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**

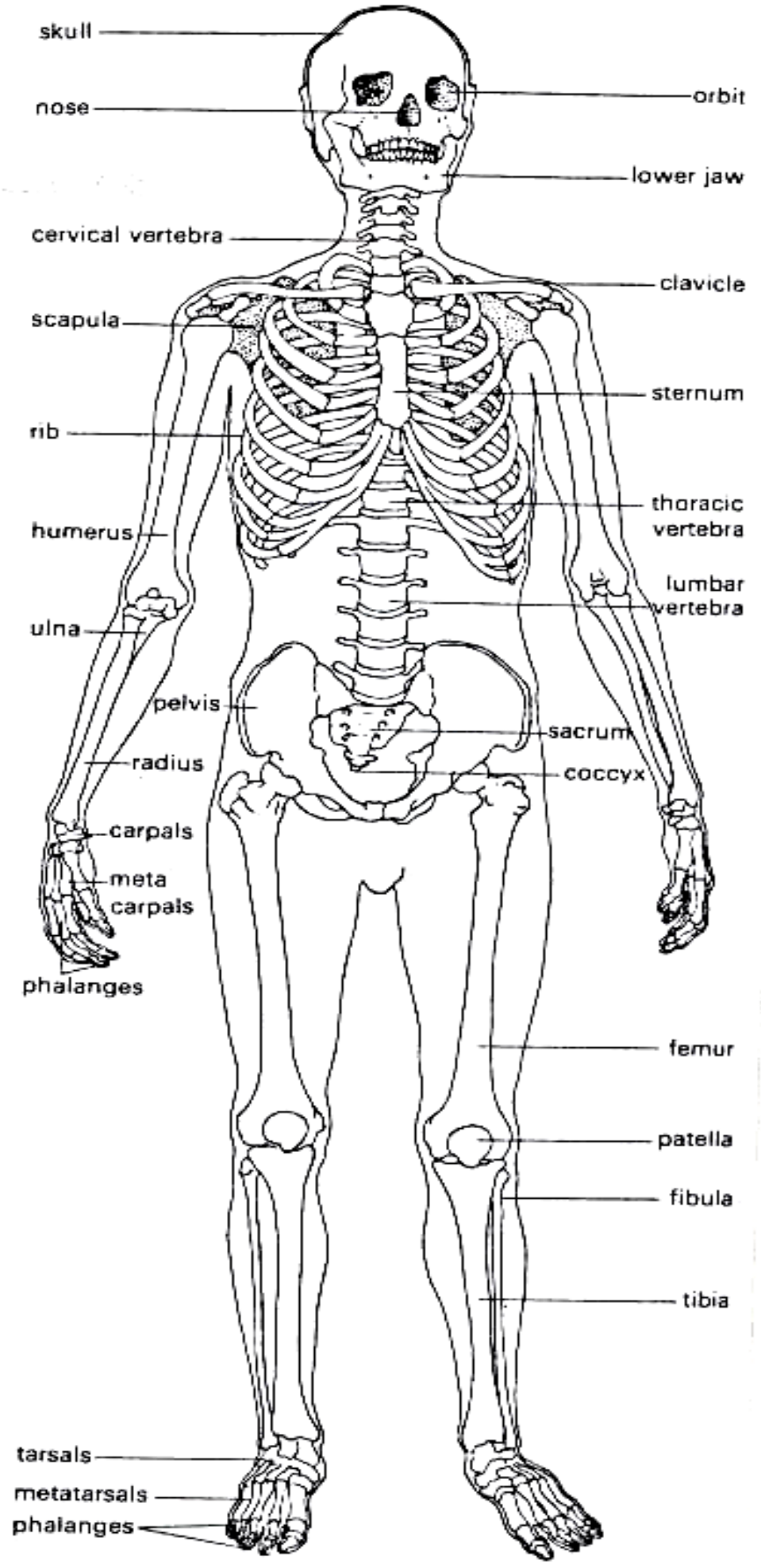
Why do new born babies have more bones than adults?

- 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

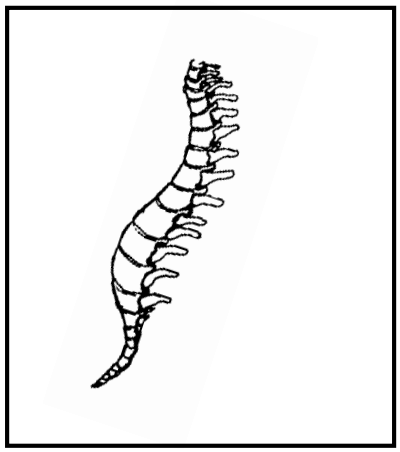
AXIAL SKELETON

- 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

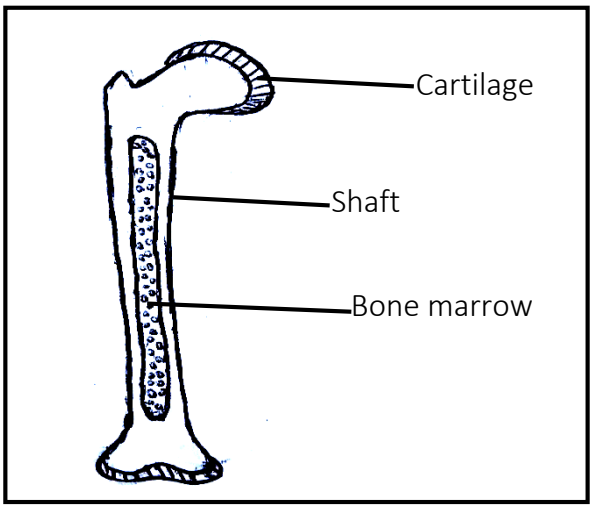
Name the longest and strongest bone in the human body.

