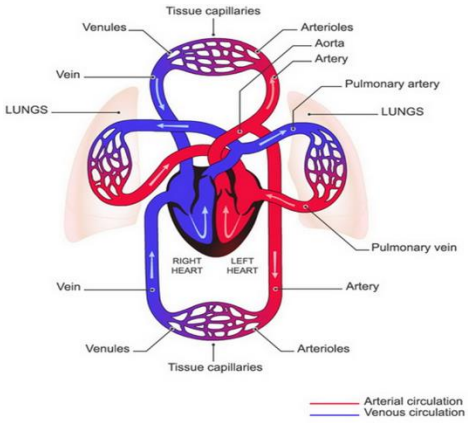
SEEDS OF GRACE PRI. SCHOOL

P.O BOX 72011 NTENJERU- MUKONO

PRIMARY SEVEN SCIENCE BOOKLET



HOME STUDY MATERIAL FOR 2024

NAME:
SCHOOL:
CLASS:

MUSCULAR – SKELETAL SYSTEM

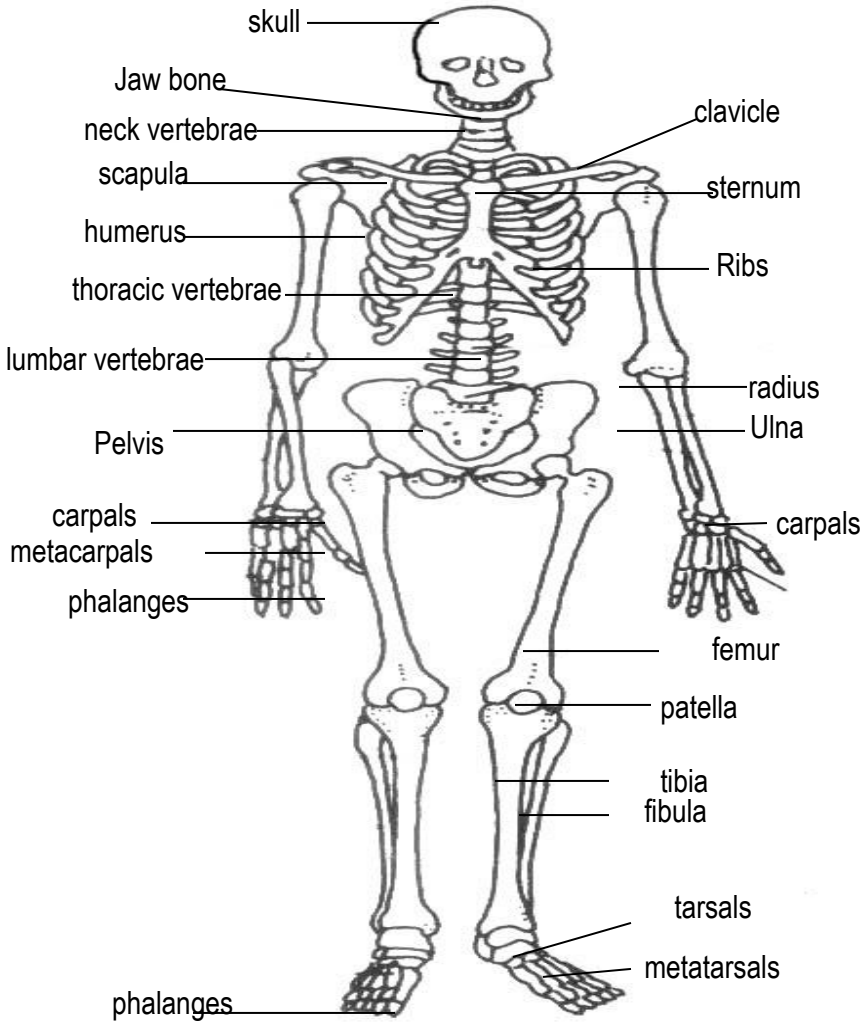
A skeleton is a supportive structure of an animal.

Human skeleton is a frame work of bones in the body of a human being.

The skeleton is hard because it contains non living mineral matter called calcium.

The human skeleton is made up of 206 bones in total. The skull has 22 bones and the back bone has 33 bones. The largest is femur the smallest is stapes in the ear.

The structure of the skeleton



Types of skeleton

Exo skeleton

Endo skeleton

Hydrostatic skeleton.

Endo – skeleton is the type of skeleton found within the body of the organism. Endo skeleton is mainly found in vertebrate animals.

Exo – skeleton is the type of skeleton found on the outside of the body of an organism.
It forms a hard covering on the body of an animal. It is commonly found on arthropods.
The exo skeleton provides protection and support to the soft parts of animals.
Animals with exo skeleton grow by moulting/ecdysis.

Hydro-static skeleton is the type of skeleton in the body cavity with fluid under pressure.
N.B The pressure of fluid and surrounding muscles are used to change the shape of an organism to produce movement.
Hydrostatic skeleton is possessed by organisms such as: snails, earthworms, slugs, star fish, jelly fish, sea urchins, etc.

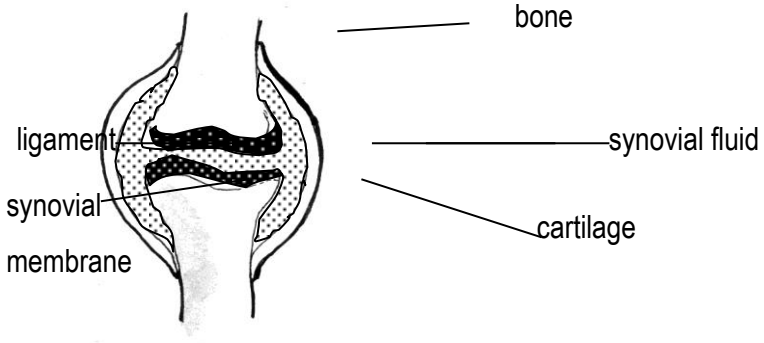
Functions of the skeleton

It gives the body shape and support.
It protects delicate organs of the body e.g
spinal cord – vertebral column
heart and lungs – ribcage
eye – orbit
brain – skull
It provides attachment for muscles to produce movement.
the skeleton stores calcium and phosphorus
the skeleton manufactures red blood cells, white blood cells and platelets in their marrow
Babies are born with their bodies made of cartilage, in adults the cartilage is found in the nose, trachea,pinna etc.

JOINTS

A joint is a place where two or more bones meet in the body.

Structure of a joint



FUNCTIONS OF THE PARTS

Cartilage: It acts as a shock absorber.
Ligament: Joins a bone to a bone.
Synovial fluid: Reduces friction at the joint.
Synovial membrane: Produces and stores synovial fluid.
N.B Ligaments reduce chances of dislocation.

CATEGORIES OF JOINTS

Movable joints

Immovable joints

Movable joints are joints that allow movement.

Immovable joints are joints that don't allow movement.

N.B Immovable joints have bones that are tightly held together.

TYPES OF JOINTS

- Hinge joint
- Ball and socket joint
- Pivot joint
- Gliding joints

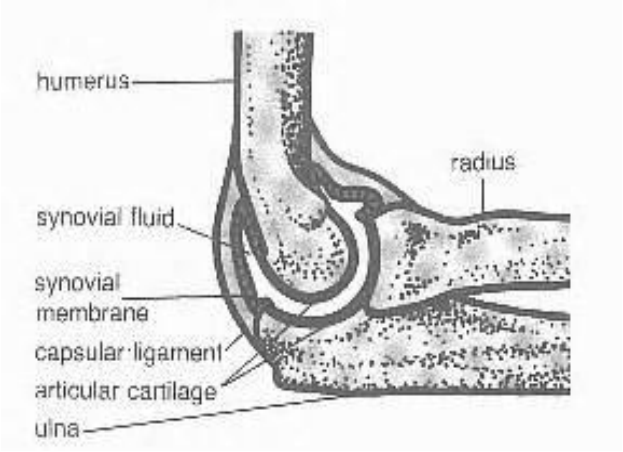
1. Hinge joints are joints that allow movement in one plane

Examples

- knee joint
- elbow joint

Elbow joint

Structure of elbow joint/hinge joint

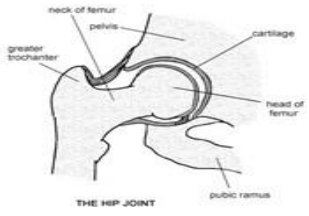


2. Ball and socket joints allow movement in all planes or directions i.e sideways, forward, backward and circular

Examples

- shoulder joint
- The (hip) pelvis joint

Structure of hip joint



Pivot joints are joints which allow rotation of certain parts of the body on other parts

Examples

The neck vertebra

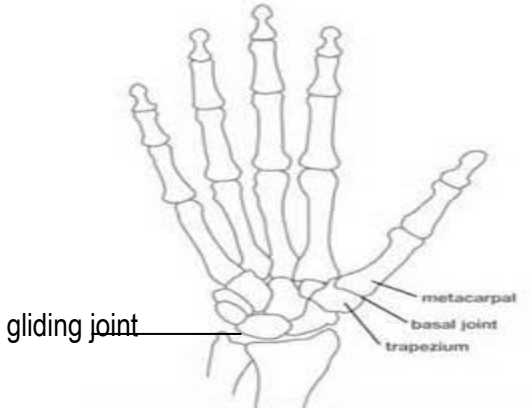
The lumbar vertebra

Gliding joints are joints where bones slide over one another easily

Examples

- ankle joint
- wrist joint

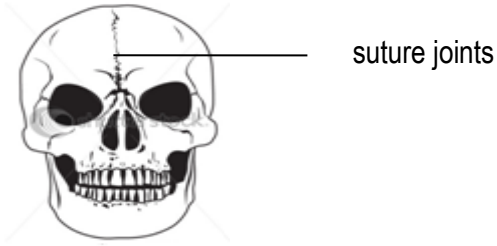
Structure of a gliding joint



Immovable joints

Immovable joints are mainly found in the skull.

Immovable joints found in the skull are called **suture joints.**



Types of bones

long bones

These are found in the arms and the legs

Examples

- femur
- humerus
- tibia
- ulna
- metacarpals
- -phalangess
- radius
- fibula
- -metatarsals.

The femur is the longest and strongest bone in the human body.

Short bones

These include : carpals,tarsals.

Flat bones

Examples are; the shoulder blade (scapula), bones of the skull and the pelvis, sternum, ribs

Irregular bones

These are found in the vertebral column i.e. the vertebrae, and the jaw bone.

MUSCLES

A muscle is an elastic tissue found in the body of an animal that contracts and relaxes to produce movement.

Muscles are connected to bones by tendons

Types of muscles

Voluntary muscles (striated muscles) or skeletal muscles.

Involuntary muscles (smooth muscles)

Voluntary muscles are those whose movement is controlled at will e.g. movement of arms and legs

Voluntary muscles are always attached to the skeleton and help to maintain body posture.

Examples

The biceps of the hand connect the scapula to the radius

The triceps of the hands connect the scapula, humerus and ulna.

Involuntary muscles are muscles whose movement cannot be controlled at will. E.g. movement of the stomach, intestines, heart etc.

The movement of involuntary muscles is automatic i.e. we have no control over them

Examples

- Muscle of the stomach and walls of the alimentary canal
- Muscles of the reproductive system
- Muscles of the blood vessels
- Muscles of the excretory system
- cardiac muscles
- Inter costal muscles
- Sphincter muscles.

