questions about it.</u>



<u>What does the diagram above illustrate?</u>

- Dispersion of light

<u>Name the parts marked Q and P</u>

- Q is white light
- P is spectrum/light spectrum

<u>Name the colours marked W, X and Z</u>

- 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

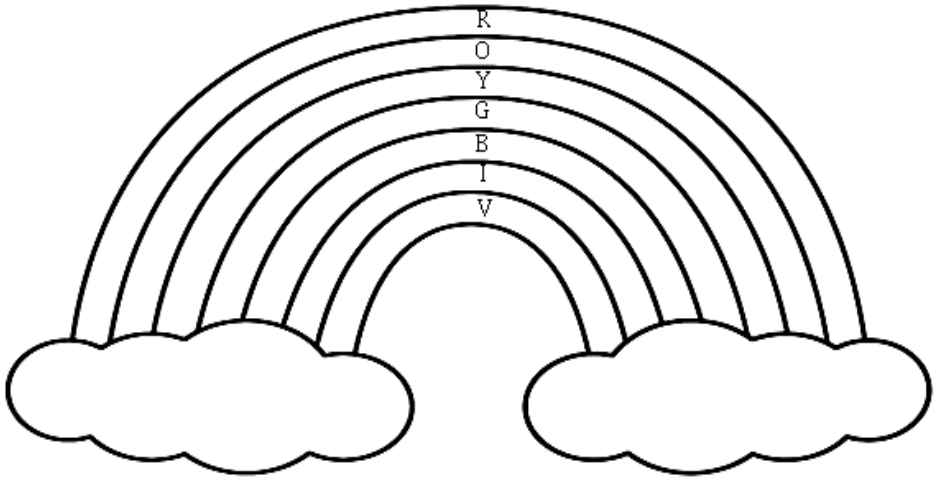
How is a rainbow formed?

- 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

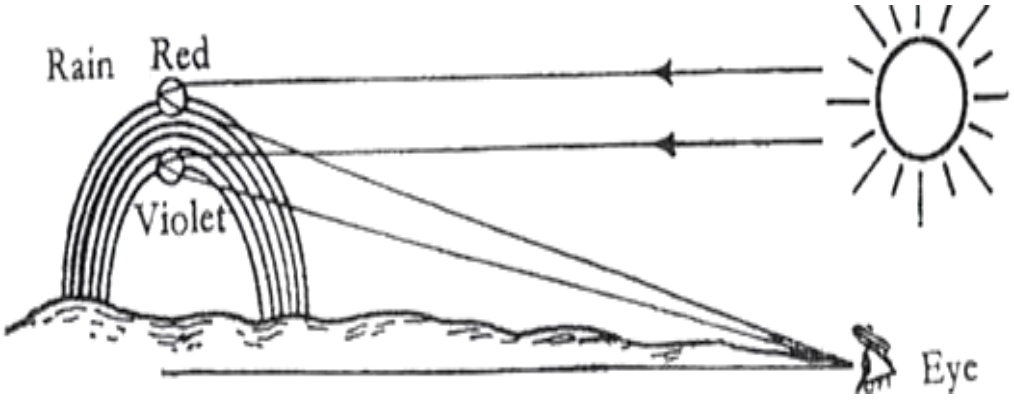
Why is red bent the least in a rainbow?

- 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

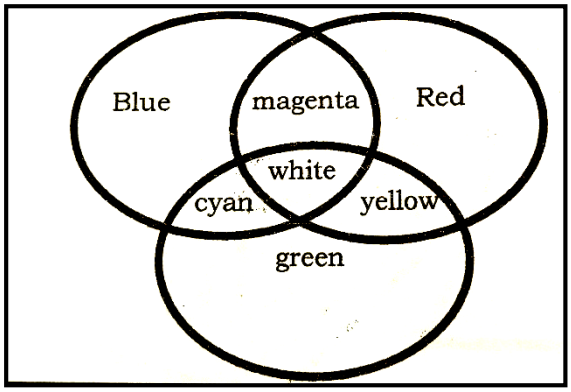
One colour must be a primary colour and another is a secondary colour mixing that primary colour.