- 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

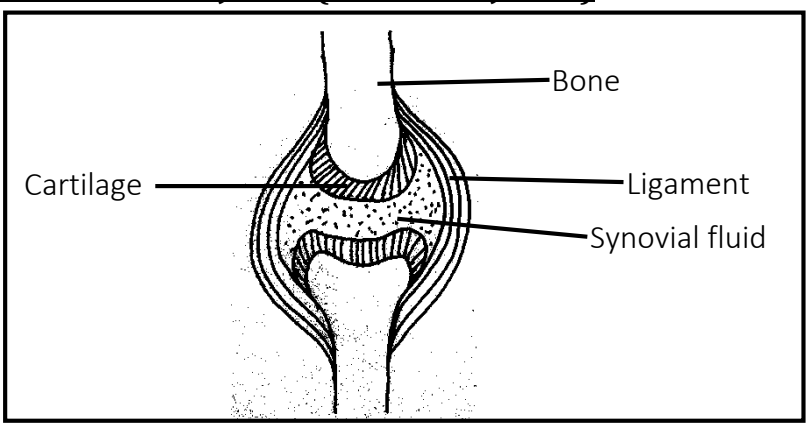
MOVABLE JOINTS

- 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

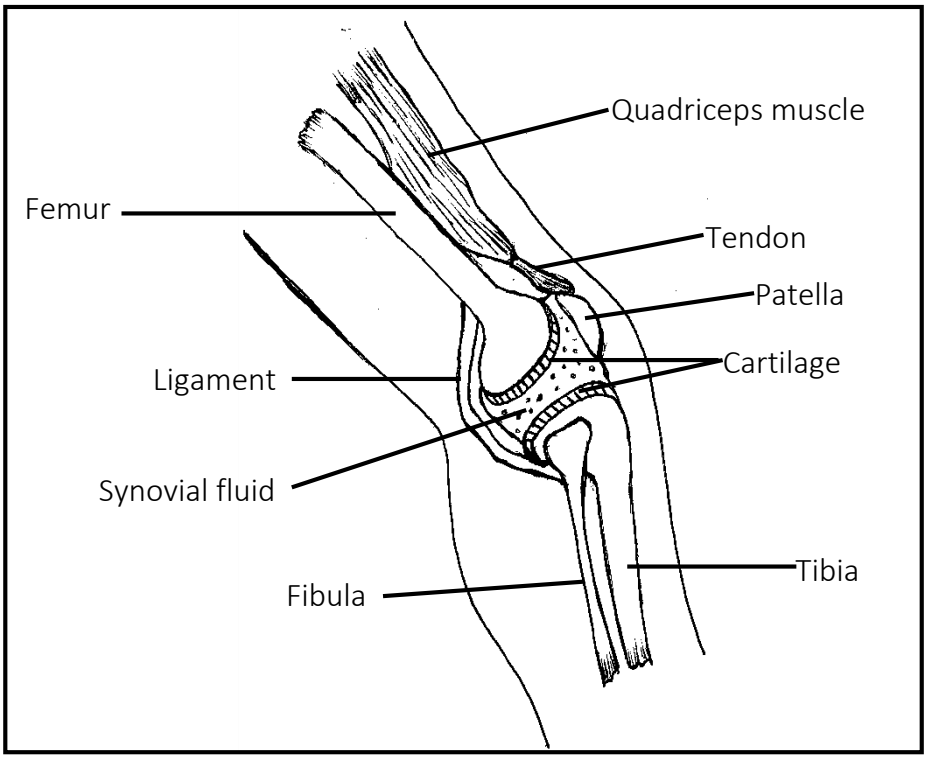
Examples of hinge joints

- 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

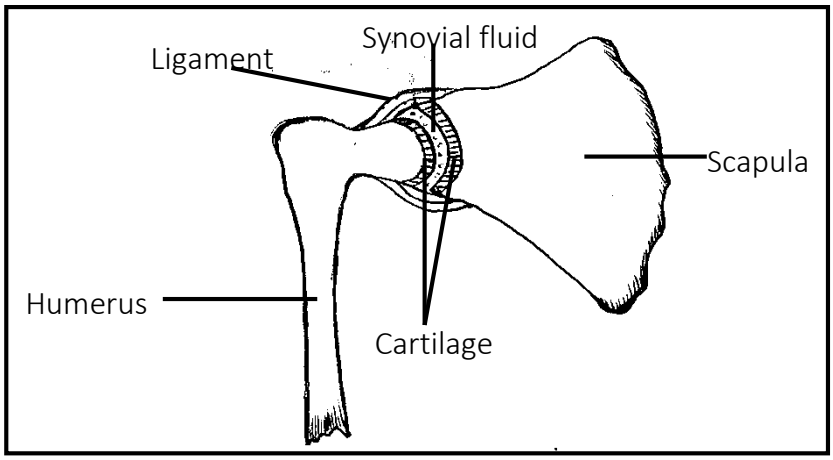
Examples of ball and socket joints

- 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

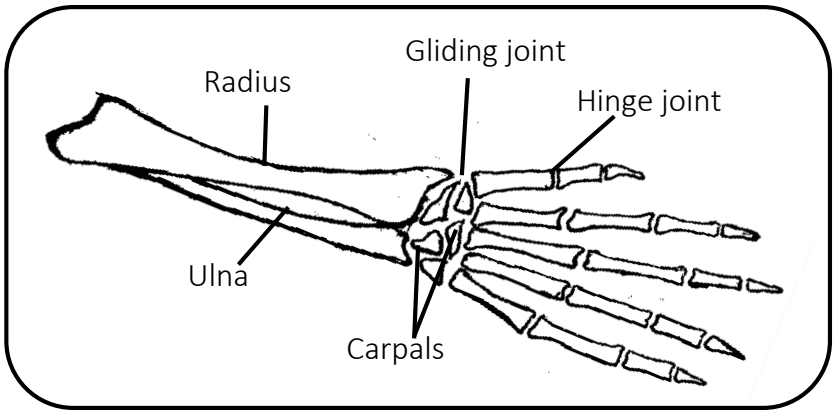
Examples of gliding joints

- 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

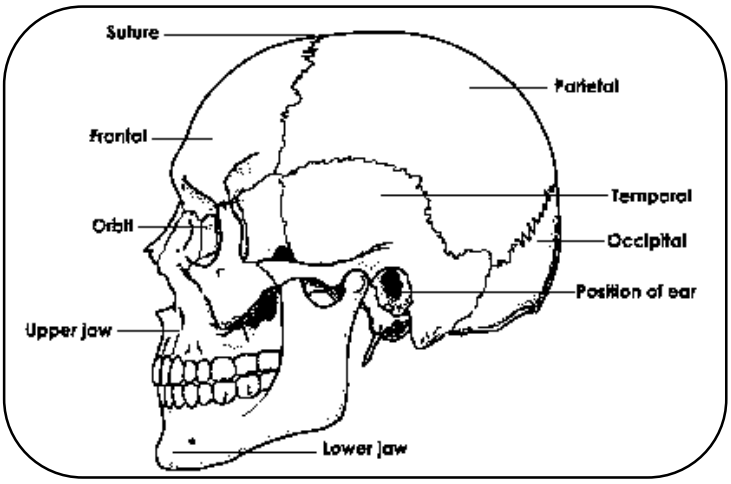
In which part of the body are suture joints found?

- 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

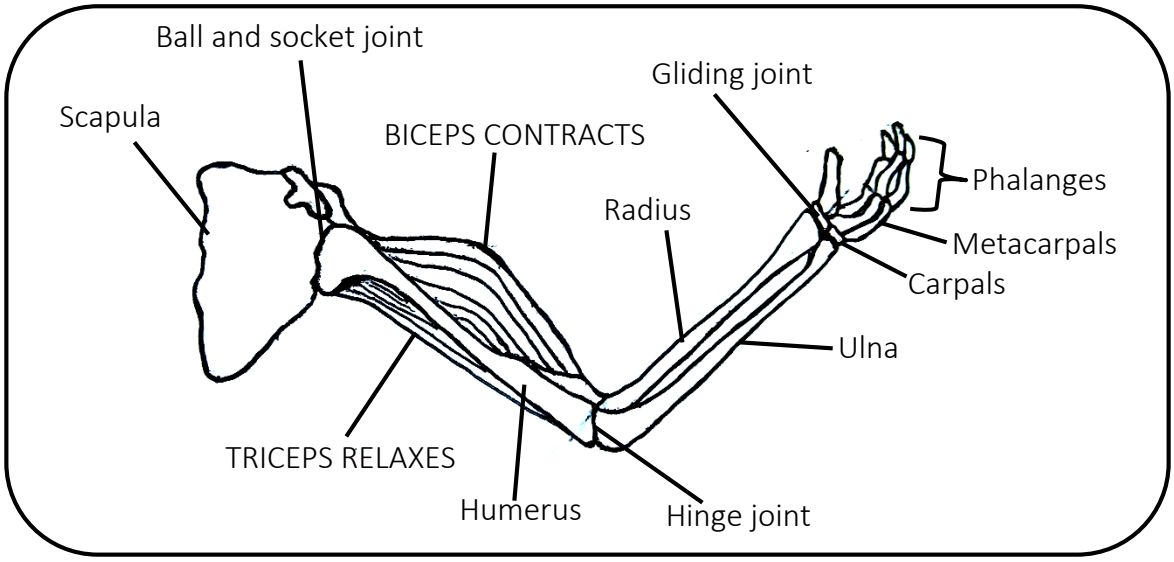
- Biceps and triceps muscles
- Quadriceps and hamstrings

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

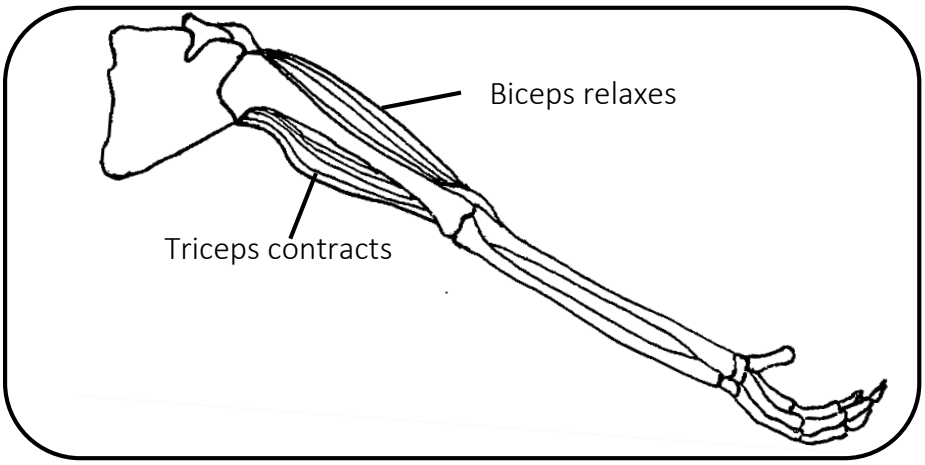
1. **WHEN THE FOREARM IS RAISED (BENT)**



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)

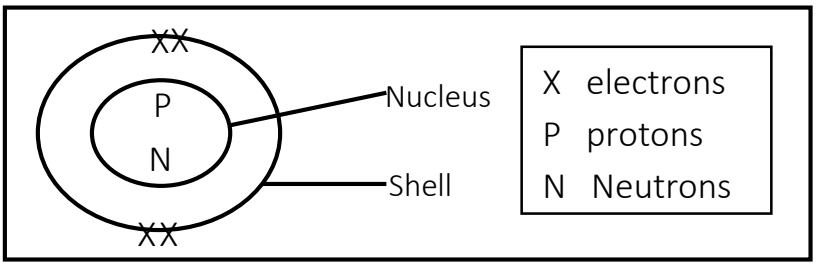
When does a body (an atom) become positively charged?

- 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

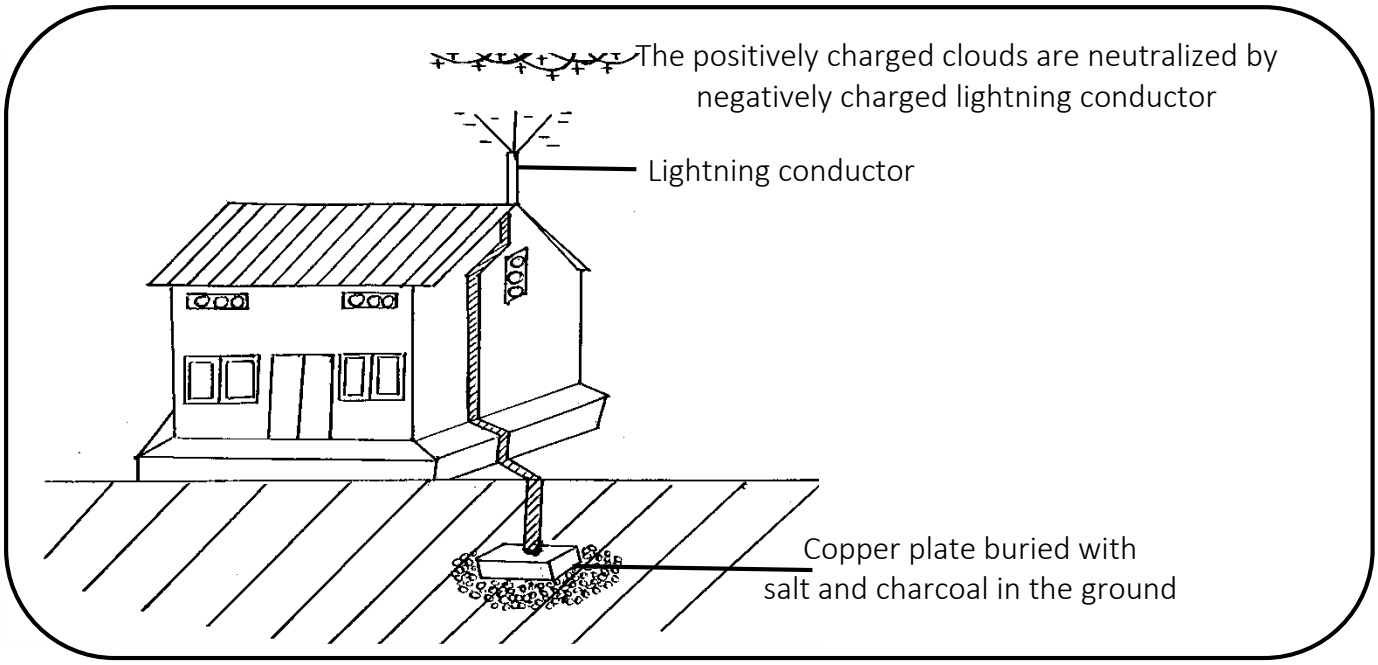
What do we call the abnormal fear of thunder and lightning?