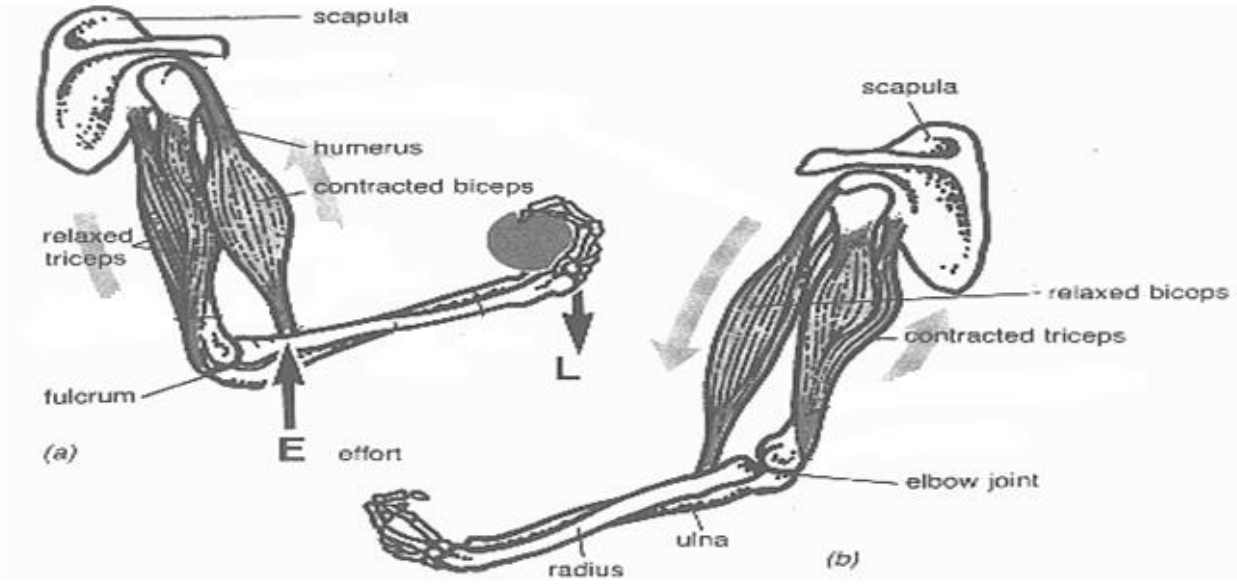
Antagonistic muscles

These are pairs of muscles that produce opposite movement at the same time. When one contracts the other relaxes. e.g. biceps and triceps

biceps is the flexor muscle in the upper arm which bends the fore arm

triceps is the extensor muscle in the upper arm which extends (straightens) the fore arm

BENDING OF THE FORE ARMSTRAIGHTENING OF THE FORE ARM



Functions of muscles

They join some bones together in the body.

They produce movement

They help in respiration.

They maintain and change body posture.

POSTURE

Posture is the position of the body when an action is taking place.

We should maintain good posture in everything we do to maintain the muscular – skeletal system in good health and proper working condition

Importance of good posture

- To look smart.
- It makes the muscles and bones stronger.
- It keeps body organs in their proper shapes and position.
- It promotes proper development of the bones and muscles.
- Bad posture leads to indigestion, deformities and skeletal and muscular disorders.

Diseases of the skeletal/muscular system

Polio

It is spread through contaminated food and drinks.

It is caused by a virus

It leads to high fever, lameness and paralysis of the limbs.

Polio is controlled by immunisation and drinking boiled water.

Tuberculosis of the bones

It is caused by a bacteria called mycobacterium

It is spread through taking in contaminated milk from a tubercular cow.

It mainly affects the spine leading to long lasting backache and paralysis of the legs

It is controlled by drinking well boiled milk, early treatment of infected people.

Tetanus

It is caused by bacteria from the soil

The bacteria enter the body through fresh cuts and wounds

It attacks muscles making them stiff and makes breathing difficult

In newly born babies it enters through the umbilical cord if cut with dirty unsterilised instrument

It is controlled through immunisation.

Rickets

It is a deficiency disease that affects bones especially during pregnancy when the mother did not eat enough foods rich in Vitamin D, calcium and phosphorous

It leads to weak bones, common fractures, oxbow legs, knock – knee legs and poor teeth

It is controlled by eating enough foods rich in Vitamin D, calcium and phosphorus in the diet.

Disorders of the skeletal and muscular system

- fractures
- sprains
- strains
- dislocations

How to maintain the skeletal system in proper working conditions

- Eat foods rich in a balanced diet with more of foods rich in vitamin D, calcium and phosphorus.
- Take children for immunisation against tuberculosis, polio and tetanus early enough
- Have regular physical exercises
- Maintain proper body posture
- Avoid playing rough games like fighting, hitting, climbing trees
- Be so careful when using the road

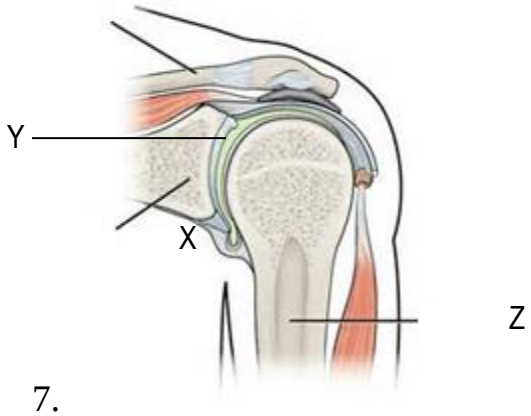
Importance of regular physical exercise

- They strengthen the bones and muscles
- They promote proper circulation of blood
- They make digestion of food more efficient

- They break fatigue (body weakness)
- They make joints flexible
- They control obesity (promote weight loss)
- They increase energy production by the muscles
- They reduce the risk of heart diseases.

Self testing exercise

1. What is a skeleton?
2. Mention 3 importance of the human skeleton.
3. Identify two types of skeleton.
4. Which types of skeleton is found in most vertebrates.
5. The longest bone in the human body is _____while the smallest bone is _____
6. Study the diagram carefully and answer questions that follow.



7.
8. Name parts.
9. x 10.z
11. Give the function of part y.
12. To which groups of bones does bone x belong.
13. Identify the movable joint shown in the diagram.
14. The biceps and triceps are examples of antagonistic muscles in the human body. Explain what happens to each of the muscles during the situations below.

15.	16.Biceps	17.Triceps
18.(i) flexion (bending)	19.	20.
21.(ii) Extension (straightening)	22.	23.

24. Give one example for each of the following types of bones.
25. short bones - _____

26. irregular bones - _____
27. long bones - _____
28. flat bones - _____
29. Identify one form of immovable joint in the human body and state where its found
30. Mention any 3 forms of movable joints you know.
31. How is the movement in the joint at the shoulder different from that at the knee?
32. Give any 3 diseases and 3 disorders of the muscular skeletal system
33. Mention 4 ways of keeping the muscular skeletal system in proper health conditions
34. Differentiate between the following
35. a ligament and a tendon
36. a sprain and a strain
37. a fracture and a dislocation
38. How are regular physical exercises important to the skeletal system? (Give 2 ways)

TOPIC II**: ELECTRICITY AND MAGNETISM**

ELECTRICITY

Electricity is a form of energy produced by charged particles

Charged particles include: electrons and protons.

Electrons are negatively charged particles orbiting around an atom.

An atom is the smallest indivisible particle of an element.

An atom has a nucleus which is the central core part of an atom consisting of protons and neutrons.

Protons are positively charged particles found in the nucleus of an atom.

Neutrons are uncharged particles found in the nucleus of an atom.

An electric current is the flow of electrons through conductor

Electric current is measured using an Ammeter in units called Amperes (amps)

Forms of electricity

- current electricity
- static electricity

Current electricity is the form of electricity produced when electrons flow from the source through a conductor to another area.

There are two types of current electricity

Direct current (D.C) electricity.

Alternating current (A.C) electricity.

Direct current (D.C)

Direct current electricity is the type of current electricity that flows in only one direction.

Sources of direct current

dry cells

simple /wet cells

Batteries / accumulators

All battery operated electrical devices like torches, calculators, remote controls etc. use direct current.

Electric cells

Electric cell is any device that stores electric energy in chemical form.

There are two types of electric cells namely: -

Primary cells

secondary cells/ accumulators.

PRIMARY CELLS

Primary cells are cells which produce electricity and cannot be recharged once exhausted.

Primary cells are of two examples: -

- simple cells or wet cells
- dry cells

Simple cells

A simple cell consists of a zinc plate and a copper plate dipped in dilute sulphuric acid.

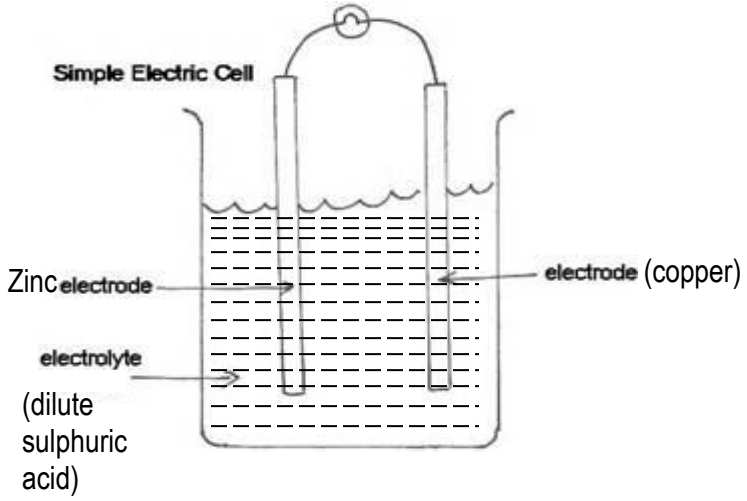
The zinc plate and copper plate are called electrodes

The zinc plate – negative electrode

The copper plate – positive electrode

The dilute sulphuric acid is the electrode

An illustration of a simple cell

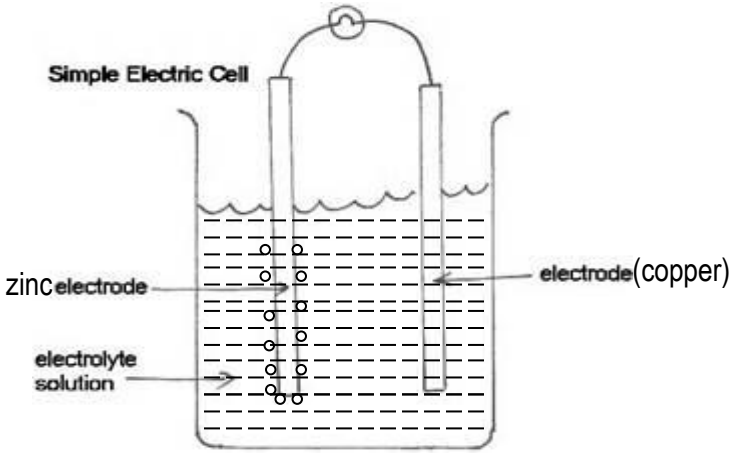


A simple cell is not so efficient because of two factors namely: -
(i) Polarisatioin
(ii) Local action

Polarisation is when hydrogen bubbles cover the copper electrode and stop the flow electrons.

If the bulb has been connected across the electrodes, it glows but after a few seconds it becomes dimmer and dimmer until it goes off. This is because polarization sets back the emf and the hydrogen gas insulates the copper plate.

Local action is when hydrogen bubbles come off the zinc plate. It is caused by impurities in the zinc e.g. carbon



A homemade simple cell

Simple cells convert chemical energy to electric energy

It can be made from an orange, lemon, lime or grape fruit

Disadvantages of simple cells (wet cells)

- They are bulky i.e. not easily carried
- They can only be used in the upright position
- They produce electricity for a very short time

Note

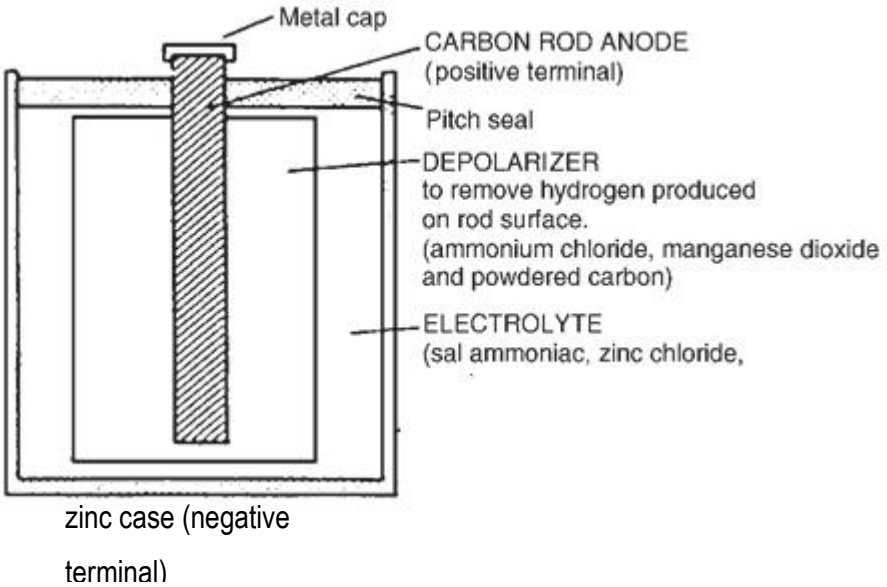
Polarisation is the formation of hydrogen bubbles on the copper plate while local action is when hydrogen bubbles come off the zinc plate.