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

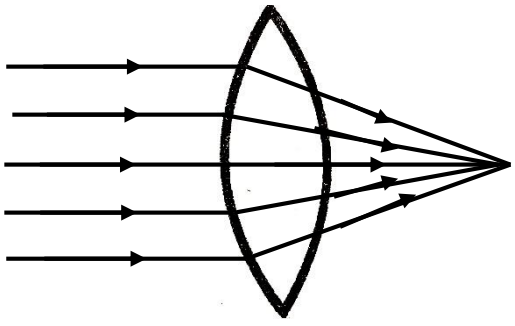
Why is a convex lens also called a converging lens?

- 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 magnified
- It is inverted

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

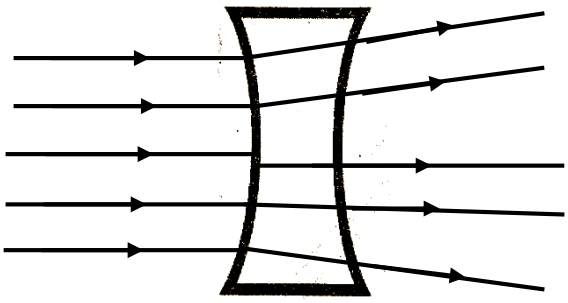
Why is a concave lens also called a diverging lens?

- 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

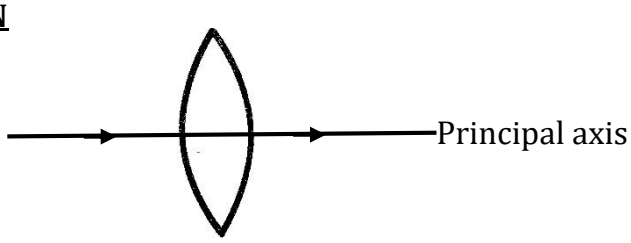
Uses of concave lenses

- 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
- Convex lens
- Projector
- Telescope
- Human eye

Optical instruments that form virtual images

- Periscope
- Microscope
- Mirrors
- 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.

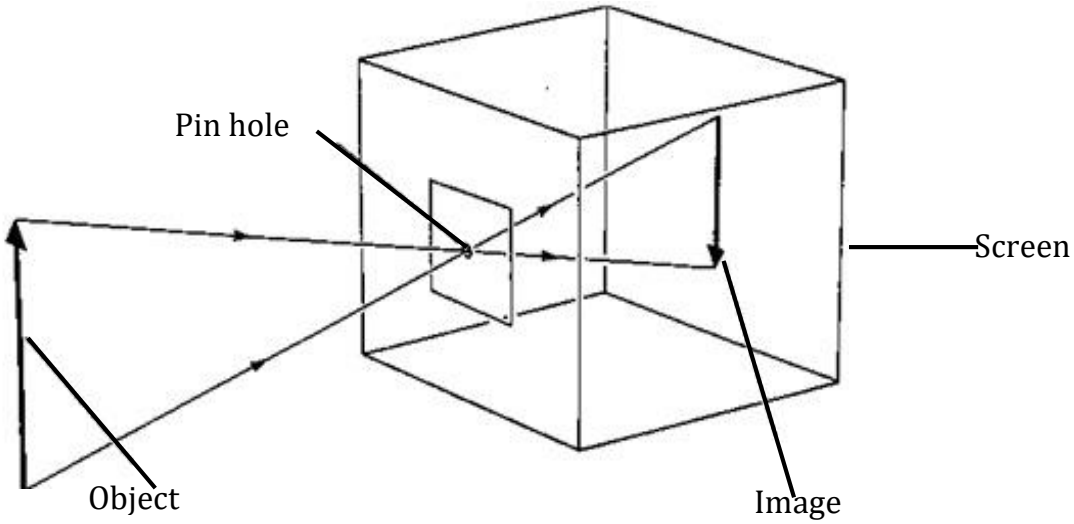
On which principle does a pinhole camera work?