- 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)

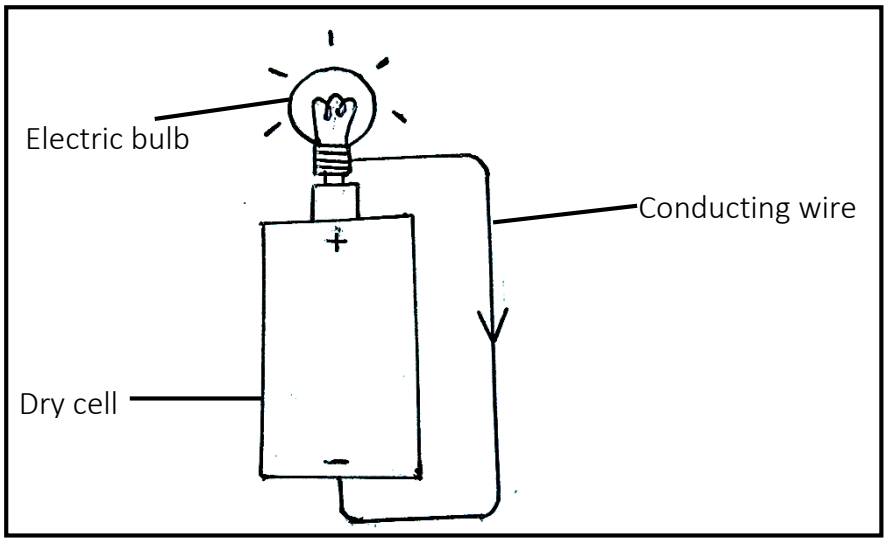
- This is the rate of flow of electric charge in a conductor
- This is the flow of electrons in a conductor

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**

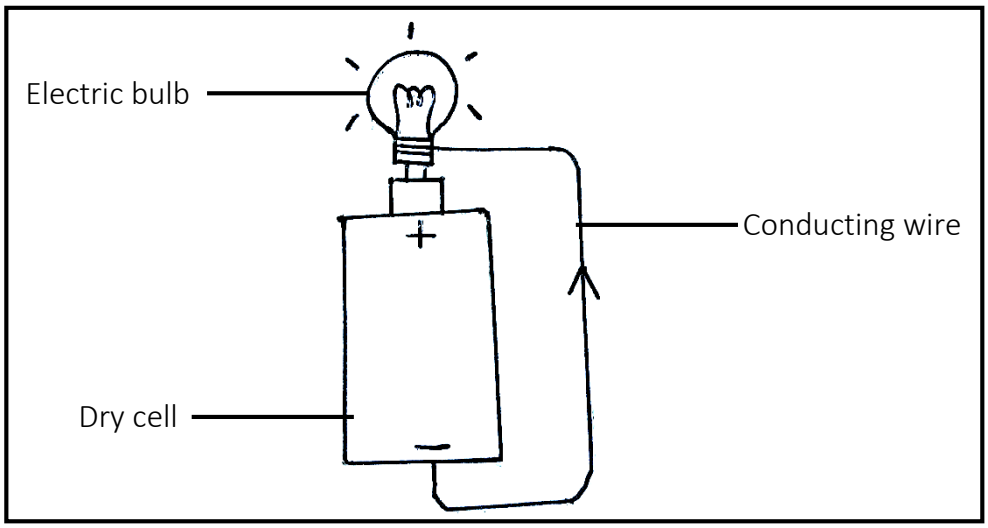
A diagram showing the flow of current (electricity)



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

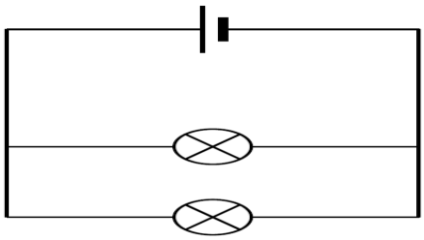
TYPES OF CIRCUITS

- Parallel circuit
- Series circuit

PARALLEL CIRCUIT

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

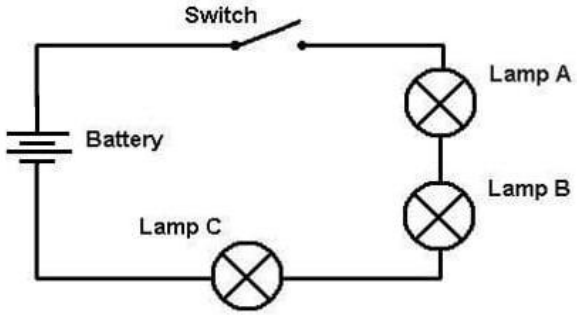
A DIAGRAM SHOWING A PARALLEL CIRCUIT



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

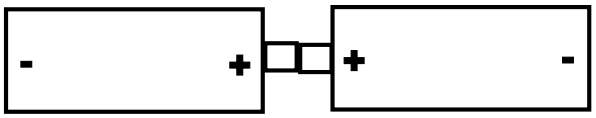
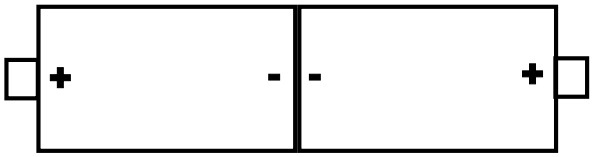


ILLUSTRATION II

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



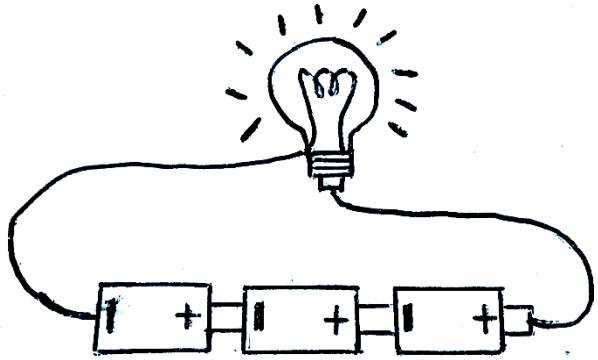
CORRECT ARRANGEMENT (CONNECTION) OF DRY CELLS

- 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

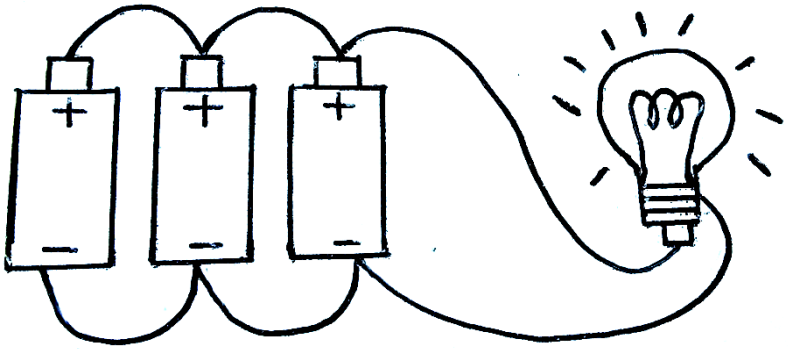
A DIAGRAM SHOWING SERIES CONNECTION OF DRY CELLS



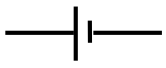
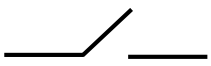
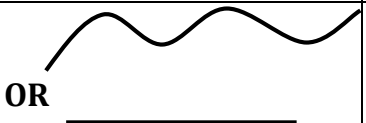
PARALLEL CONNECTION

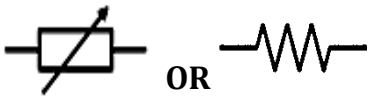
- This is when all positive terminals of dry cells are joined and all negative terminals are also joined in the circuit

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

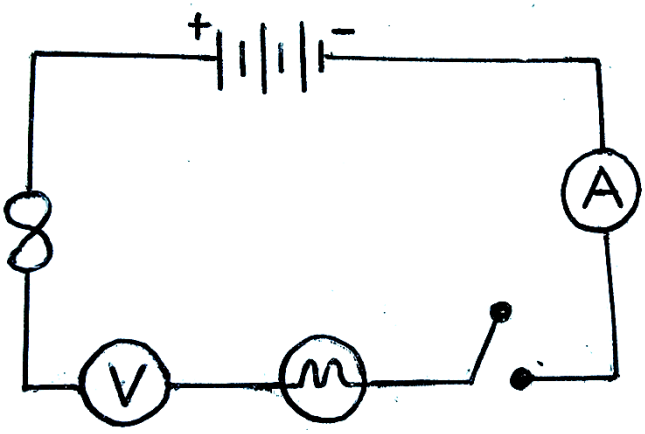
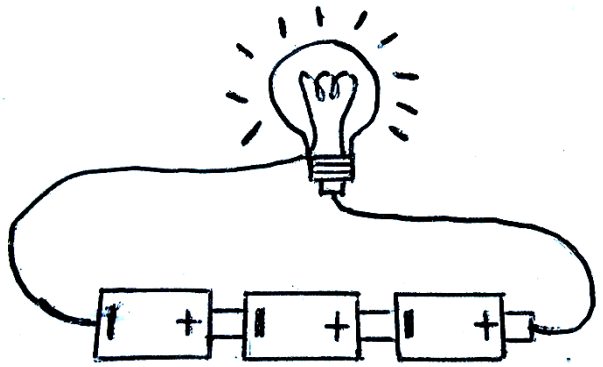