Dry cells

A dry cell is an example of a primary cell. It has the capacity to produce an emf or electric pressure of 1.5 volts per cell when still new. The electric pressure decreases as one continues to use

Number of dry cells	(voltage)		Total emf
1 dry cell	1 x 1.5	=	1.5 volts
2 dry cells	2x1.5	=	3.0 volts
4 dry cells	4x1.5	=	6.ovolts
5 dry cells	5 x 1.5	=	7.5 volts

A dry cell



Uses of the parts

Brass cap: it is the contact for the positive terminal

Pitch: It prevents ammonium chloride jelly from drying up.

Ammonium chloride paste: It transfers electrons

Carbon and manganese oxide

reduce the work of the cell in moving electrons

reduces the internal resistance of the cell

Manganese oxide prevents the buildup of hydrogen around the carbon rod by changing it to water (depolarizing agent)

That's why dry cells leak when they get exhausted
The carbon rod is made from graphite
Zinc can: It acts as the contact for the negative terminal
It is where all contents of the cell are put.
A dry cell stores chemical energy which it converts to electric energy

Secondary cells:

Secondary cells are cells that cannot produce their own electricity.
Secondary cells can be recharged by passing an electric current through them.
This can be done using a dynamo or alternating current
They store electric energy in a chemical form
They are also called storage cells or accumulators because they don't produce electricity of their own but just store it. The most common example of secondary cells.
lead acid accumulator (car battery) It is a wet cell commonly used as a car battery with 6 cells each with an emf of 2 volts hence total voltage in a car battery is 12 volts
The car battery is always recharged by a car dynamo
The dynamo converts mechanical energy to electric energy

Advantages of using car batteries

They can be recharged once exhausted.

Alternating current (A.C) electricity

Alternating current electricity (a.c) is the type of current electricity which reverses its direction of flow i.e. forward and backward
Alternating current can however be stored in form of direct current
A.C can be stepped up and down by the help of a transformer.

The sources of alternating current electricity include:
Waterfalls, the sun, hot springs, uranium, fuels etc.

Examples of alternating current electricity.

- hydro electricity
- Atomic electricity
- solar electricity
- Thermal electricity
- Geothermal electricity.

Hydro electricity

This is the type of electricity got by the power of running water which turns turbines connected to a generator to produce electric energy.
The kinetic energy in the running water is converted into electric energy at the power station.

This electricity is then transmitted by cables or wires on poles to factories and our houses.

Thermal electricity

This is the type of electricity obtained by burning fuels like petroleum (crude oil) and coal.

Dis advantages of thermal electricity

Thermal electricity is more expensive than hydro electricity to produce and use.
Generation of thermal electricity can pollute the environment unlike hydro electricity.

Atomic electricity

This is the type of electricity produced burning uranium. The chemical energy in uranium is converted into electric energy in the process called **nuclear fission.**

Nuclear fissionoccurs in a nuclear reactor at a nuclear power station or nuclear power plant.

Solar electricity

This is the type of electricity got from the sun. Solar cells in solar panels are used to trap light and heat energy from the sun which is then sent to solar batteries which store it and produce electricity

Conductors and insulators

Conductors or good conductors are substances that allow electricity to flow through them.

Or

Conductors are materials that allow an electric current to flow through them.

Examples of good conductors

All metals are good conductors of electricity because they have mobile electrons or electrons that are free to move.

Their order of electrical conductivity from the best is; -

- silver
- copper
- aluminum
- tungsten
- Nickel
- zinc
- lead
- Brass
- iron
- platinum
- etc

Electrical conductivity is the ability of a substance to allow passage of an electric current through it.

Good conductors have a high electrical conductivity while insulators have a very low electrical conductivity

Silver is the best conductor of electricity but very expensive.

Most electric over head cables/wires are made of copper and aluminum because: -

they are good conductors of electricity

they are cheaper than silver.

they don't easily rust

All salt solutions conduct electricity e.g. sodium chloride solution

All acids conduct electricity e.g. hydrochloric acid, sulphuric acid, Nitric acid, lead acid etc

Water (but not distilled water) can conduct electricity

Distilled water doesn't conduct electricity because it doesn't contain mineral salts

All substances that conduct electricity in liquid form are called **electrolytes**

They conduct electricity because their ions are free to move.

Insulators are substances that do not allow electricity to flow through them.

They are also called bad conductors of electricity / poor conductors.

They don't conduct electricity because they don't have mobile electrons

Examples of insulators

- rubber
- chalk
- dry wood
- plastic
- paper
- cloth
- cork
- air
- polythene
- porcelain

Uses of insulators

They are used to cover wires carrying electricity to prevent short circuits and electric shocks

they are used as handles of electric appliances to prevent electric shocks

Porcelain is used for making sockets, plugs, lamp holders etc to prevent shock to the users.

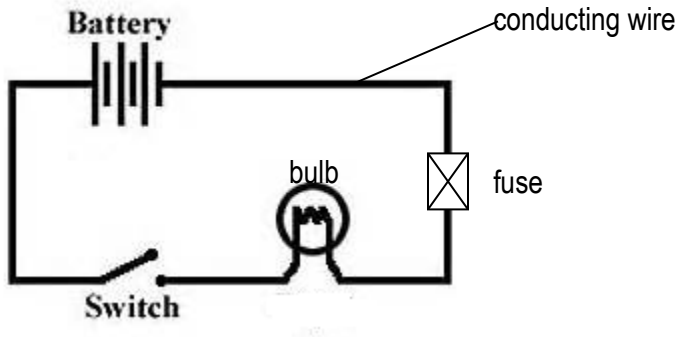
An electric circuit

It is a conducting path along which electric current flows.

For the electricity to flow, the circuit must be complete.

An electric circuit starts from the source and ends at the source.

A diagram of a simple electric circuit



In an electric circuit, current flows from the positive terminal to the negative terminal where as electrons flow from the negative terminal to the positive terminal of the dry cell or battery or source of electricity.
For the case when one is using more than one dry cell current will flow when the negative terminal is directly connected to the positive terminal.
Electric current will only flow in the arrangement
Only because the dry cells are well connected.

Components of an electric circuit

Conducting wire
appliance e.g. bulb
fuse
source of electricity e.g. dry cells
switch
Ammeter

Symbols for devices used in an electric circuit

Symbol	Meaning
	bulb
	fuse
	dry cells (battery)
	switch

Functions of each part of a circuit

Ammeter

It measures the amount of electric current flowing through the circuit

Switch

It is a safety device placed on the live wire. It breaks or completes the circuit at one's will. When the switch is closed the circuit is completed, when the switch is opened the circuit is broken and the appliance stops /goes off.

The wire

It is the conductor of electricity from the source to the appliance

Fuse

The fuse protects electric appliances from damage in case of high voltage in the circuit.

It is a safety device which breaks the circuit in case too much current is flowing.

A fuse is a thin wire made of an alloy of tin and lead (solder) with a very low melting point. So it easily melts and breaks the circuit due to current over load.

Advantages of fuses

They protect electrical appliances from damage by too much current

They reduce the risks of electric fires in houses

Reasons why a fuse may melt or blow

When the wire is too old or weak

overloading of the circuit

Similarity between a fuse and a switch

Both break the circuit.

The bulb

It produces light when the circuit is complete
it changes electric energy to light and heat energy

Why the bulb stops lighting

- When the filament blows
- When the fuse blows/melts
- When the dry cells are exhausted
- When the switch is opened
- Why the bulb fails to work
- If it is not well fixed
- If the dry cells are poorly arranged
- If the circuit is not complete
- If the wire is not well connected to the dry cells.

Dry cells

They are the source of electricity
They produce electricity for the appliance
They store chemical energy
They convert chemical energy to electric energy when the circuit is complete
The dry cells should always be well arranged to function well.

Voltmeter: It is another device on the circuit used to measure the potential difference (voltage) between two points in an electric circuit.

Electric resistance

It is the opposition to the flow of electric current in a circuit
When the circuit opposes the flow of current it produces heat
Electric resistance is measured in **ohm**s using **an ohmmeter**
The higher the resistance the greater the heat produced. The lower the resistance the less the heat produced
Thinner and longer wires produce more resistance than thicker and shorter wires
Electromotive force (emf) or electric pressure
This is the force that drives current through the resistance of the circuit
It is measured by a voltmeter in units called volts.

Electric power

It is the rate at which electrical energy is converted into other forms.
It is measured in watts. (w)

Short circuits

A short circuit is an electric path with low resistance to the flow of electric current

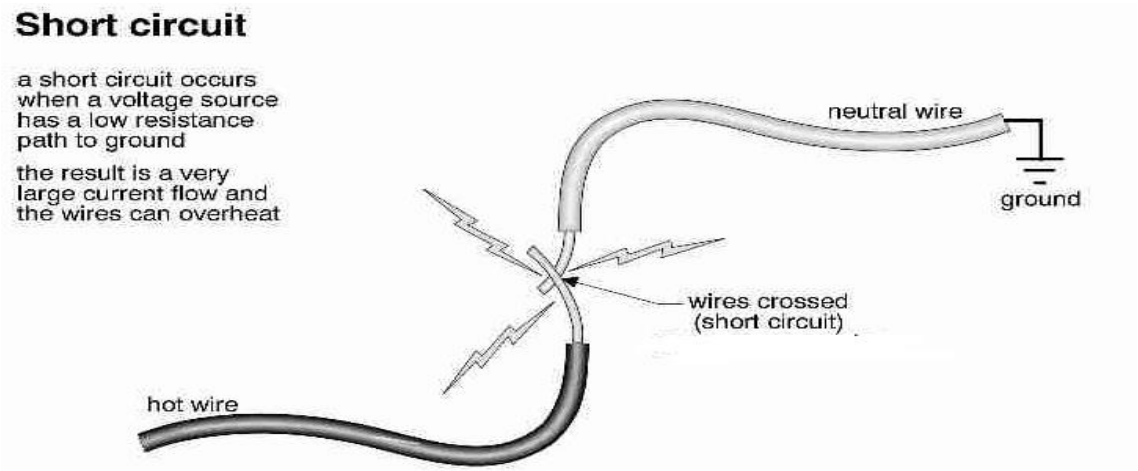
Electricity flows through a path that shows least resistance

The shorter the path, the least the resistance. The flow of electricity is greater for a longer path. When the path becomes shorter the circuit is said to be short. When two un insulated wires carrying electricity get in touch a short circuit is produced.

Causes of short circuits

- Damage to insulation due to age.
- Rubbing of the insulation / damage to the insulation by rubbing of moving equipment
- Overloading the supply lines
- damage to the insulation by rats
- Pushing metallic objects into the socket
- Metallic objects falling across power cable lines.
- fault in electrical appliances e.g. flatiron, radios, cooker etc

Illustration for short circuit



When the switch is closed, the bulb will not light instead sparks are seen at the meeting point of the un insulated or naked wires which will light the match stick showing a short circuit. A short circuit produces light and heat which are the major cause of buildings to catch fire.

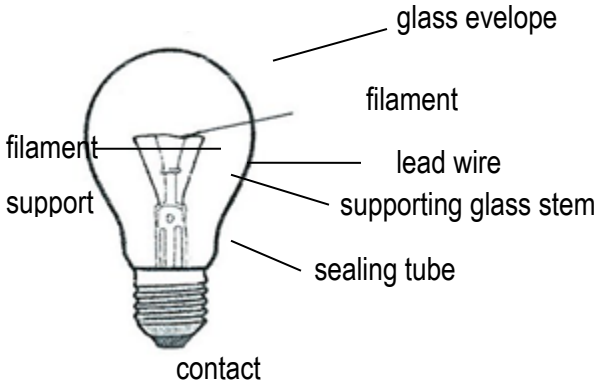
Dangers of short circuits

- They cause buildings to burn
- They cause fire that destroys house property
- They lead to death of people
- Explosion of cars and aero planes.