- 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)

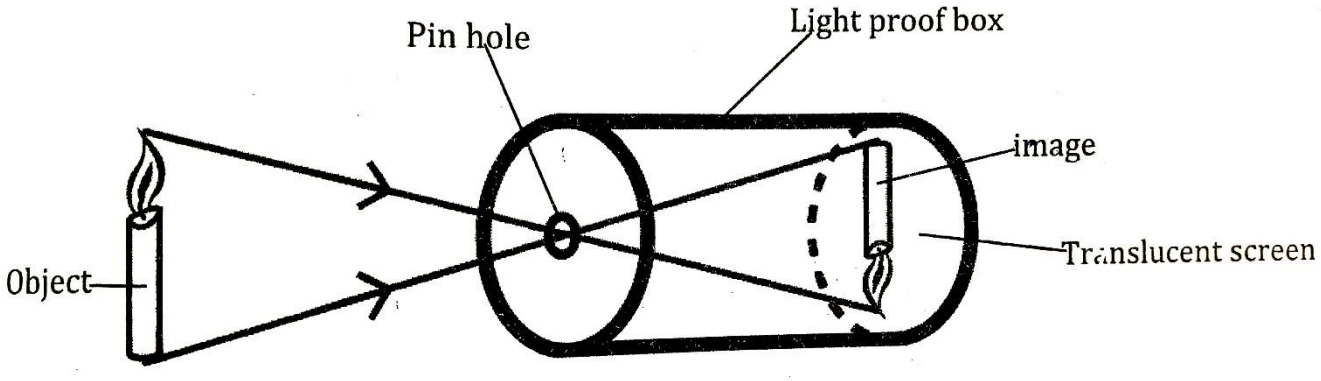
A diagram showing a pinhole camera



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

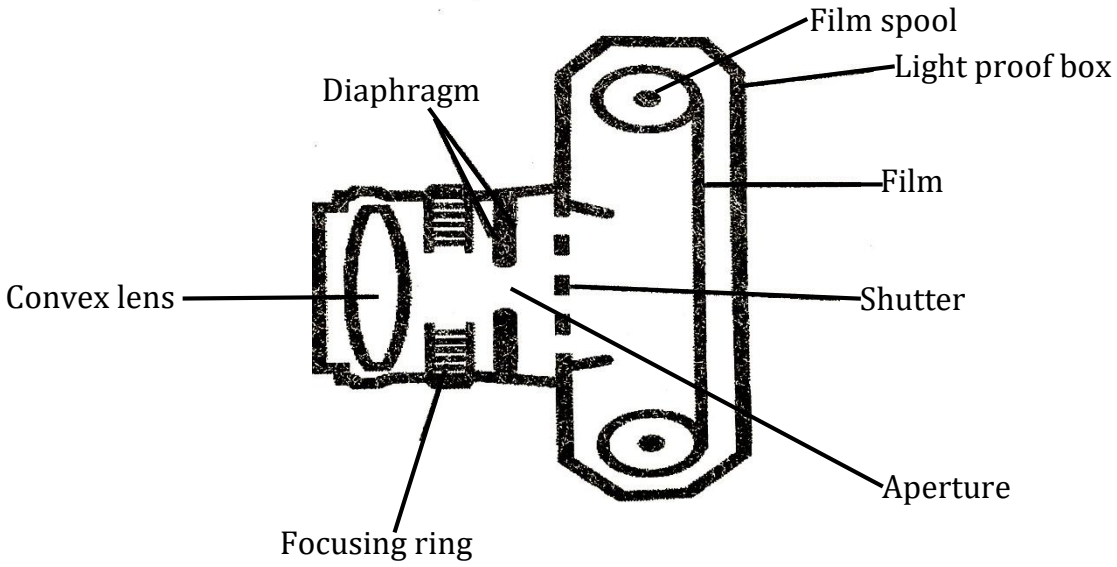
Name the type of lens used in a lens camera?

- 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 opens or closes the aperture
- It keeps out light when it is not needed

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)

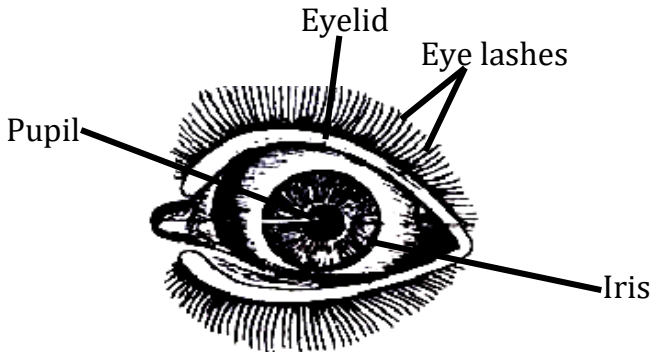
How are eyes protected from mechanical injury?