DIAGRAM 2



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

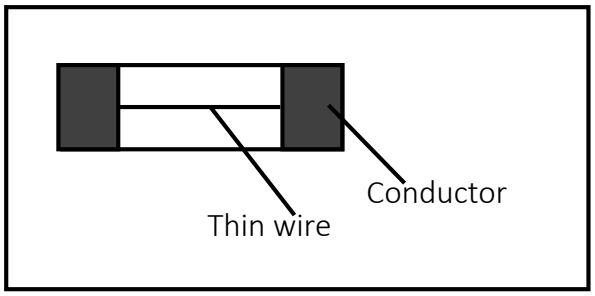
CIRCUIT BEAKER

- ✓ 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

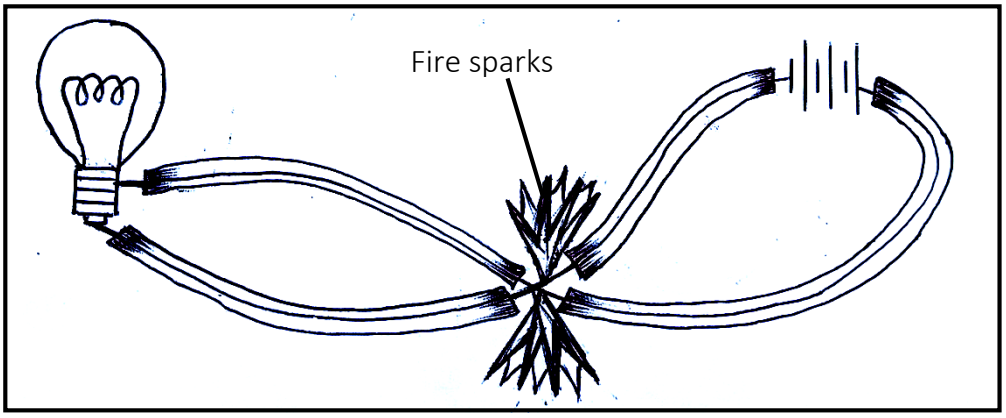
SHORT CIRCUIT

- 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

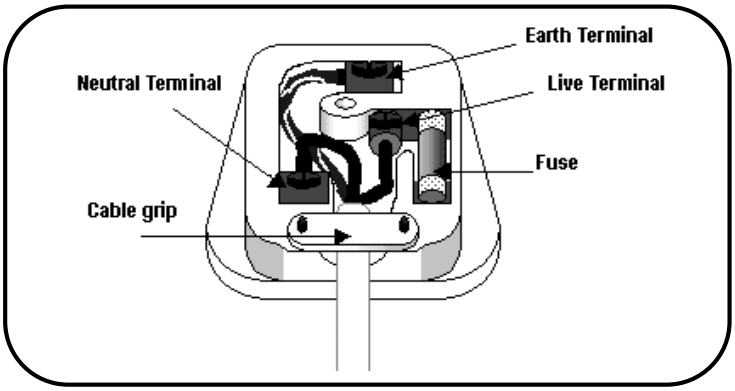
TYPES OF ELECTRIC PLUGS

- 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

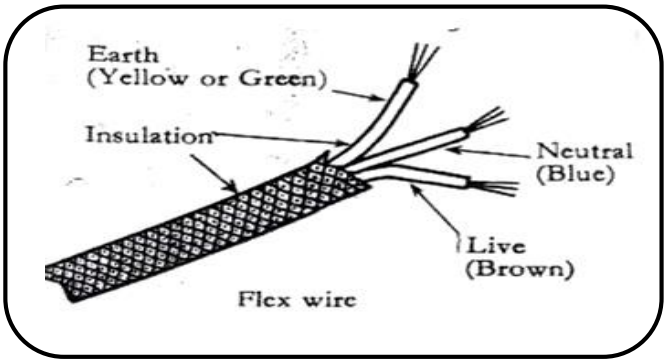
Cable grip

- 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

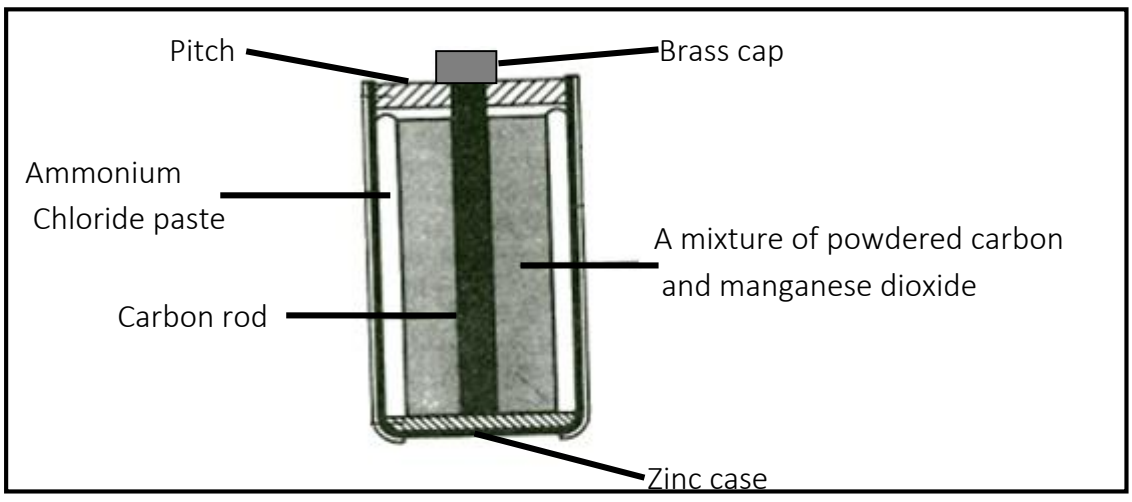
A DRY CELL

- 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

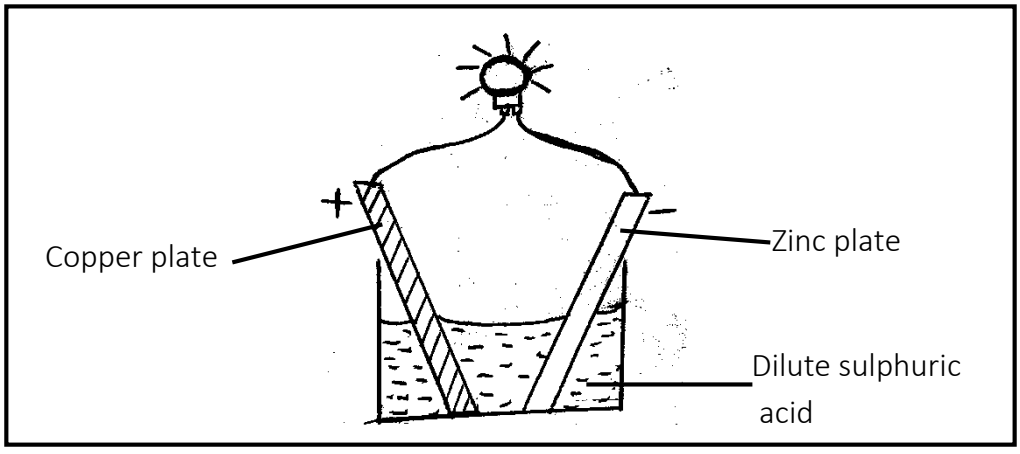
Functions of carbon powder in the dry cell

- 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



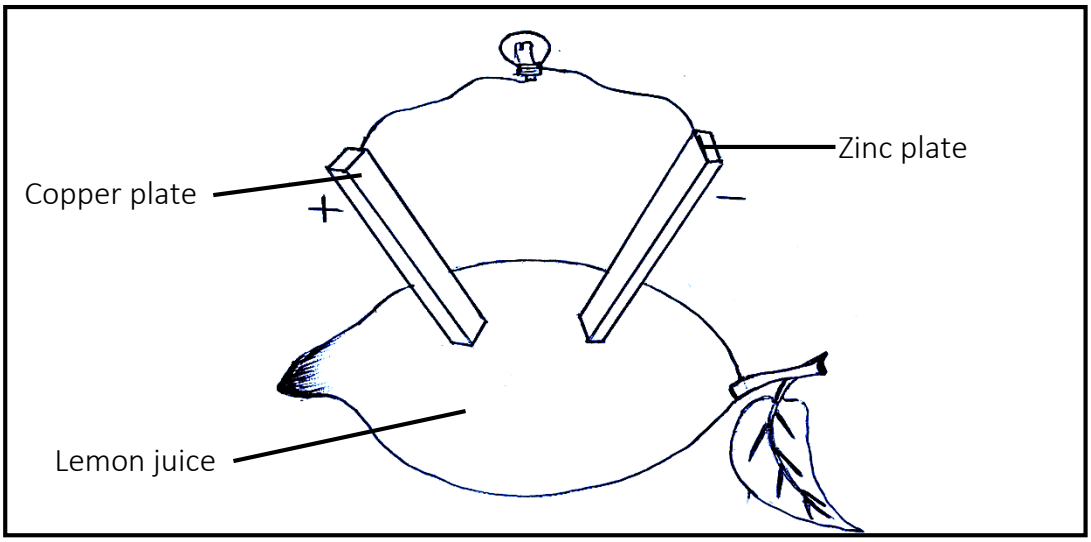
Fruits that can be used to make a simple cell at home

- 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

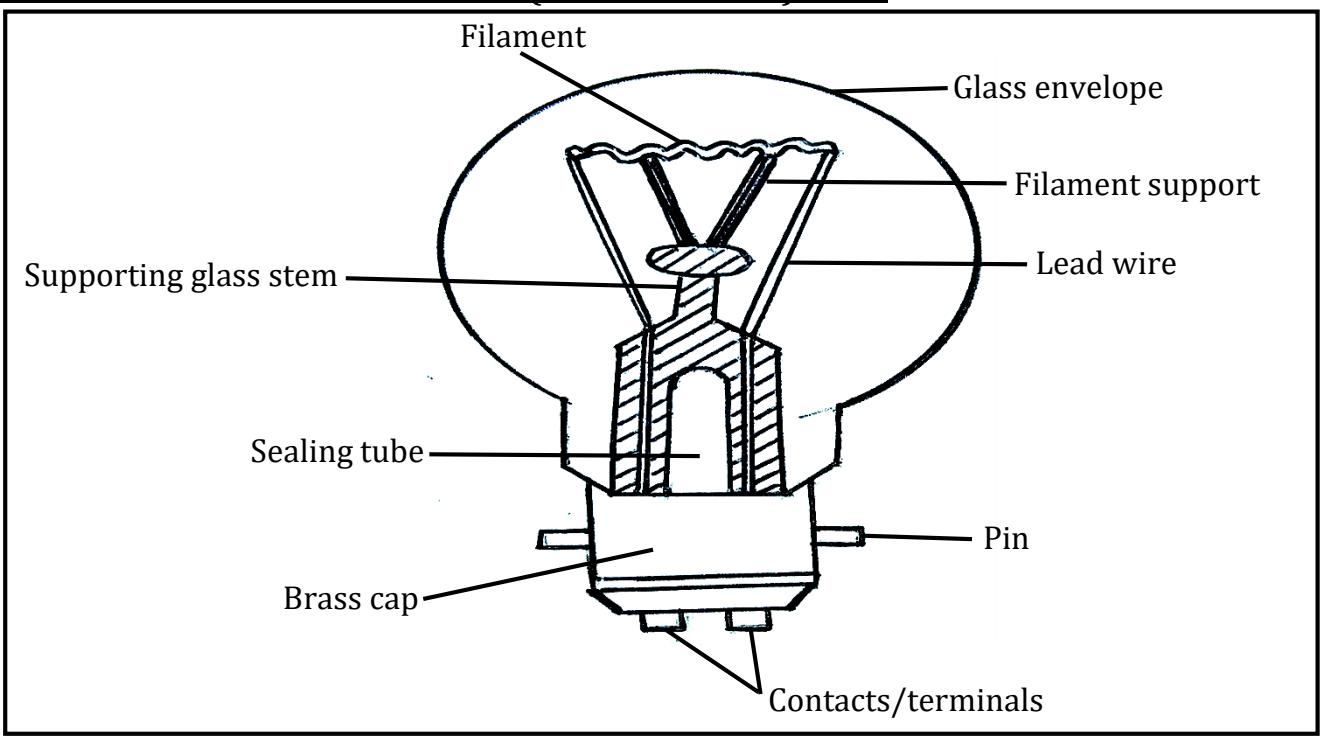
Advantages of using fluorescent bulbs

- 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

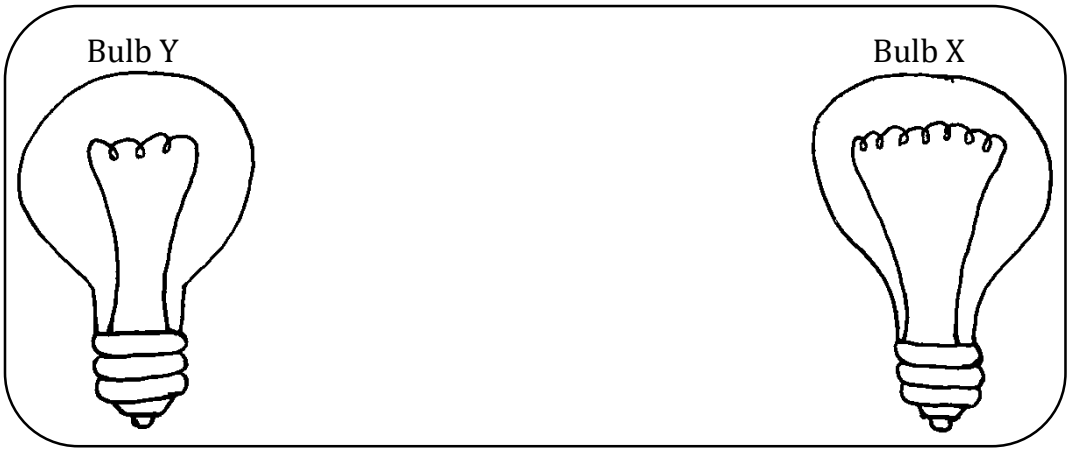
What energy change occurs on the filament of an electric bulb?