Prevention of short circuits

- Use properly insulated wires
- Electrical installations in building should be done by experts only.
- Repair of electrical appliances should be done by qualified people only

The electric bulb



Functions of the parts

Brass cap: It enables the bulb to get fixed in the lamp holder

Sealing tube: Prevents oxygen from entering the bulb to get into contact with the filament

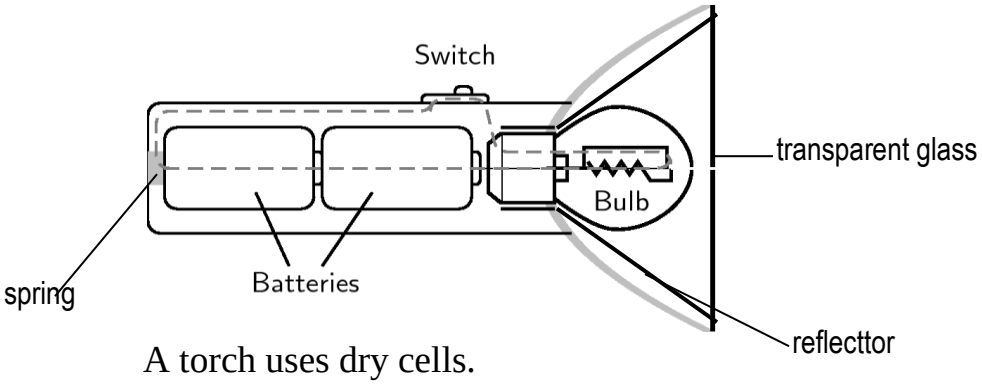
Coiled filament: It converts electric energy into heat and light energy. (It is made of tungsten with a high melting point to enable the filament heat up to high temperatures without melting

Glass envelope: It holds the mixture of argon and nitrogen gas to prevent evaporation of the filament

Supporting glass stem: it holds the filament in position

Lead wires: they take electricity to the filament

The Torch



A torch uses dry cells.

In most cases the dry cells are arranged in series

It operates on a principle that electricity flows in a complete circuit

Uses of the parts of a torch

The switch: It breaks and completes the circuit at one's will.

The bulb: It produces light when the circuit is complete.

The dry cells: They produce electricity or electric energy.

The reflector: It directs light produced by the bulb into a divergent beam.

The cover and spring: they complete the circuit and keep the dry cells tightly held together.

Why a torch may fail to work

- When the bulb is not fixed properly
- When the dry cells are poorly connected
- When the dry cells are already exhausted
- Why a torch may go off
- When the bulb blows
- When the dry cells get exhausted

Domestic electricity

Importance of electricity is solving day to day problems

- cooking food
- lighting houses and compounds
- In radios and televisions for entertainment and communication
- In industries to run machines
- In loudspeakers, electric bells, alarm for communication and security
- For security in electric fences, electric detectors and electric security gadgets.
- For washing clothes, ironing, charging phones and operating electric appliances.

Advantages of using electricity

- It is quick and time saving
- It is easy to use compared to other sources of energy
- It is environment friendly i.e. it conserves trees and doesn't cause pollution.
- It produces neat and clean work
- It can easily transform into other forms of energy e.g.
- electric energy to sound energy by a radio
- electric energy to heat energy by a cooker

- electric energy to mechanical energy by a motor

Disadvantages of using electricity

- It causes fires that burn buildings and property
- It shocks and kills people when carelessly used
- It is costly to people who can't afford paying bills
- Electricity is expensive to install

Safety precautions when using electricity/ Nevers of electricity

- Never perform experiments using electricity from mains
- Never push metallic objects like pins, nails and wires into electric sockets
- Electric wires should always be well insulated
- Never operate electrical equipment with wet hands
- Avoid overloading electrical sockets
- Never touch naked wires connected to electricity
- Never touch hanging electric wires from electric poles
- Never try to repair electric equipment, leave it for experts.
- Never touch a switch or socket or a victim of electric shock with wet hands.
- Report to umeme (UEDCL) offices for any broken or hanging wires and broken mains.
- Installation of electricity in houses should be done by trained personnel only.

Devices connected to electricity

Generators

They produce electricity by changing kinetic energy to electric energy

A generator is a combination of a source of power and a dynamo

How to increase the power of a generator

- Increasing the number of turns in a coil.
- Increasing the speed of rotation.
- Increasing the magnetic field of a magnet inside the generator.

Dynamos

They produce electricity by converting kinetic energy into electric energy.

A dynamo in a vehicle helps in recharging the battery

A dynamo uses a permanent magnet to induce current into the coil during rotation.

A generator produces larger amounts of electricity while a dynamo produces smaller amounts of electricity.

A dynamo should have many coils in the armature in order to produce more steady current.

Motors

Motors use electric energy to produce mechanical energy

Motors are used to start engines of cars, to move some buses, trains, lifts, fans, vacuum cleaner, radio cassettes, sewing machines, milling machines etc

Energy transformations related to electricity

battery/dry cell	-	chemical energy to electrical energy
bulb	-	electrical energy to heat and light energy
Radio cassette stereo	-	electrical energy to sound energy
Solar cell	-	heat energy and light energy to electrical energy
Loudspeakers	-	electrical energy to sound energy
motor	-	electrical energy to kinetic energy
cooker	-	electrical energy to heat energy
Dynamo/generator	-	kinetic energy to electrical energy
Microphone	-	sound energy to electrical energy

Electric appliances An electric appliance is any device that uses electricity to work.

Home equipment that use electricity

- Telephone receivers
- Radio cassettes
- Television
- Electric flat iron
- electric chargers
- torches
- cookers
- electric kettles
- microwave ovens
- lamps, bulbs and fluorescent tubes
- Juice blenders
- washing machine.
- refrigerator
- DVD players
- computers
- electric fan
- air conditioners
- electric bells
- clocks

Static electricity

Static electricity is the type of electricity produced when an electric charge is produced by rubbing insulators together.
It is a type of electricity that does not flow from one place to another.
It is produced by friction.
The surface of an insulator becomes charged either positively or negatively and when the opposite charges attract electricity is produced.

Diagram showing production of static electricity

Before rubbing **After rubbing**

Lightning

Lightning is a sudden electric discharge between charged clouds and the earth. When the charge builds up in the cloud, the voltage also increases and results into a sudden spark.

Advantages of lightning

- It is a natural source of light.
- It fixes nitrogen into the soil.

Reasons why we see lightning before hearing thunder.

- Light travels faster than sound in air

Disadvantages of lightning

- It causes death to human beings and animals
- It causes fire that destroys buildings and property
- It destroys trees and other plants

How to safe guard against lightning

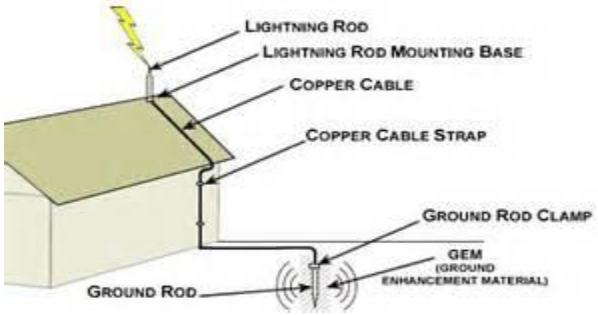
- Avoid standing under a tree during heavy storms lightning usually strikes the tallest object the electron come into contact with.
- Tall buildings should be fitted with lightning conductors
- Avoid standing in isolated places like play grounds when it is raining.
- Avoid walking bare footed on bare ground when it is raining. Always put on rubber shoes when moving.

- Avoid flying kites when it is raining.
- Buildings and other tall structures can be protected from lighting by fitting lighting conductors.

The lightning conductor is a strip of metal with one end attached to the highest part of the building and the other buried into the earth

The use of the lightning conductor is to trap the charges and direct them safely into the earth.

Diagram showing a building with a lightning conductor



Differences between static electricity and current electricity

Static electricity	Current electricity
It occurs in insulators The charge is on the surface of the insulator The electrons don't flow from one point to another	It occurs in conductors The charge is inside the conductor The electrons flow along the whole conductor

Self – Testing exercise

1. Briefly explain what is meant by current electricity
2. What are the two forms of current electricity
3. Name three sources of alternating current.
4. How is lightning produced?
5. What is the role of a lightning conductor when safe guarding against lightning?
6. Use an illustration, using a pair of dry cells, a bulb and a wire to show a simple circuit, on it indicate with an arrow the flow of electrons.
7. Identify 3 materials that conduct electricity.
8. Mention 3 substances that are poor conductors of electricity.
9. Why can't distilled water conduct electricity?
10. Name one non – metallic material that conducts electricity.

11. Name 2 common gases used in an electric bulb.
12. State the importance of each of the following parts of an electric circuit.

13. dry cell
14. switch
15. fuse

16. How is the function of a fuse different from that of a switch?
17. Which energy change occurs in a bulb when the circuit is complete?
18. Mention the energy change that occurs in a dry cell when the switch is closed.
19. Identify 2 common electrical equipments that use electric energy to produce heat energy.
20. Suggest two common causes of short circuits.
21. What name is given to the path along which an electric current flows?
22. State two advantages of using electricity for cooking other that wood fuel.
23. Outline two dangers associated with using electricity.
24. Give two domestic appliances that use both electricity and magnetism.
25. Name the two common types of cells
26. There are two major problems that affect the efficiency of wet cells. name them
27. How is a motor different from a generator in function?
28. Name any two companies connected to electricity supply in Uganda today.

MAGNETISM

Magnetism is aforce that enables a piece of metal to attract magnetic materials
A magnet is a piece of metal that has the ability to attract magnetic materials
Magnetic materials are substances that can be attracted by a magnet

NOTE

Magnetic materials can be made into magnets**.**

Examples of magnetic materials;

Steel
iron
Nickel

cobalt

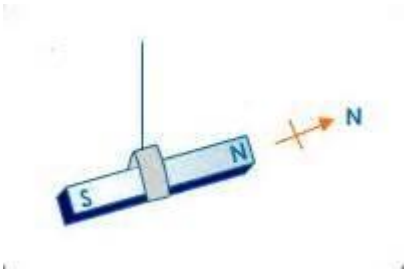
Non – magnetic materials are substances that can't be attracted by a magnet

Examples of non magnetic materials

- copper
- paper
- plastic
- aluminum
- lead
- rubber etc

Properties of magnets

1. A freely suspended bar magnet always points in the North – south direction

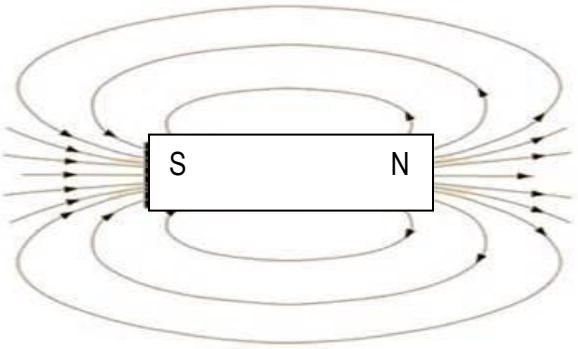


This happens because the North Pole (north – seeking pole) of a magnet is attracted to the north pole of the earth and the South Pole (south seeking pole) of the magnet is attracted to the south pole of the earth

2. Magnetism is concentrated at the poles of a magnet or

3. Lines of force in a magnetic field run from the north pole to the south pole

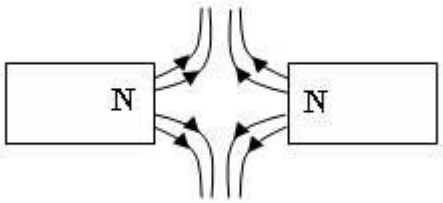
A magnetic field is a region around a magnet where magnetism acts.