- 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

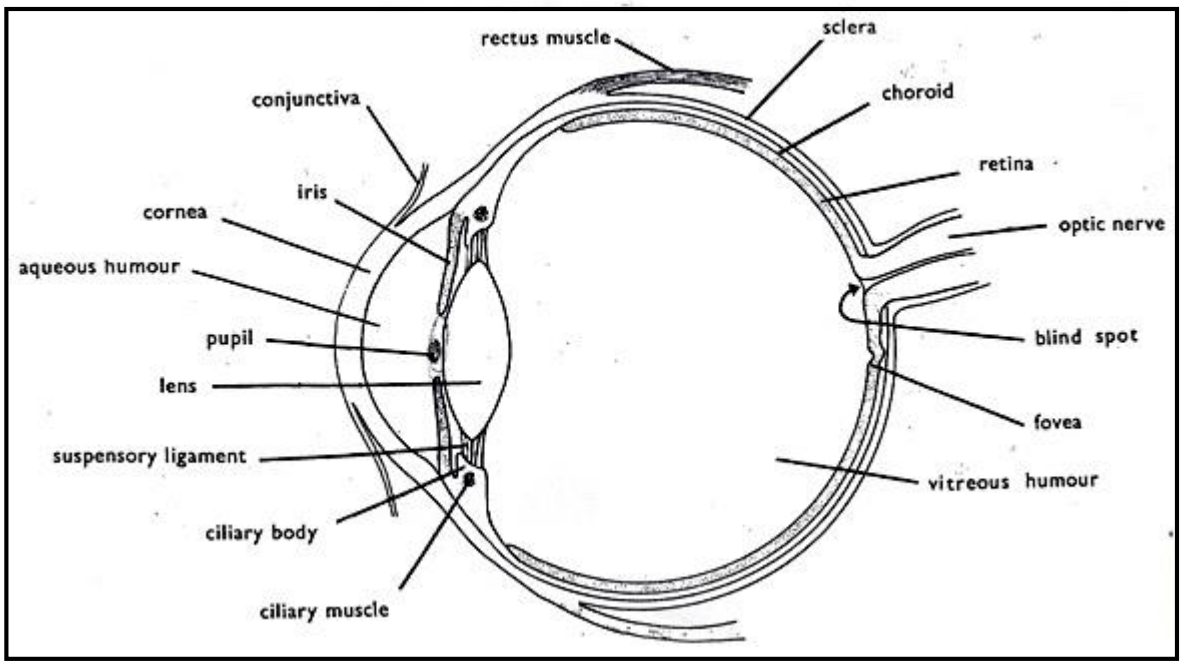
It acts as a protective outer coat for the eyeball.

- 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

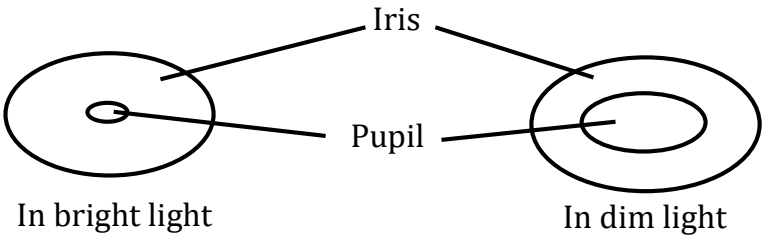
How does the iris regulate the amount of light entering the eye?

- 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



In bright light In 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

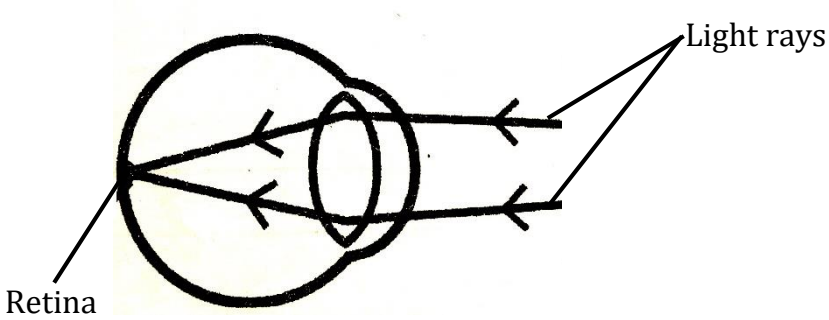
- During normal vision, both near and distant objects can be focused on the retina.