- 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

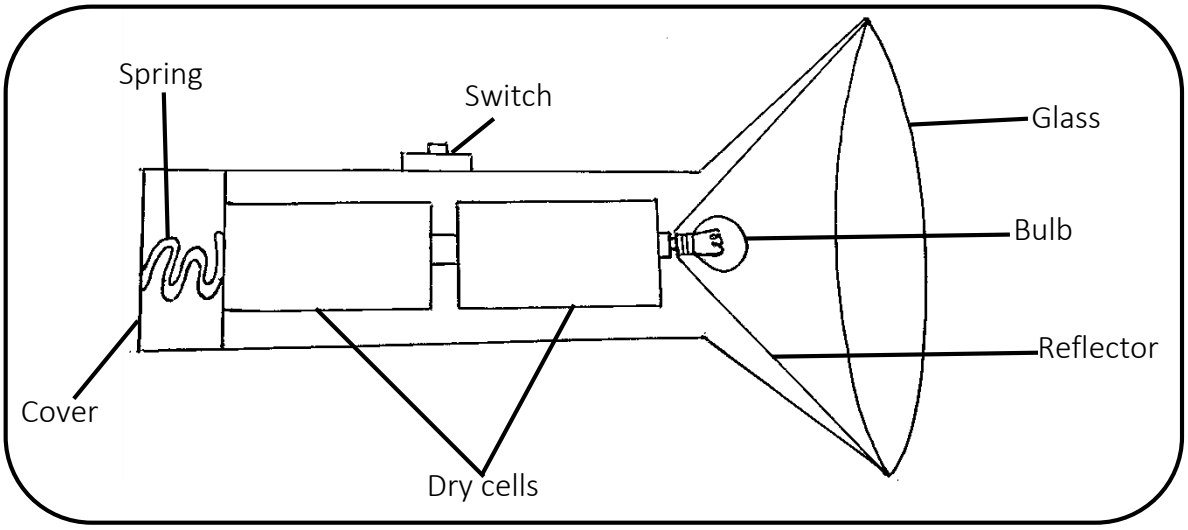
On which principle does a torch work?

- 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)

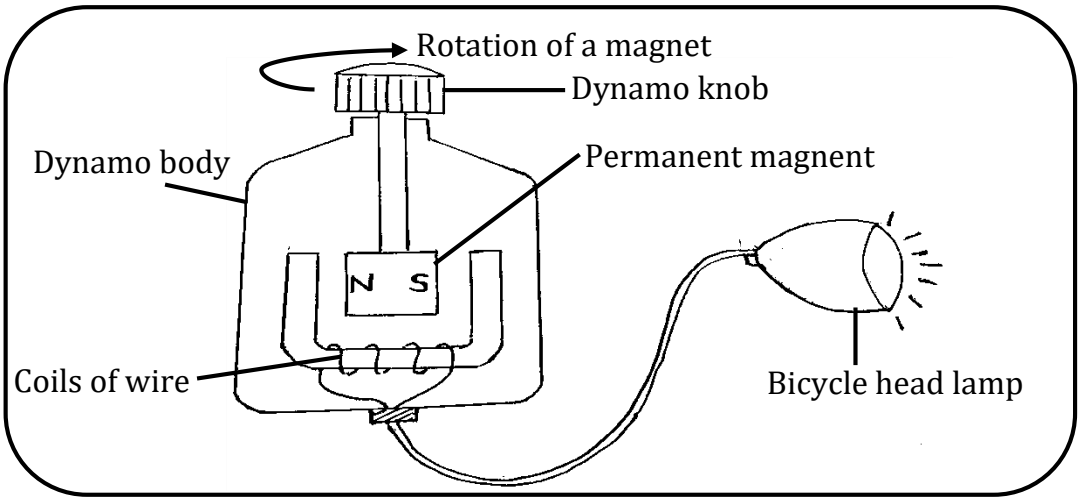
USES OF DYNAMOS

- 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

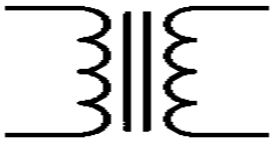
How does a motor differ from a dynamo/generator/alternator?

- 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

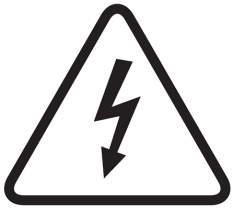
- It reduces electricity in an area

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

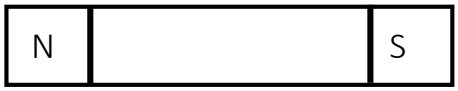
POLES OF A MAGNET (MAGNETIC POLES)

- 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

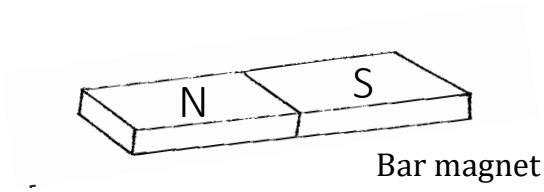
MATERIALS USED TO MAKE PERMANENT MAGNETS

- Steel
- Nickel
- Cobalt

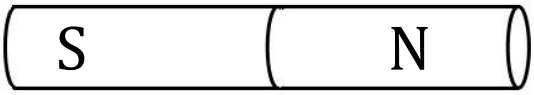
Why is steel used to make permanent magnets?

- Steel is difficult to be demagnetized

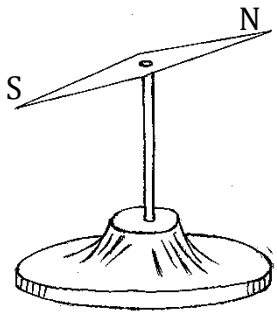
EXAMPLES / TYPES (SHAPES) OF PERMANENT MAGNETS



Bar magnet

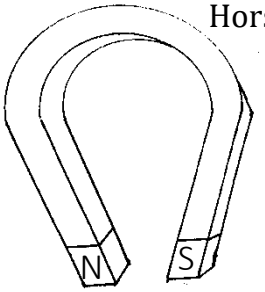


Cylindrical magnet

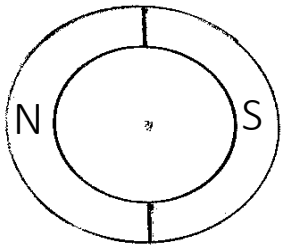


Needle shaped magnet

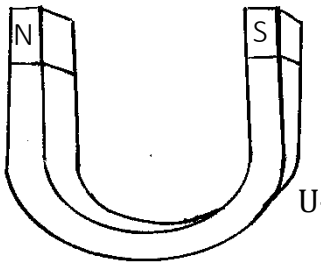
(Magnetic compass needle)



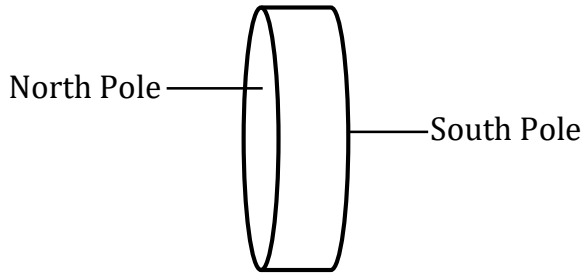
Horseshoe magnet



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

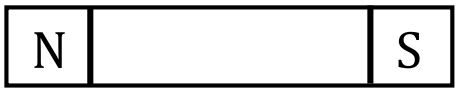
- Iron makes temporary magnets while steel makes permanent magnets
- Iron is easy to magnetize while steel is difficult to magnetize
- Iron loses magnetism in a short time while steel keeps magnetism for a long time

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

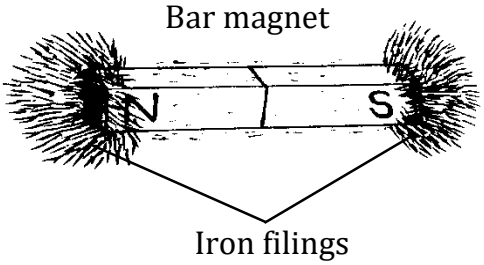
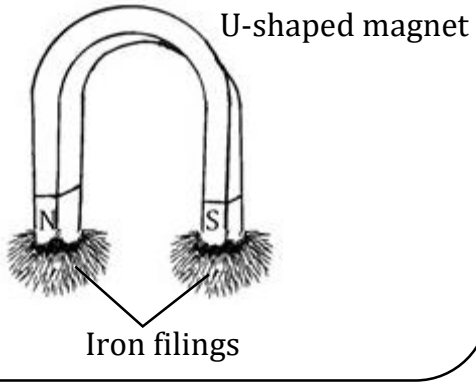


ILLUSTRATION II



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

ILLUSTRATION I

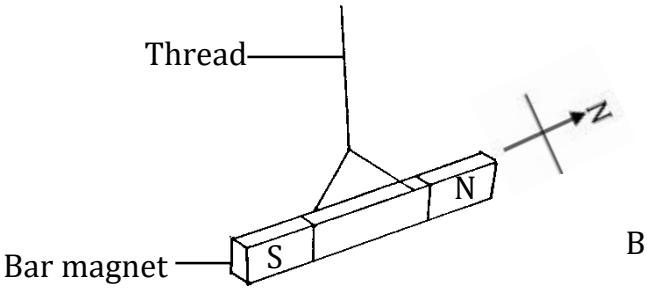
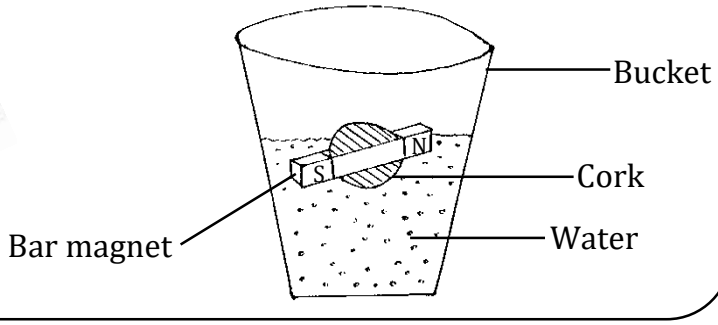


ILLUSTRATION II



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?