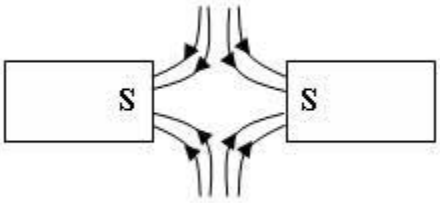
The law of magnetism states that, “like poles of magnets repel while unlike poles attract

4. Like poles of magnets repel

(i) North poles repelling

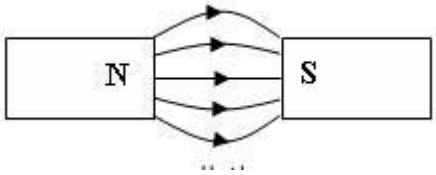


(ii) South poles repelling

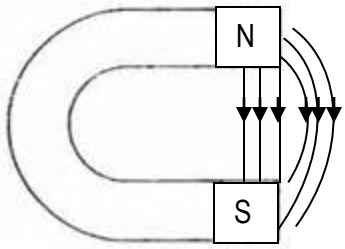


5. Unlike poles of magnets attract

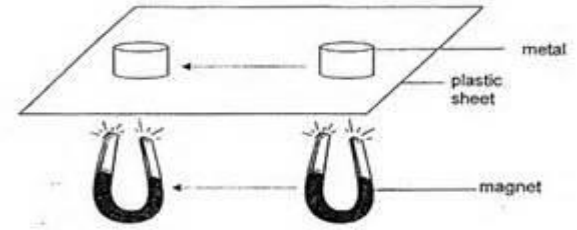
Lines of force of two magnets with unlike poles attracting



(iii) Attraction in a horseshoe magnet



6. Magnetism can pass through non – magnetic materials like wood, paper, cloth etc but can't pass through magnetic materials like steel, iron, nickel and cobalt.



N.B

Magnets become weaker with age: -

This can be prevented by using iron keepers

They absorb the magnetism and keep the strength of the magnet

Breaking a magnet

When a magnet is broken into half the two portions gain opposite poles on either sides no matter how many times the magnet has been broken.

N S

N S N S

N S N S N S N S

Types of magnets

Natural magnets

Artificial magnets

There are two forms of natural magnets

The earth

lodestone or magnetite

The earth is called a natural magnet because it has both the north and South Pole to which magnets are attracted.

Forms of artificial magnets

These are magnets made by man from magnetic materials

permanent magnets
temporary magnets

Permanent magnets are magnets that keep their magnetism for many years provided they are carefully stored and handled e.g. steel

Temporary magnets are magnets that easily lose their magnetism as soon as the things causing them to be magnetised are removed e.g. iron

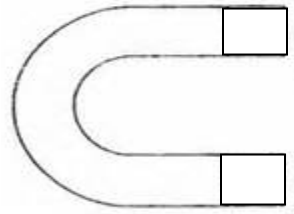
Properties of iron and steel

Iron	Steel
It makes temporary magnets It easily loses its magnetism It is easily induced	It makes permanent magnets It keeps magnetism It takes long to be induced

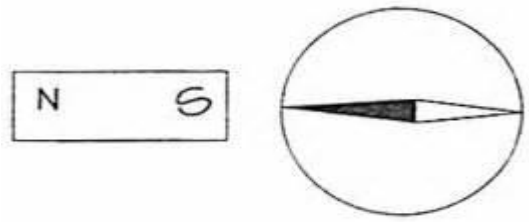
Examples of permanent magnets

1. Bar magnet

2. Horse shoe magnet



3. Magnetic needle/compass needle



Devices that use permanent magnets

Dynamo,generator,television,radio etc.

Temporary magnets

The electro magnet is the most common form of temporary magnet

It is made by using soft iron in a solenoid. The iron becomes magnetised when an eclectic current passes through the coil. If current is switched off, the iron loses its magnetism.

Such magnets are very powerful but their magnetism exists as long as current is flowing.

They can be made stronger by:

Increasing the number of turns of wire in the solenoid

Increasing the electric voltage at the source of current

Magnetisation This is a process of turning a magnetic material into a magnet.

Methods of making magnets

There are four methods of making magnets

- Single touch method (single stroking method)
- double touch method (double strokingmethod)
- Induction method
- Electric method

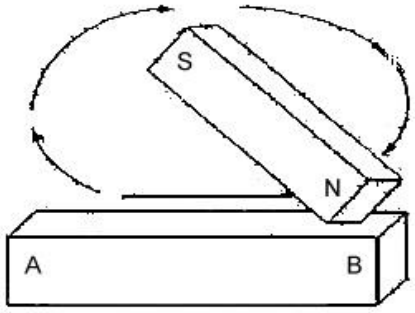
Single touch method

This is done by stroking a magnetic material like iron with a bar magnet in the same direction and with the same pole of a magnet

The pole of a magnet last stroked becomes the opposite pole to the pole of the magnet used

Or

The pole of the magnet first stroked (touched) becomes the same pole as that of the magnet used.

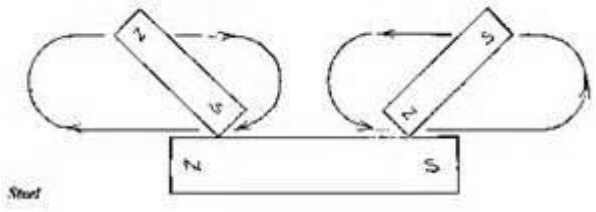


Double touch method

This one is done by stroking the magnetic material with two bar magnets.

Unlike poles and opposite direction must be followed and kept

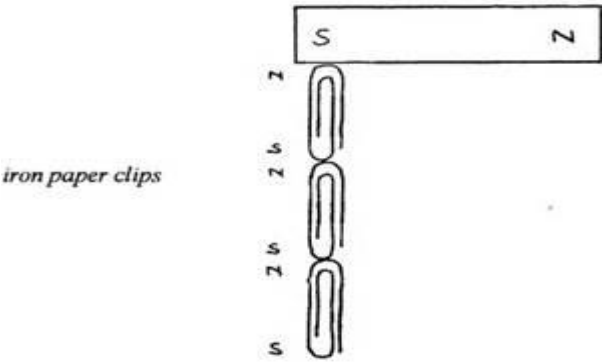
Opposite poles are produced at the point last stroked



Induction method

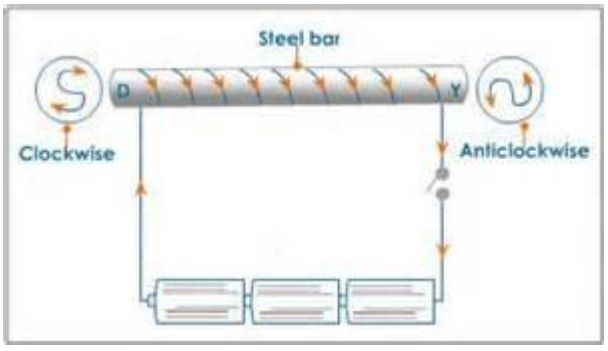
The method is done by attaching a magnetic substance e.g. steel bar or iron nails onto a permanent magnet and leave it to stay overnight for one or two days
The magnet made by induction is called an induced magnet
Unlike poles are immediately formed at the ends of the new magnet
The new magnet formed can then be used to attract other magnetic materials

Diagram showing induction method



(iv**) Electric method**

This method is done by placing a steel bar or iron bar in a coil of wire called a solenoid and then allowing an electric current to pass through it.
This is the best method of making magnets
Magnets made by this method are called electro-magnet



The polarity of an electro can be found using the following rule

- If current flows clockwise the end where current enters the solenoid becomes the South Pole.
- If current flows anti – clockwise the end where current enters the solenoid becomes the North Pole.

Using fleming right hand grip rule;

- When the hand is placed around the magnetic substance the four fingers point to the direction of current while the thumb points to the North Pole.

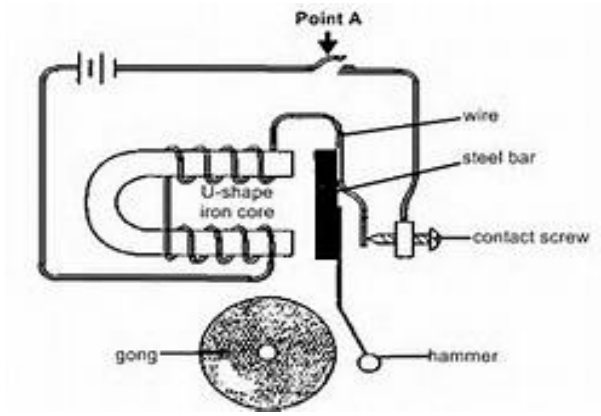
The strength of an electro magnet can be increased by; -

- Increasing the number of turns of wire in the coil
- Increasing the voltage on the source of electric current

Uses of electro magnets

- They are used in electric bells
- Powerful electromagnets are used in cranes to lift scrap iron and steel during smelting

The electric bell



How the electric bell works

- When the switch is closed, current flows and the electro magnet becomes magnetised
- The electro magnet attracts the soft iron bar
- The hammer attached to the soft iron bar bangs the gong giving out sound
- The soft iron bar pulls the steel spring away from the contact screw.
- The circuit is broken and the electro magnet loses its magnetism.
- The soft iron bar is no longer attracted and the steel falls and whole cycle is repeated.

DEMAGNETISATION

It is the way of making a magnet lose its magnetism

Ways of demagnetising magnets

- By hammering it or dropping a magnet several times.
- By placing a magnet in a solenoid through which alternating current is flowing in the East – west direction
- keeping a magnet in the East – west direction for a long time
- heating a magnet strongly
- Keeping magnets with like poles together for a long time
- leaving a magnet to rust

Uses of magnets

- They are used to pick up magnetic pins, screws or needles.
- They are used in hospitals to remove iron bits form eyes of patients.
- They keep cabinet and refrigerator doors closed.
- They hold magnetic cutlery in the kitchen together.
- Magnets are used in compasses in aeroplanes and submarines to find direction.
- They are used in ear pieces and telephone receivers.
- They are used in loudspeakers and microphones.
- They are used by cobblers and watch repairs to hold small magnetic nails and screws.
- magnets are used in industries to lift heavy iron and steel scrap materials.
- magnets are used in electric bells.

Devices that use magnetism only

Magnetic tapes

Magnetic compasses.

Devices that use both electricity and magnetism

Electric motors

Electric bell

Microphone

Loud speaker

Refrigerator

Self testing exercise

1. What is a magnet?
2. Identify 2 examples of magnetic materials
3. Mention 3 examples of non magnetic materials.

4. What do we call the natural magnetic rock?
5. State any 4 properties of magnets.
6. Suggest 4 ways of making magnets.
7. What property of magnetism is shown below?
8. Define the following terms.
9. Magnetic field
10. Demagnetisation
11. Identify 4 uses of magnets
12. How are magnets useful to: -
13. a doctor
14. a watch repair
15. a pilot
16. a person in an iron smelting industry
17. How can the strength of an electro magnet be increased?
18. Identify 2 ways of making a magnet lose its magnetism.

ENERGY RESOURCES IN OUR ENVIRONMENT

Energy is the ability to do work.

A resource is something in the environment used by people to satisfy their needs.

Environment refers to all things that surround people

Energy resources are things/materials in the environment which are used to produce useful energy

Examples of energy resources include: water,wind,sun,minerals,plants,animals.

Types of energy resources in the environment

1. Renewable resources

Renewable energy resources are energy resources which can be replaced *naturally*..

Renewable energy resources can be maintained by natural processes of reproduction, growth, the air cycle, water cycle, weathering and decomposition.

Examples of renewable energy resource

- water
- wind
- animals
- plants

2. Non – renewable energy resources.

Non – renewable energy resources are energy resources which cannot be replaced naturally.

Non – renewable energy resources form slowly yet they are used up very fast.

Examples of non – renewable energy resources

- Minerals
- Fossi fuels
- Rocks

(ii) Plants

Uses of plants as energy resources

- Plant material provides biogas for which is used for cooking and lighting.
- Plants are a source of food to man. Food contains chemical energy.
- Plants provide fuel to people i.e. charcoal and fire wood.

Energy resources from plants

- Wood fuel
- Food

Examples of wood fuel

- Fire wood
- Charcoa
- Saw dust

Ways of conserving plants

- Afforestation
- Reafforestation
- Use fuel saving stoves
- Carry out agroforestry
- Use other sources of energy E.g. solar, biogas etc
- Through rural electrification.

(iii**) Animals**

Uses of animals as energy resources

- Animals like oxen and donkeys are used to plough land.
- Animals are used for transport.
- Animal wastes are used in production of biogas.
- Animals are a source of food to people.

Energy resources from animals

- Meat
- Animal dung and urine

Ways of conserving animals

- Banning poaching
- Gazetting game parks and game reserves
- Treating animals when they are sick
- Proper feeding of animals

Reasons for conserving wild life

- Some plants and animals should be conserved because they are a source of food to man.
- Some animals and birds are valued as cultural heritage by some countries or tribes.
- Plants are a source of wood fuel.
- Plants provide food and herbal medicine.
- Plants and wild animals promote tourism.
- Plants provide shade and oxygen to people and other animals.
- Plants provide timber for construction and making furniture.
- Trees modify climate by influencing rain formation.