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 eyeball
- Abnormal shape of the eye lens
- Aging (old age)

EXAMPLES/TYPES OF EYE DEFECTS (REFRACTIVE ERRORS/EYE DISORDERS)

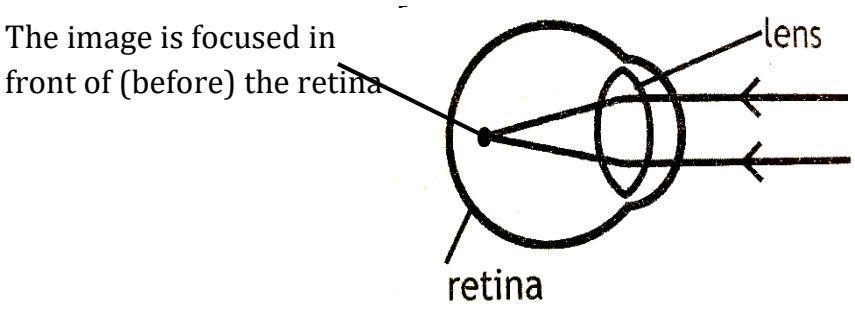
- Short sightedness (myopia)
- Long sightedness (hyperopia)
- Old age sight (presbyopia)
- Astigmatism

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)

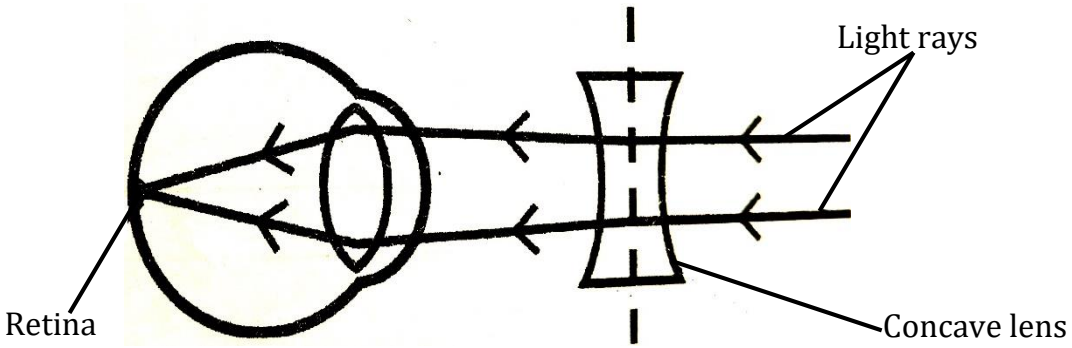
AN ILLUSTRATION SHOWING MYOPIA



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?