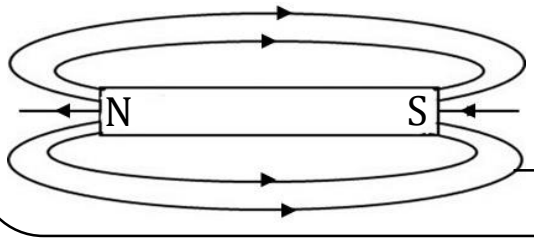
- It points towards the south when a bar magnet is suspended freely

State the importance of a thread in the experiment above.

- It holds the bar magnet when suspended freely

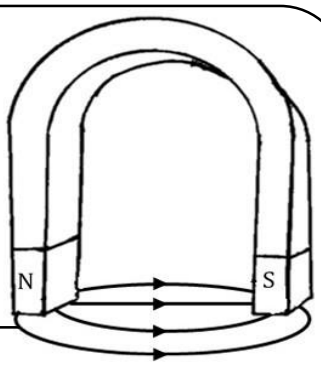
4. Magnetic lines of force run from North Pole to South Pole.

ILLUSTRATION I



Magnetic lines of force
(Magnetic field lines)

ILLUSTRATION II



5. Like poles of magnets repel.

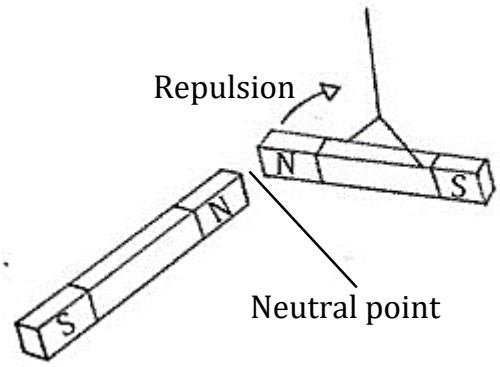


ILLUSTRATION I

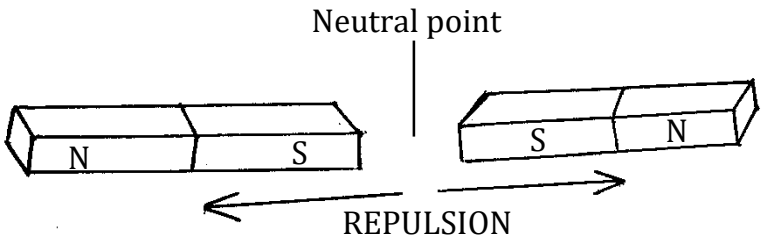


ILLUSTRATION II

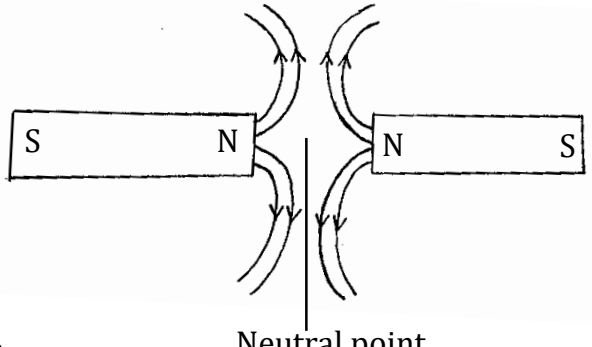


ILLUSTRATION III

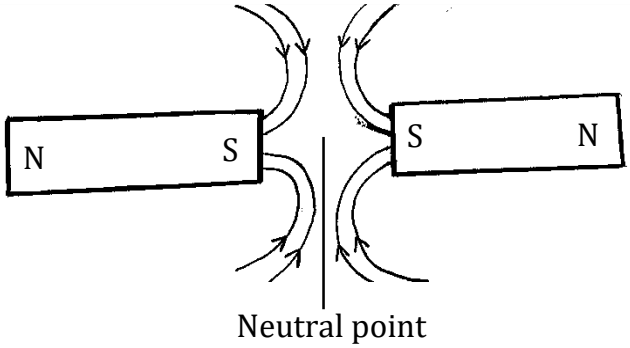


ILLUSTRATION IV

What is a neutral point?

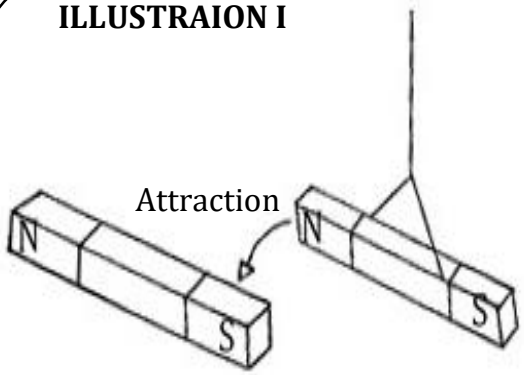
- This is the point where the resultant magnetic field is zero
- This is a point between like poles of magnets at which magnetism is not felt

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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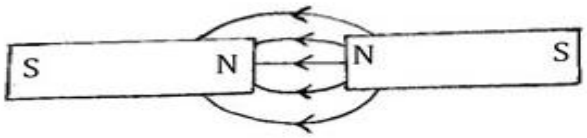
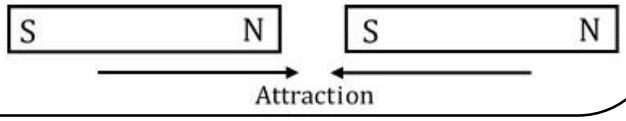


ILLUSTRATION III



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

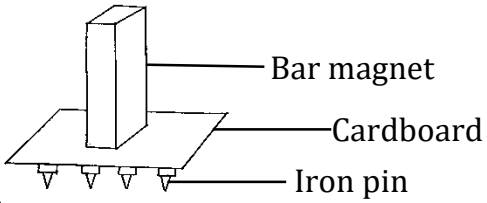
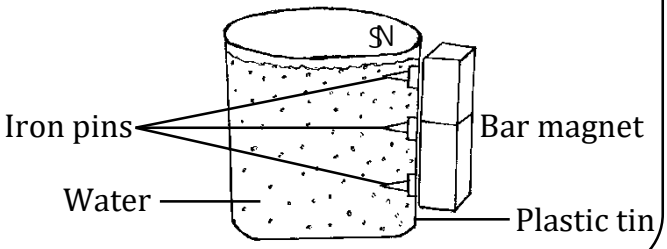


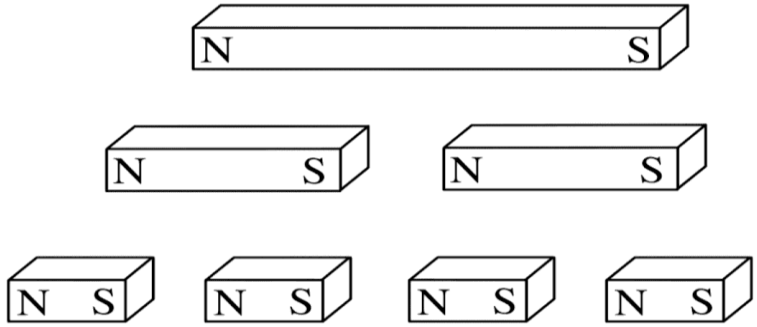
ILLUSTRATION II



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

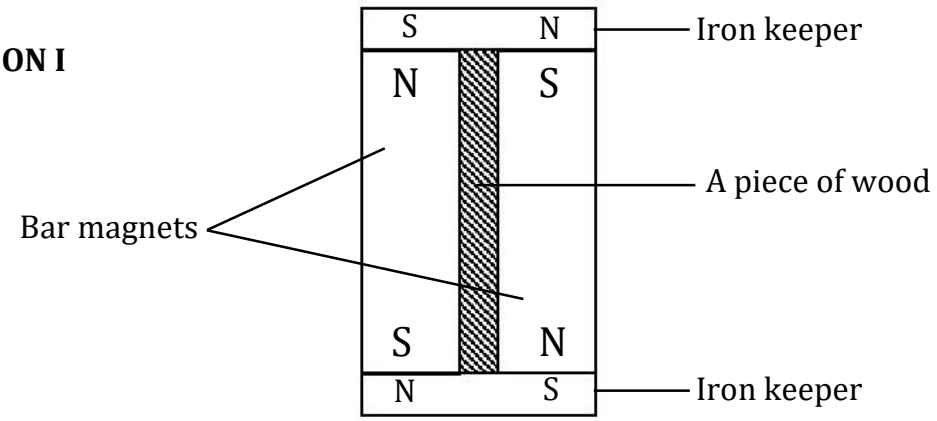


ILLUSTRATION II

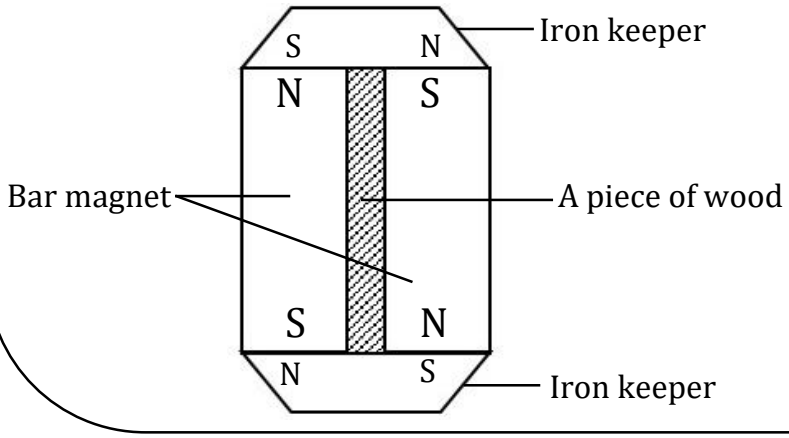
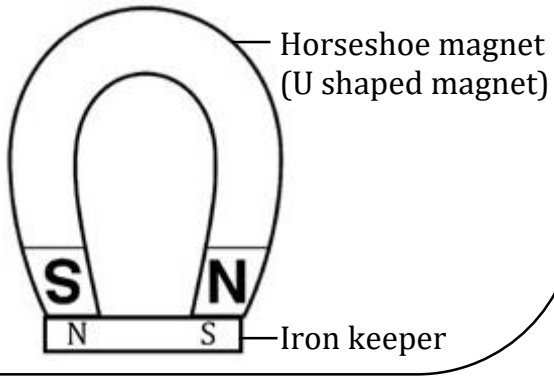


ILLUSTRATION III



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

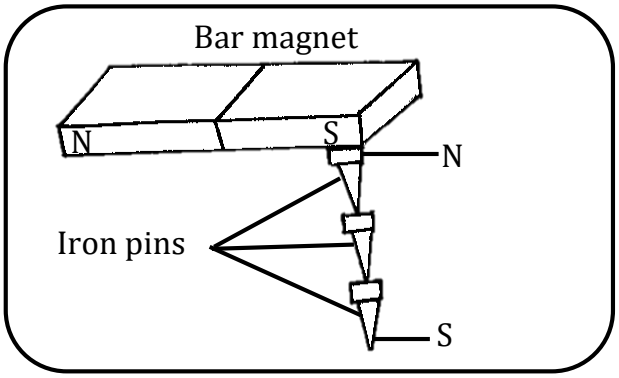
What type of magnets are made by induction method?