Production of biogas

The living material used in production of biogas is called **biomass**

Biomass can also mean the amount of living matter in an area.

Biomss can be used to produce **biomass fuel**

Biomas fuel is produced by treating plants and animal waste with bacteria called **anaerobes**

Biogas is a gas that is produced from rotting organic matter.

Organic matter used in production of biogas include:

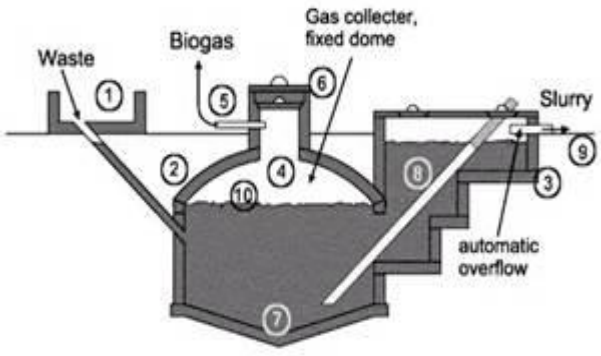
- Cowdung
- Peelings from cassava,bananas,potatoes,etc
- Animal urine

The above materials are put in an air-tight container called **abiogas digester**

In the biogas digester, the materials are fermented by the help of **anaerobic bacteria**.

After anaerobic fermentation, **methane gas** is then produced and this gas is what is referred to as biogas by most people.

Structure of a biogas digester



Uses of the parts of a biogas digester

Inlet: it is an entrance for plant and animal matter to the digester.

Inlet pipe: it allows plant and animal matter into the digester

Outlet: it is an exit for old used up matter
Outlet pipe: it allows used up matter to the emptying tank
Emptying tank: To collect the used up old matter from the digester
Biogas tube: It traps biogas and takes it to the heating or lighting equipment

Why the biogas digester should be tightly covered

- To prevent leakage of biogas
- To prevent entry of oxygen

Why the biogas digester should be buried far from kitchens and other sources of heat

- To prevent explosion of biogas
- To prevent death of anaerobic bacteria

Uses of biogas

- For cooking
- For lighting
- For heating

Advantages of using biogas

- It is cheaper than using natural gas.
- It does not pollute the environment
- The materials are readily available nin the environment
- It is the source of manure for plants

(iv) Water

Uses of water as an energy resource.

- Running water is used to generate hydro electricity.
- Steam from hotsprings is used to generate thermal electricity.
- Tides in oceans is used to generate **tidal energy**
- Water is a medium of transport using dhows,boats, and ships.

Energy resources from water

- Hydro electricity
- Steam energy
- Tidal energy

Uses of rocks as energy resources

- Rocks provide geothermal energy form their hot springs.
- When underground water gets heated by hot underlying rocks, it rises as steam which is used to generate geo – thermal energy.

Minerals as energy resources

Uranium is a source of atomic (nuclear energy).An equipment which uses uranium to produce atomic energy is called a nuclear reactor.

Uses of fossil fuels as energy resources

- Petroleum products provide fuel that helps to run engines.

Petroleum products like petrol, diesel, kerosene and jet fuel are obtained from crude oil by the process called fractional distillation.

- Coal is a source of thermal energy.

NOTE: Petroleum and coal are the major fossil fuels.

Another example of fossilfuel is oil shale.

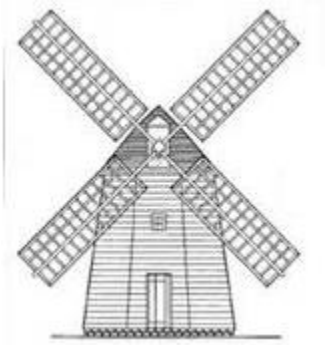
Wind

Wind is air in motion.wind is caused due to difference in air pressure.

Uses of wind as an energy resource

- Energy from wind is used by wind mills to pump water from underground and mill grains.
- Force from wind helps to move boats in water bodies.
- Wind is used for winnowing seeds.

Structure of a wind mill



Uses of a wind mill

- To generate electricity.
- To pump water from underground
- To mill grains like: maize

Sun

Uses of sun as an energy resource

- The sun provides light that enables us to see.
- The sun provides heat that is used to dry crop produce.
- Heat and light energy from the sun is used in solar cells to produce solar electricity.

Solar electricity is produced using solar panels.

Components of a solar panel

Solar cells: convert solar energy into solar electricity.

Solar battery: To store electric energy.

N.B A solar panel traps heat and light from the sun.
A solar panel is painted black to trap sun's heat and light.

Ways of conserving non – renewable resources

- Using the available non renewable resources sparingly.
- Recycling plastic material (non – biodegradable waste)
- Repairing cars in poor mechanical condition should be done to control fuel consumption.
- Using other sources of energy like solar energy instead of oil products.

CONTROLLING AND MANAGING RESOURCES IN THE ENVIRONMENT

Environment refers to people and their surrounding.

Components of the environment

- physical components/ Abiotic components
- Biological component/ Biotic components

Physical components of the environment are non – living components of the environment

Examples:

- The sun
- Air
- water
- land (soil)Biological components of the environment are the living components of the environment

Examples

- plants
- Animals

Importance of the environment to man

- Source of food.
- It is a source of water.
- Source of building materials
- It is a habiat for people.
- Source of craft materials
- Source of herbal medicine
- For recreation

Environmental degradation

Environmental degradation is the destruction of resources in the environment
Or
Environmental degradation is the lowering of the quality of resources in the environment
Or

Environmental degradation is the way in which the productivity and usefulness of the environment is lowered.

Environmental degradation involves;

- Pollution of air, water and soil
- Devegetation
- silting of rivers, lakes, dams and wells
- wetland degradation
- land/soil degradation

Pollution

Pollution is the releasing of harmful substances into the environment.

Pollutants

Pollutants are harmful substances released into the environment
examples of pollutants:- industrial fumes, smoke, dust, green house gases, un treated waste, polythene, metal, scrap, plastics, rubber etc

Types of pollution

air pollution
water pollution
soil pollution
sound pollution

Air pollution

Air pollution is the releasing of harmful substances into the air.

Examples of air pollutants:

- smoke
- harmful gases from sewage, burning plastics/rubber and vegetation.
- oxides of carbon e.g. carbon monoxide, carbon dioxide.
- exhaust fumes

Causes of air pollution

- Exhaust fumes from vehicles
- Smoke from kitchens, burning vegetation, rubber and plastics
- fumes from herbicides, insecticides. fumigants, pesticides, sprays.
- tobacco smoke from smoking

Effects of air pollution

- It leads to respiratory health problems
- It leads to acidic rain
- it leads to global warming
- It damages the ozone layer exposing people to chances of skin cancer

Control measures for air pollution

- Using lead free fuel in vehicles
- Treat gases released by car exhaust systems
- Avoid using sprays and agrochemicals that pollute the air.
- Control bush burning, burning rubber and plastics
- people should avoid smoking
- Treating gaseous waste from factories before release

Water Pollution

Water pollution is the releasing of harmful substances into water sources

Water pollutants

- Untreate sewage
- Human wastes
- Agrochemicals
- Silt

Causes of water pollution

- Disposing chemicals from factories into lakes and rivers
- Disposing untreated sewage into water sources
- Use of excess fertilizers on farms that are eroded into water sources
- Silting from farms and bare land

- Animals drinking in water sources
- Animals defecating or urinating in water sources
- Dumping human, animal and domestic wastes in water sources

Effects of water pollution

- It makes water unsafe for domestic use
- It leads to water associated diseases
- silt makes water bodies shallow which may lead to floods.
- It leads to blocking of water channels
- It leads to destruction of water sources.
- It leads to destruction of acquatic life. (Plants and animals)

Control measures for water pollution

- Treat sewage before disposing it
- protecting bare land from erosion by environment friendly practices like afforestation mulching etc)
- Protecting water sources by fencing them
- Avoid cultivating along river banks or lakes shores
- Industrial wastes should be treated before they are released off.

Use the **5R's** of waste management i.e.

- Recycle
- Re use
- Reduce
- Reject
- Return

Soil Pollution

Soil pollution is the releasing of harmful substances into the soil

Soil pollutants

- Agro chemicals
- Engine oil
- Polythene
- Glass
- plastic

Causes of soil pollution

- Excessive use of artificial fertiizers on farms
- dumping non – biodegradable wastes on land e.g. plastics, polythene, rubber, glass, metals etc
- Disposing untreated wastes from factories into the soil.

Effects of soil pollution

- It leads to soil exhaustion
- It leads to poor crop production

- It kills living organisms in the soil
- It makes cultivation of land difficult and tiresome

Control measures for soil pollution

- Use organic manure instead of artificial fertilizers
- Ensure proper management of non-biodegradable wastes
- Use the lowest possible amounts of herbicides and pesticides on farms.
- Use biological and environment friendly methods of weed control, pest control and improving soil fertility.
- Treat wastes from factories before disposing them off.
- Use the 3R's of waste management.

Devegetation

It is the removal of plant cover in an area.

Causes of devegetation

- bush burning
- deforestation
- overgrazing
- overstocking
- industrialization

Effects of devegetation

- Land is left bare and exposed to agents of soil erosion
- animal habitats are destroyed
- some plant species become extinct
- leads to air pollution
- reduction of rainfall amounts
- Leads to global warming
- food for many wild animals is destroyed
- Medicinal herbs are destroyed
- It results in desertification

Control measures of devegetation

- planting many tree types and maintaining them
- practicing afforestation
- practicing reafforestation
- practicing agro forestry
- conserve forests
- controlled bush burning
- practicing rotational grazing
- sensitizing people about the importance of vegetation

Silting of water bodies

Silting is the deposition of eroded soil into water sources

Agents of silting

- running water
- wind

Causes of silting

- deforestation
- cultivating along riverbanks and lake shores
- clearing vegetation around/near riverbanks and lakes

Effects of silting

- It leads to water pollution
- It destroys plant and animal life in water sources when silt deposited chokes them to death
- It prevents light from reaching far into the water
- It reduces the volume and capacity of water sources leading to floods

SIMPLE MACHINES

A machine is a device that makes work easier or quicker.

A machine is a device on which a force is applied to do work.

A simple machine is a device is made of few parts and simplify work.

A complex machine is a device made of many parts and it simplify work

Examples of simple machines

- a hoe
- *Wheelbarrow*
- Paiir of scisor
- See saw
- Pincers
- Claw hammer

Examples of complex machines

- Tractor
- Car
- Aeroplane
- Computer
- Sewing machine

Advantages of machines

- They make work easier (simpler) by reducing the force applied to do work.
- They do work quicker (they save time in doing work)
- They increase the speed of doing work.
- They change the direction of effort.

- How machines reduce effort needed to do work
- By increasing the effort distance

Dis advantages of machines

- Machines cause laziness
- Machines may cause accidents
- It is expensive to maintain some machines

Work

Work is an activity done when a force applied moves through a given distance in the direction of the force.

Work is the product of the force applied and the distance it moves in the direction of force.

Work = Force x distance

Work is measured in Joules (J)

Force is measured in Newtons (N) 1kg = 10N

Distance is measured in metres (M)

A joule is the amount of work done when a force of one Newton moves through a distance of one metre.

Example I

Find the amount of work done when a man carries a sack of beans of 80N through a distance of 9 metres.

Work done = Force x distance

= 80N x 9m

= 720 Joules

Example II

Find the work done by James if he carries a wheel barrow containing a load of 90kg through a distance of 5 metres

Work done = Force x distance

= Force = 90 x 10

= 900N

W = 900N x 5m

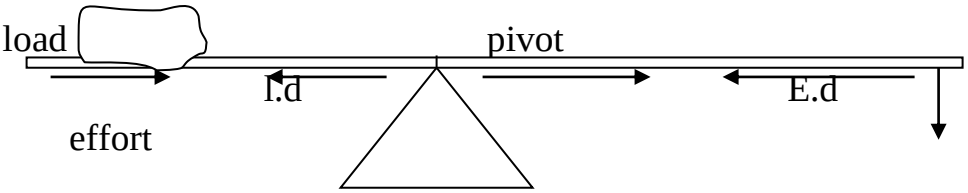
= 4500 Joules

Groups of simple machines

- Levers
- inclined plane (slope)
- wedges
- Levers
- screws
- wheel and axle
- pulleys

A lever is a rigid bar which turns freely at a fixed point called pivot (fulcrum) e.g. a see saw

A pivot is the turning point of a machine.