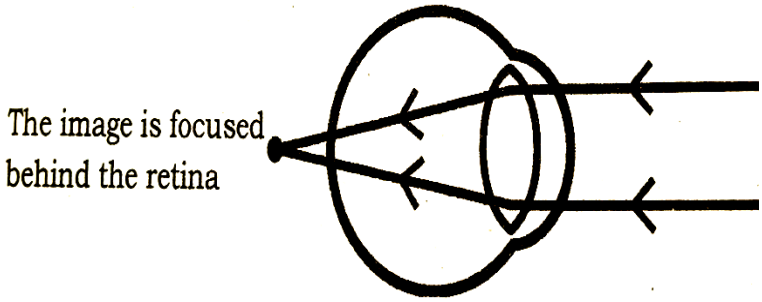
- It slightly diverges light rays

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

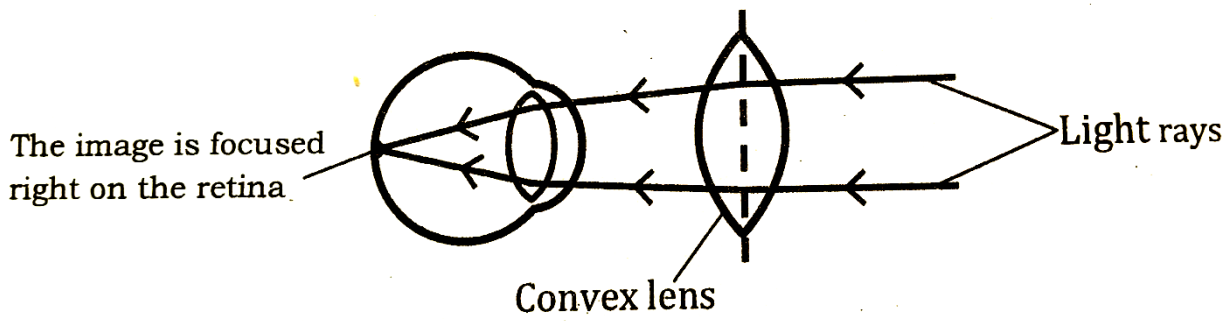
AN ILLUSTRATION SHOWING HYPEROPIA



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 rood 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

- Uncorrected eye defects (uncorrected refractive errors)
- Eye diseases
- Vitamin A deficiency
- Injuries to the eye
- Birth defects
- 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
- Animals
- Water
- Air
- Soil
- 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
- Donkeys
- Dolphins
- Llamas
- Geese

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

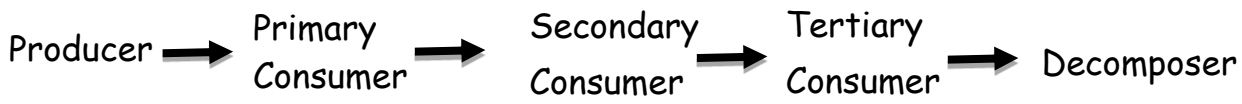
Components of a food chain (trophic levels in a food chain)

- 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)

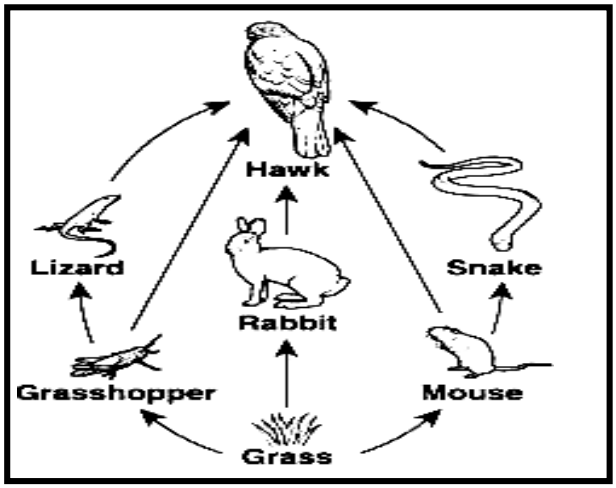
What happens to producers when primary consumers reduced?

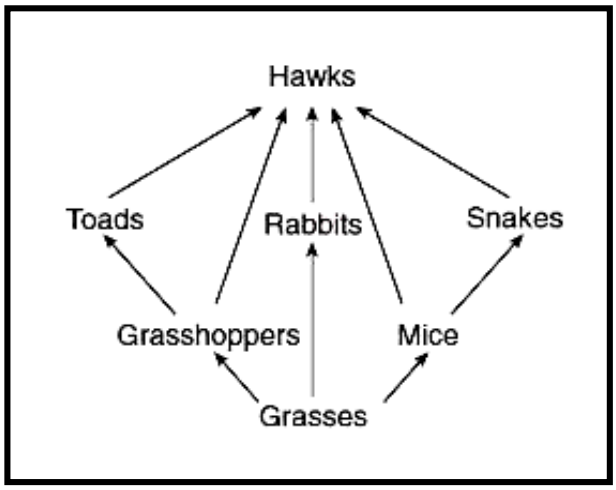
- The population of producers increases

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.