- 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)

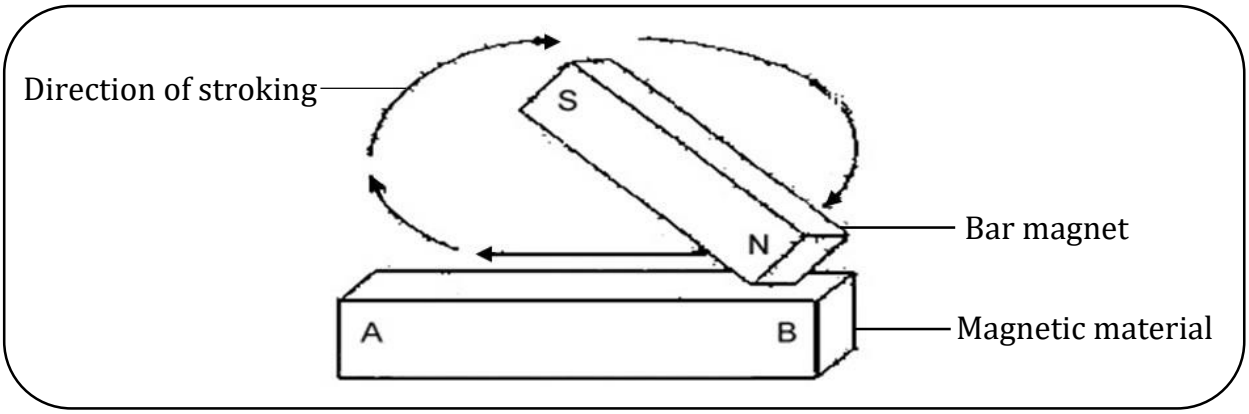
- Single stroke method/single touch method/single stroking
- Double stroke method/double touch method/double stroking

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

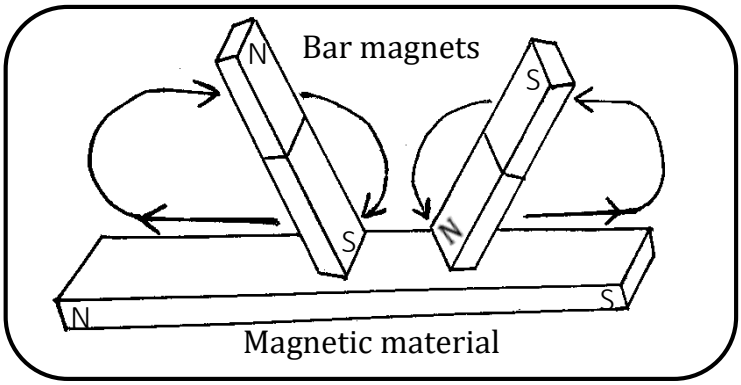
DOUBLE STROKING (DOUBLE TOUCH METHOD)

- 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

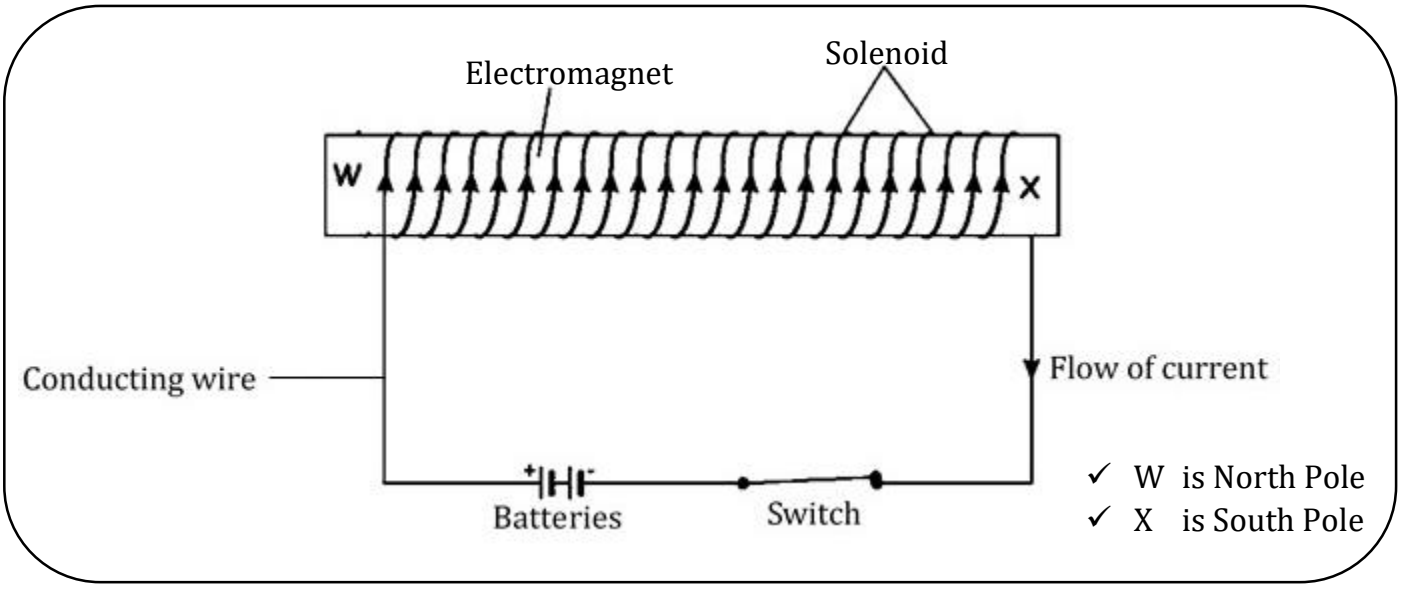
What is a solenoid?

- 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

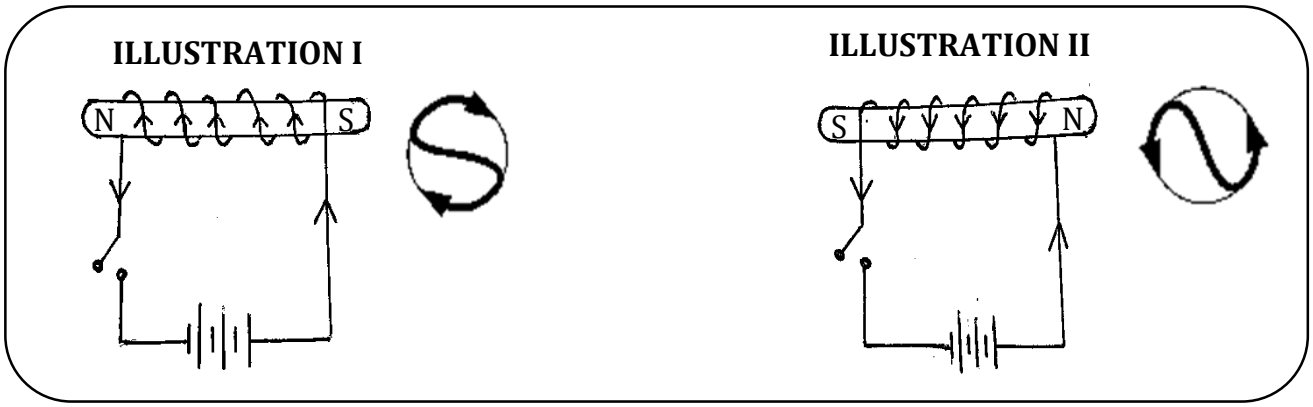
- Increasing the current or voltage
- Increasing the number of turns in the coil (Adding more coils in the solenoid)
- Using soft iron core in the solenoid (Using soft iron instead of steel in the solenoid)

Advantage of using electrical method of magnetization

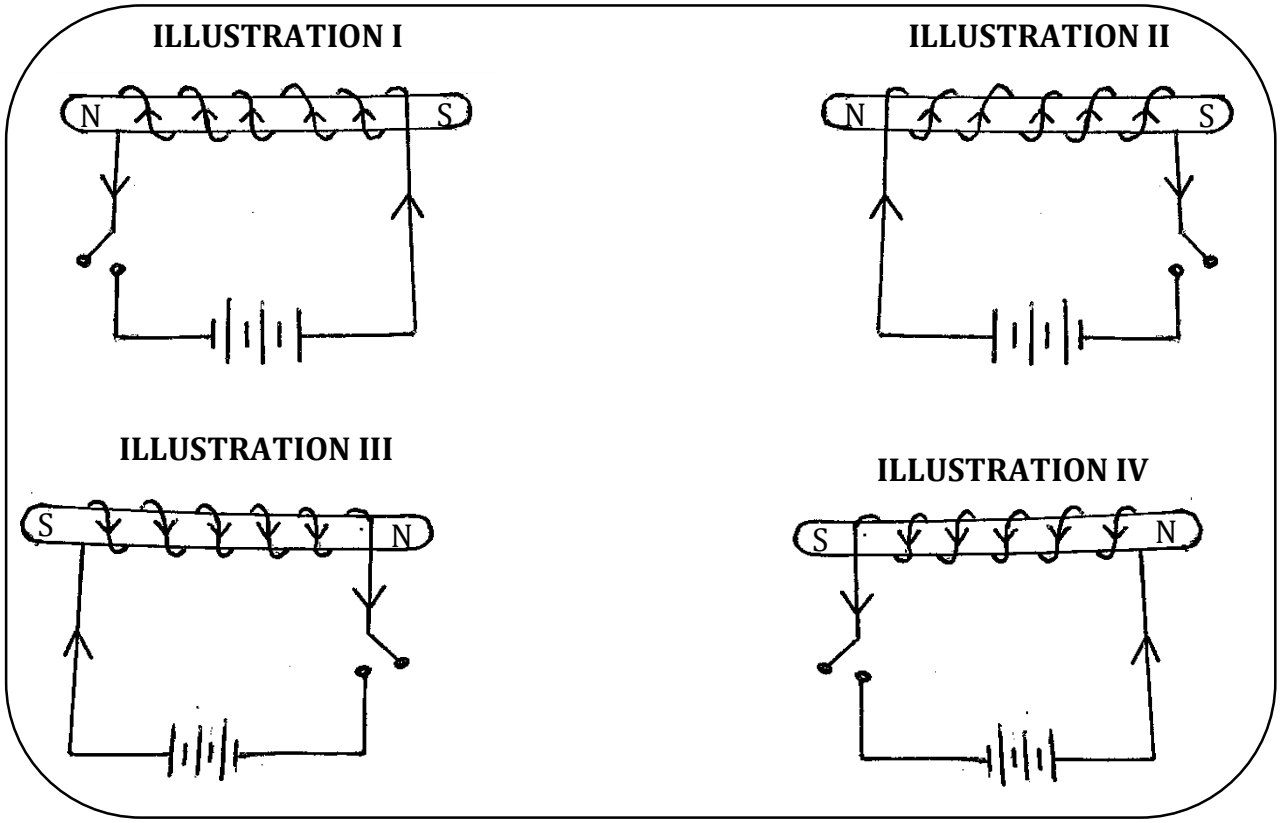
- The strength of an electromagnet can be increased