Load is the force to be overcome by the machine

Effort is the force applied to overcome another force called load.

Load (L.d) is the distance between the load and the pivot.

Effort distance (E.d) is the distance between the effort and the pivot.

Load distance is also called (load arm) and effort distance is also called effort arm.

A lever works best when the load arm is shorter than the effort arm.

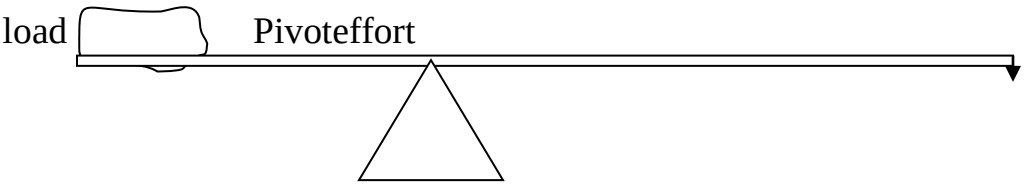
CLASSES OF LEVERS

- First class levers
- second class levers
- Third class levers

First class levers are levers in which the pivot (fulcrum) is in between the load and the effort.

Examples of first class lever machines are: -

a weighing balance
see saw
tin opener (lid opener)
pliers
pair of scissors
a claw hammer
crowbar with pivot between load and effortpincers

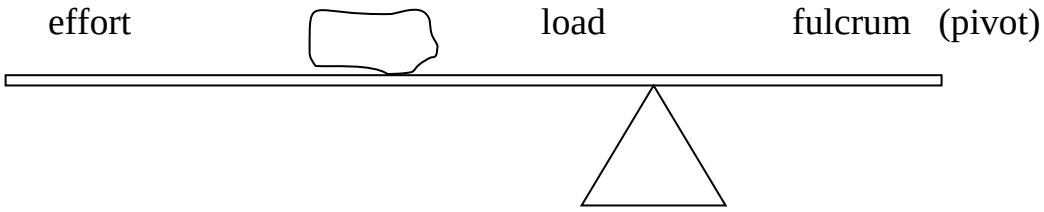


Second class levers are levers in which the load is located between the pivot and the effort.

Examples of second class lever machines include: -

- A wheel barrow
- human foot
- a nut cracker
- a bottle opener
- an oar of a boat
- door handle
- spanner
- crow bar with load between effort and pivot

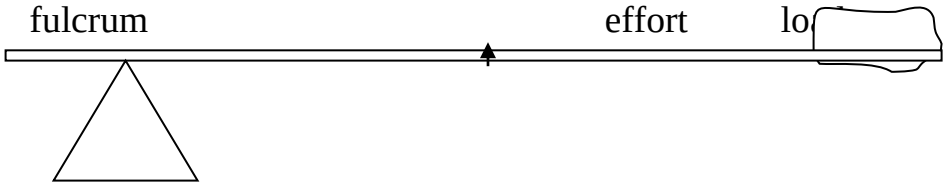
In 2nd class levers the effort arm is longer than the load arm
Or the effort is less than the load.



Third class levers are levers where the effort is in between the fulcrum and the load.

Examples

- a pair of tongs
- human arm
- tweezers
- a spade
- fishing rod
- a broom
- shovel



In third class levers the load arm is longer than the effort arm or
The effort applied is greater than the load.
Disadvantage of 3rd class lever is that the effort moves through a shorter distance.
Note:
To remember the classes of levers well we use PLE.
P (1st class) pivot in between the load and effort.
L (2nd class) load in between the pivot and effort.
E (3rd class) Effort in between the pivot and load.

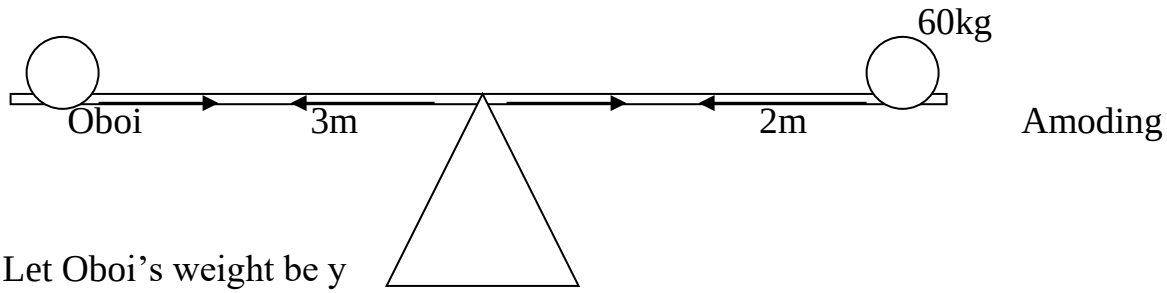
The law of levers

Also called the law of moments/the principle of moments. A moment is a turning force or
A moment is a product a force and its distance from the pivot
It states that the sum of clockwise moments about a point is equal to the sum of the anticlockwise moments for a lever to balance.
Effort moment = Effort x Effort arm
Load moment = Load x Load arm

Example

Amoding weighs 60kg and sits 2 metres from the pivot of the see saw. Oboi on the other side of the pivot sits 3 metres away in order to balance.

Find Oboi's weight.



Let Oboi's weight be y

Anticlockwise moment.	=	Clockwise moment
= E. XE.A		= L.XL.A
= Y x 3		= 60 x 2
= 3y		= 120

By the law of levers

Anti – clockwise moment = clockwise moments

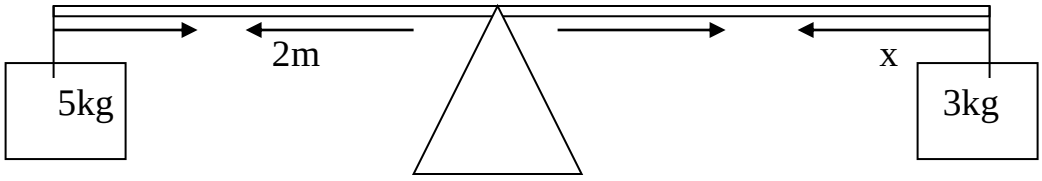
3y = 120

3 3 = 40kg

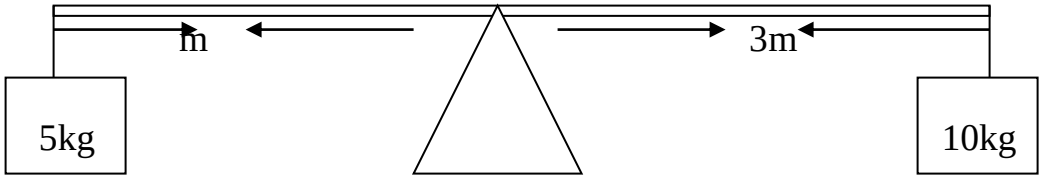
Oboi's weight is 40kg.

Exercise

Find the value of x.

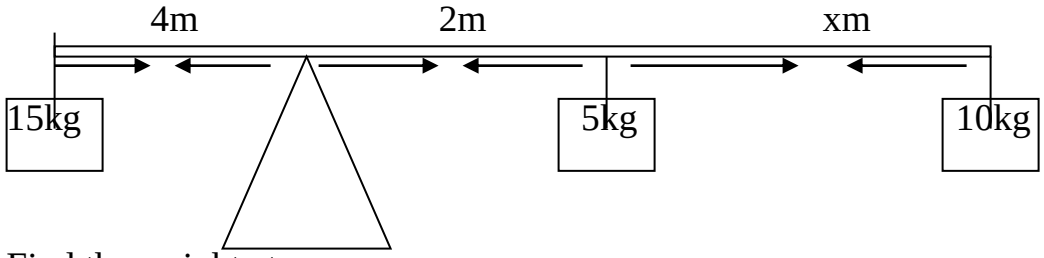


Find the weight at S.

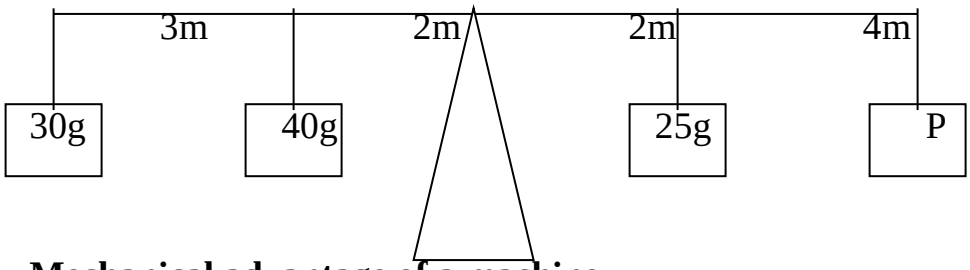


A boy and a girl balance on a see – saw. A boy weighs 30kgf and sits 60m from the pivot while a girl weighs 45kgf and sits ym from the pivot. Draw a sketch for the information and find distance y.

Using the law of levers find the value of x.



Find the weight at p.



Mechanical advantage of a machine

It is the number of times a machine simplifies work

It is the ratio of the load to the effort

MA = load
Effort

MA has no units

Examples

A boy uses a crowbar to lift a stone of 400N using a force of 100N. Find how many times the crowbar simplifies work.

MA = Load = 400N
Effort 100N
= 4

The crow bar eases work 4 times.

Calculate the mechanical advantage of a machine lifting a load of 30kgf using an effort of 30N.

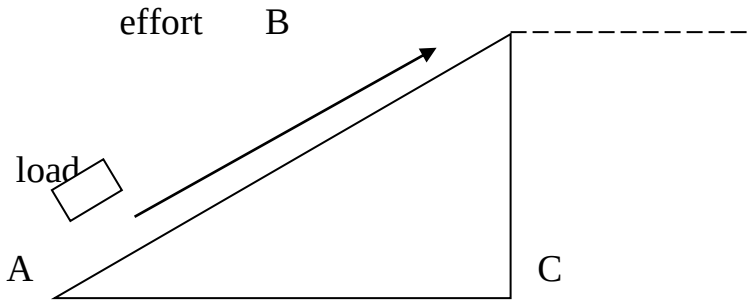
MA = Load 1kgf = 1N
Effort

= 30N
30N

MA = 1

An inclined plane

An inclined plane is a slanting surface used to connect (join) a lower level to a higher level.