- Capital
- Land
- Labour
- 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
- Mangoes
- Avocado
- Jackfruit
- Musizi
- Acacia
- Mahogany
- 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
- Coffee
- Cabbage
- Passion fruit
- Eucalyptus
- Red pepper
- Bitter tomato
- Egg plant

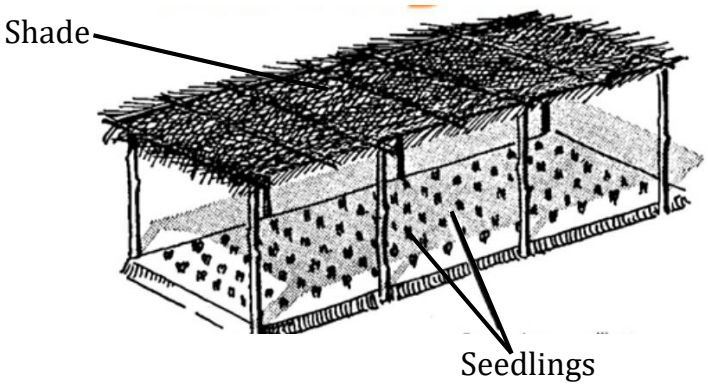
What is pricking out?

- 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)

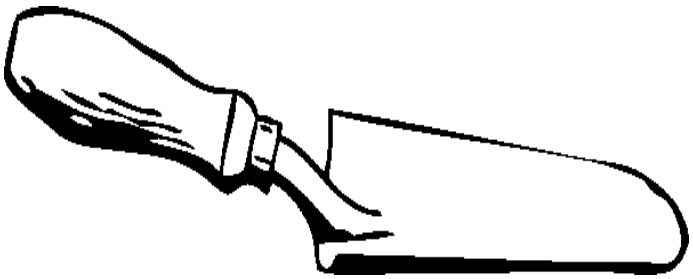
Steps for hardening off

- 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

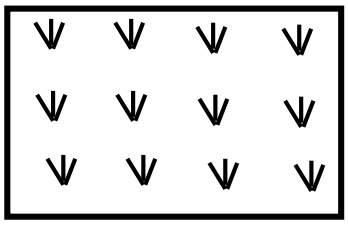
- This is the planting of crops in lines giving proper space among plants.
- It is done using a **garden line**

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

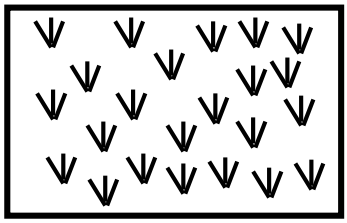
2. BROADCASTING METHOD

- 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

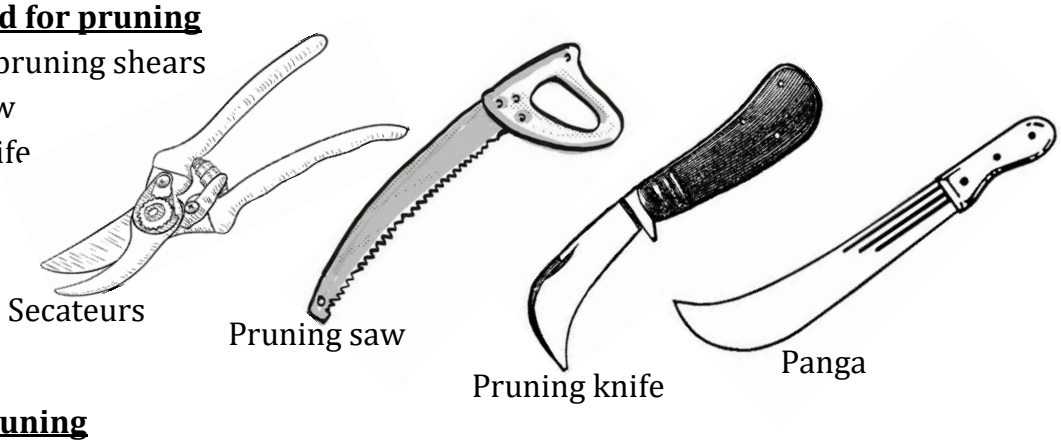
- Weeding
- Pruning
- Thinning
- Roguing
- Plant training
- Mulching
- Spraying with pesticides

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
- 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