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

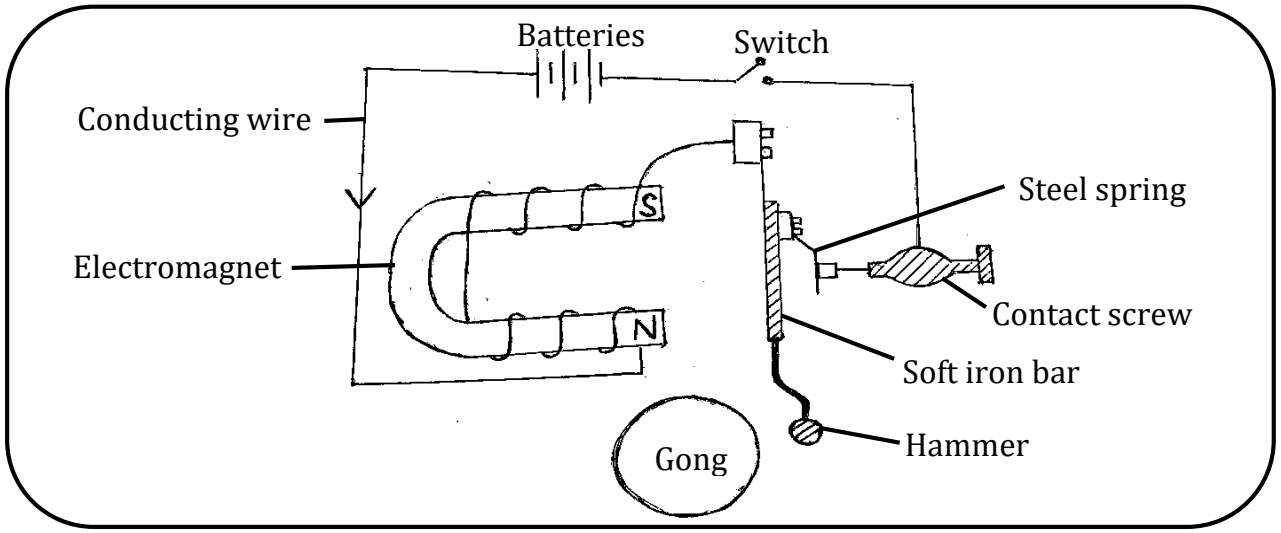
ELECTRIC BELL

- 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

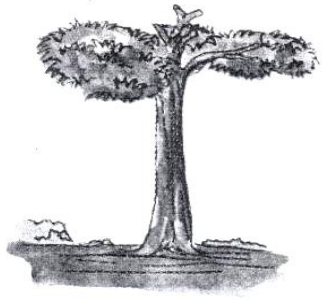
BETTER METHODS OF HARVESTING WOOD

- 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

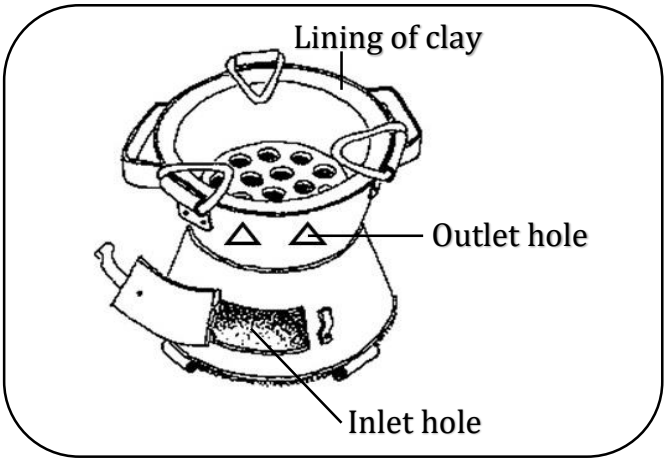
NOTE:

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

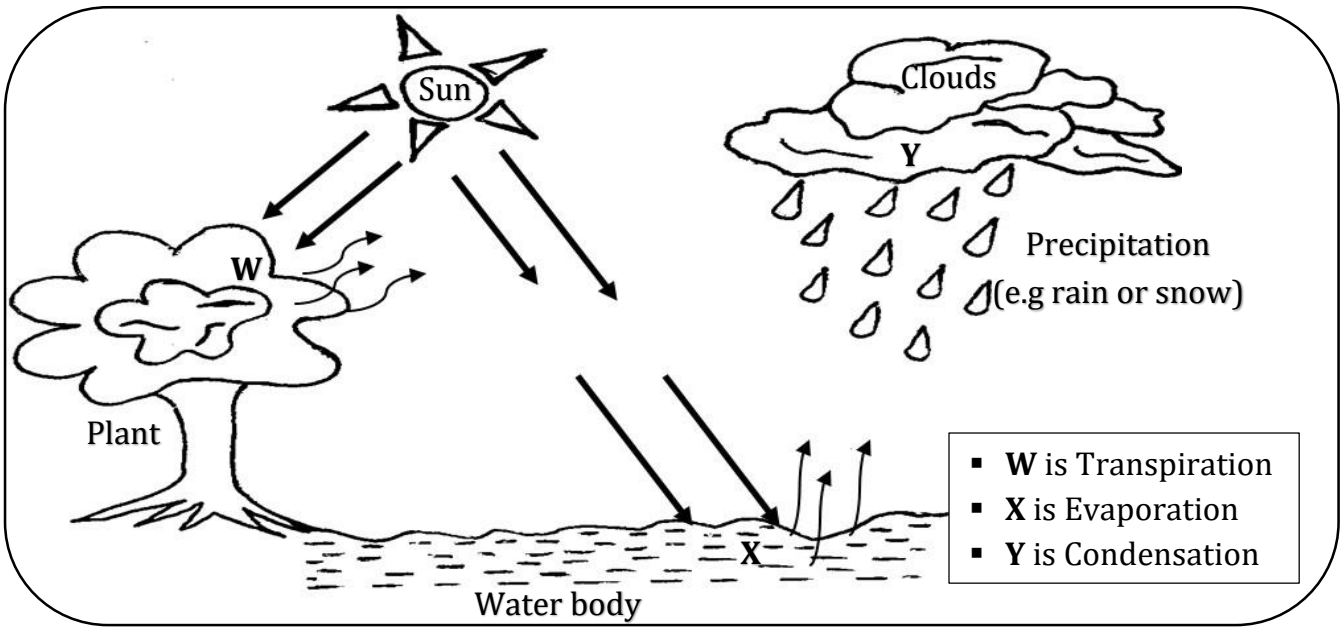
Name the three processes involved in the water cycle

- 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?

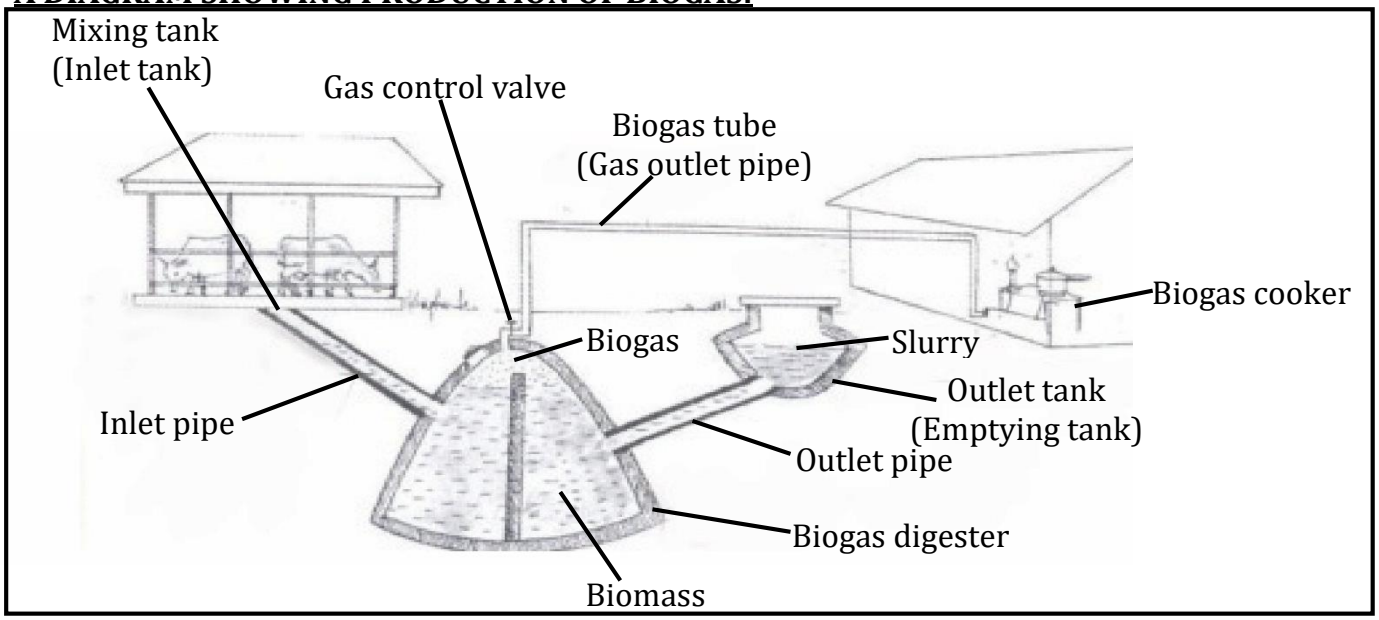
- They do not need oxygen for respiration.

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

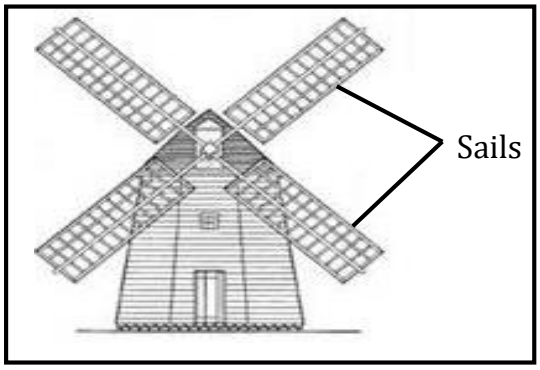
Which property of air enables wind to dry wet clothes at night?

- 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