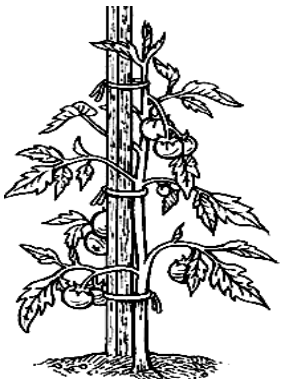
- Staking
- Propping
- Trellising

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

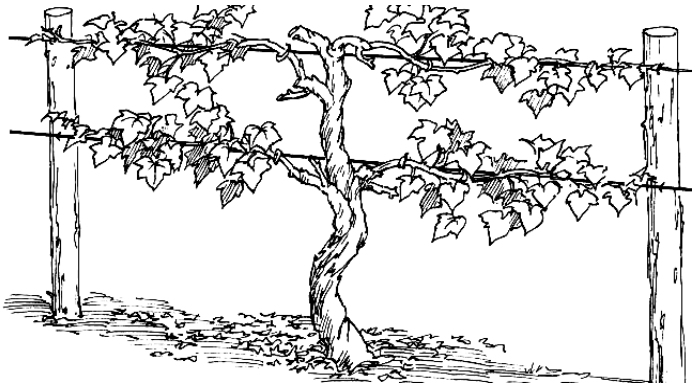
3. TRELLISING

- 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)
- Common chickweed
- Pigweed
- Crabgrass
- Foxtail millet

ii) Biennial weeds

- Wild carrot
- Common burdock
- Moth mullein

iii) Perennial weeds

- Elephant grass
- Star grass
- Dandelion
- Wandering jew
- Thorn apple
- Guinea grass
- Couch grass
- Spear grass
- Poison ivy
- 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

- Mulches hide pests
- Undried/wet mulches can grow into weeds
- 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, been 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)

- By crop rotation
- Regular weeding
- Pruning
- By early planting
- By timely harvesting
- Roguing
- 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 Cigar end rot Banana Bacterial Wilt	Leaves Banana fingers (fruit) 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

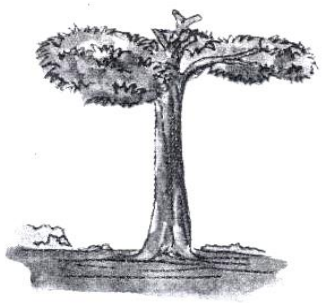
POLLARDING

- 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 fruits 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

COPPICING

- 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 COPPICING (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 not 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

PREPARATIONAND 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 OFWOOD 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
- Feeding on balanced diet
- Proper personal hygiene
- Performing regular body exercises
- Proper food hygiene
- Drinking safe water
- Avoiding drug abuse
- 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
- Cholera
- Malaria
- Kwashiorkor
- Typhoid
- Diarrhoea
- Measles
- Poliomyelitis

Causes of common sickness at home

- Poor sanitation
- Poor personal hygiene
- Malnutrition (poor feeding)
- Inadequate water supply
- Lack of physical exercises
- Drinking contaminated water
- Smoking
- Alcoholism
- Drug abuse
- Air pollution
- Lack of immunization

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
Water borne diseases ▪ These are diseases spread through drinking contaminated water	▪ Cholera ▪ Typhoid fever ▪ Bilharziasis (schistosomiasis) ▪ Poliomyelitis ▪ Dysentery ▪ Hepatitis A ▪ Diarrhoea ▪ Guinea worm disease
Water contact diseases ▪ These are diseases spread through direct body contact (swimming or bathing) with contaminated water	✓ Bilharziasis ✓ Swimmer's itch ✓ Swimmer's ear (otitis externa)
Water cleaned diseases ▪ These are diseases spread due to lack of clean water to clean our bodies/promote personal hygiene	❖ Scabies ❖ Impetigo ❖ Trachoma ❖ Ringworm ❖ Athlete's foot ❖ Conjunctivitis
Water habitat vector diseases ▪ These are diseases spread by vectors that breed in water	• 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

STDS

- ✓ Leprosy
- ✓ Ebola
- ✓ Ringworm
- ✓ Scabies

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-INFLICTED 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)

- Telling lies (deception)
- Bullying
- Stealing
- Using bad language
- Arson (fire setting)
- Fighting
- Smoking
- Violence and aggression
- Alcoholism
- 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
- Inconsistence 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

- 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
- 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 the 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
- Common sickness in the community
- Ways of preventing common sickness
- Immunization coverage
- Food security in the area
- Housing information

Housing information collected during health survey

- Type of houses
- Size of each house
- Ventilation of the house
- Number of people who live in each 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
- Prioritizing
- Evaluation
- Accounting
- Strict management

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
- 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 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