AB = effort distance

BC = load distance

AB = inclined plane

The longer the inclined plane the less the effort needed to move the load

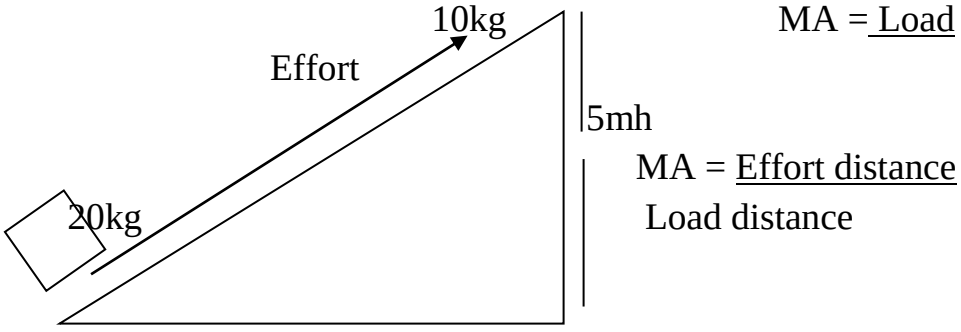
Examples of inclined planes

- A stair case
- a winding road up hill
- plunk of wood
- a ramp
- a ladder
- straight road uphill

Uses of inclined planes

- for loading and offloading goods on trucks.
- for moving up a steep mountain or hill
- moving up a flat building
- going up a tree or building

To find mechanical advantage of an inclined plane



MA = Load

MA = Effort distance

Load distance

Find the mechanical advantage of the plane

MA = Load

Effort

= 20kg

10kg

= 2

Calculate the distance moved by the effort

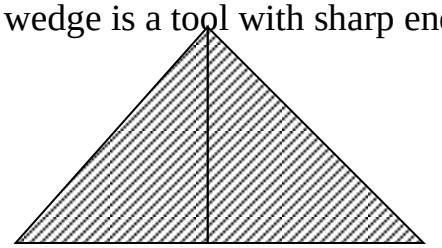
MA = $\frac{Ed}{Ld}$

$\frac{2}{1} = \frac{Ed}{1 \times 5m}$

Ed = 10 metres

WEDGES

A wedge is a tool with sharp ends that gradually get wider



Wedges are used for cutting, piercing or splitting wood, tree logs, food etc

Examples of wedges

- axe
- hoe
- spear
- panga
- knife
- chisel
- nails
- spears
- scissors

Wedges are sometimes called a double slope or double inclined planes

Uses of wedges

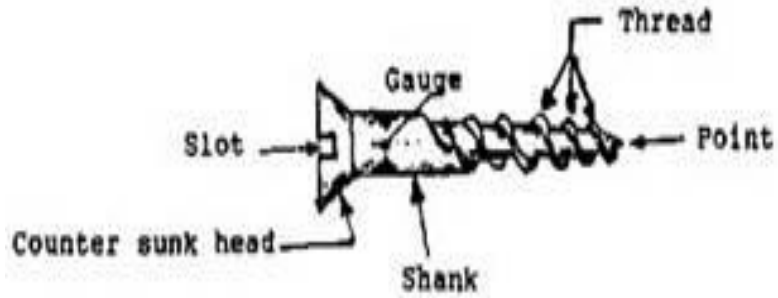
- for splitting logs of wood
- cutting big trees
- cutting fire wood
- peeling food

SCREWS: A screw is an inclined plane wound round a rod. Screws are used to fasten things like wood together, pieces of metal together etc.

Most lids of tins and bottles use screws

Screws hold things tightly together the way we could hold them with our hands.

Structure of a screw



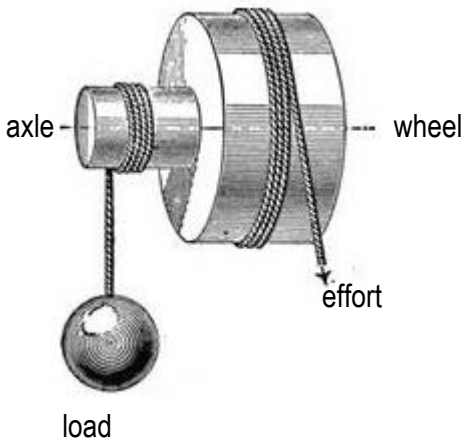
Examples of screws

- Motor car jacks used to lift heavy vehicles

- Engineers vice used in mechanics to holds metals
- bolts and nuts used to fasten metals together

WHEEL AND AXLE

They are composed of two rotating wheels together
A small wheel is fixed through a groove of a large one
The small one is the shaft or axle while the big one is the wheel
A strong thread is then wound tightly around the axle
An axel is a rod on which a wheel turns
The thread coming out of the wheel leads to the effort area while the one that comes out of the axle leads to the load area.

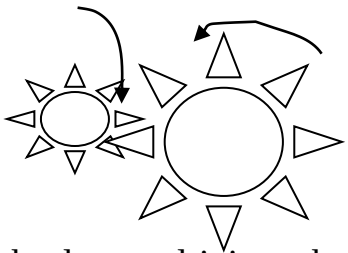


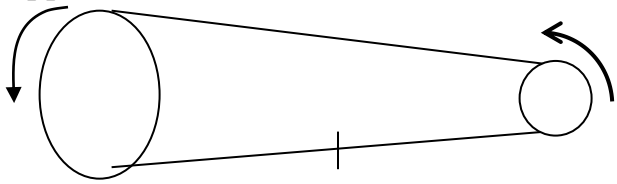
Examples of wheels and axles

- an egg beater
- a door knob
- car steering wheel
- a wind lass
- pedals and chain wheels of a bicycle

GEAR WHEELS AND BELT DRIVES

They are a special form of wheels and axles.
Belt drives transmit motion from one wheel to another. If the diameter of the driving wheel is twice that of the driven wheel, then the driven wheel will rotate at a speed twice that of the driving wheel but in the same direction
For toothed wheels, the wheels rotate in opposite direction


driven wheel driving wheel


driven wheel belt driving wheel

Wheels driven by a belt rotate in the same direction.

Uses of gear wheels and belt drives

- Gears multiply speed in vehicles and cranes
- Gear wheels can change the direction of rotation e.g. in reversing vehicles
- Gear wheels can be used to multiply effort
- Belt drives transmit motion from one wheel to another
- Belt drives are used in factories and industries to transport manufactured products from one place to another.

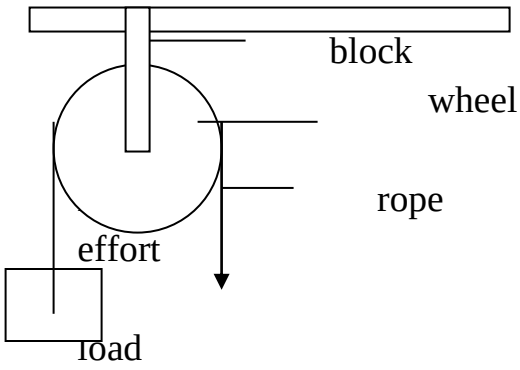
PULLEYS

A pulley is a freely rotating wheel with a grooved rim. A rope or chain passes over the pulley and is prevented from slipping off by the grooved rim. The frame which holds the pulley called the block.

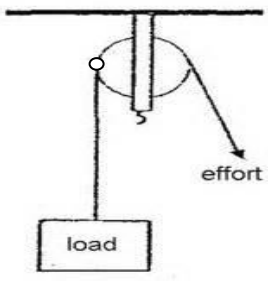
Types of pulley

single fixed pulley
single movable pulley
block and tackle system (fixed movable pulley)

PARTS OF A PULLEY



A single fixed pulley



A single fixed pulley does not move as it is fixed to one end.
Its advantage is that it changes the direction of the effort
In a single fixed pulley the load is equal to the effort therefore the mechanical advantage is always equal to one.
A single fixed pulley acts like a first class lever as the fulcrum is in between the load and the effort.

Find the force applied to lift a load of 50kgf using a single fixed pulley

MA = load / Effort

1 = 50kgf

1 E

E= 50kgf

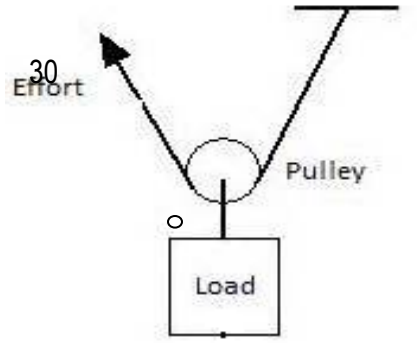
A single movable pulley

A single movable pulley moves along the rope/chain.

It doesn't not change the direction of the force.

Its advantage is that it reduces the effort required by half

Mechanical advantage of a single movable pulley is 2 therefore L = 2E



Calculate the load carried by the pulley

L = 2E

MA = L / E

2 = L

1 30

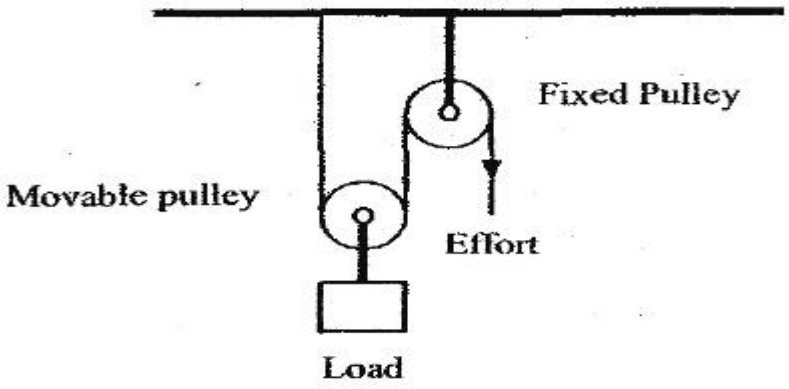
L = 60N

The single movable pulley acts like a second class lever.

Block and tackle system

A block and tackle system consists of two blocks consisting of two to eight pulleys depending on the mechanical advantage needed.

The more movable pulleys used the less the effort required to raise the load.



The mechanical advantage of a block and tackle system is the number of strings/ropes supporting the movable pulley in this case, MA = 2

Uses of pulleys

- In breakdown vehicles for towing vehicles with mechanical problems
- In cranes to lift and load heavy goods on trains, ships, trailors etc.
- In lifts to move people from one level to another of a storeyed building.
- In scaffolds by painters to paint high buildings
- In cranes by builders to lift heavy building materials to high levels
- On flag posts for hoisting flags
- Used to move window curtains

FRICTION

Friction is the force that opposes motion between two surfaces in contact.

Types of friction

- Static friction – found in objects that are fixed in one position
- Sliding /rolling friction – found in moving objects
- Fluid friction (viscosity) – In liquids and gases.

Advantages of friction (Friction as a useful force)

- Helps in walking
- writing
- climbing trees
- grinding cereals/seeds
- braking to stop vehicles
- lighting a match tick
- opening doors

sharpening cutting objects.

Disadvantages of friction (friction as a nuisance force)

- It leads to wearing out of objects
- It produces unnecessary heat
- It produces unnecessary noise
- It makes work difficult
- It leads to bruises
- It reduces the efficiency of machines
- It retards motion/delays work
- Ways of reducing friction
- by lubrication using grease or oil
- by using ball bearings

- by using rollers
- by streamlining objects
- making rough surfaces in contact smooth

Substances that can be used to reduce friction

- Rollers
- Ball bearings
- wheels
- oil
- Grease
- polish

Ways of increasing friction

- Increase the weight of moving bodies
- making surfaces in contact rough
- put treads on tyres/shoes
- put grooves on bicycle handles/steering wheels of vehicles.
- Put spikes on shoe soles for soccer.
- Putting tarmac murram on roads surface.

TOPIC IV: THE EXCRETORY SYSTEM

It is a group of organs in the body that work together to remove waste products from body cells.

Excretion is the removal of waste products from body cells.

Excretory organs

These are body organs that helps the body to pass out waste product

Examples of excretory organs and their excretory products

Excretory organ	Excretory product
The kidney	Urine (excess salts, urea ,uric acid, excess water)
The lungs	carbon dioxide and water vapour
The skin	Sweat (excess salts, lactic acid and excess water)
The liver	Bile pigments.(formed after decomposition of red bloodcells)ss

The kidney:

There are two kidneys at the back of the abdomen.

They are reddish brown, small and bean shaped

The left one is slightly bigger than the right one

Kidneys are attached to the back walls of the lower abdomen just below the diaphragm

Each kidney is connected to two blood vessels ie; **renal artery** and **renal vein**
Kidneys have nephrons where filtration takes place

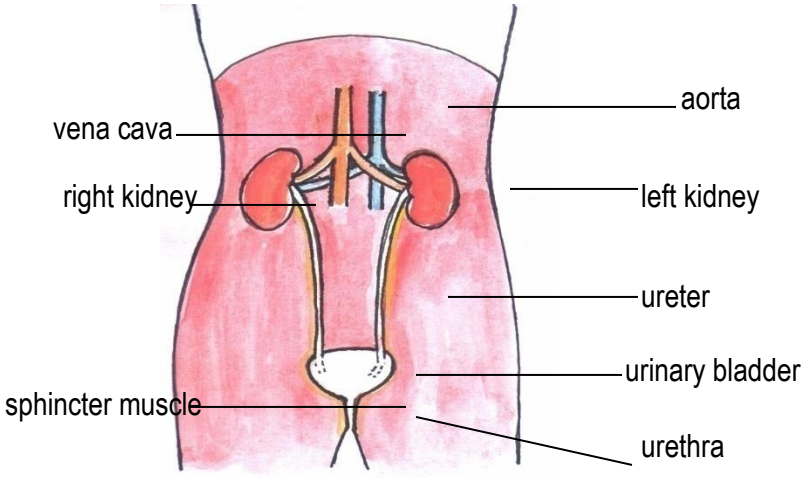
Functions of the kidney

- It filters blood
- It maintains a water balance in the body

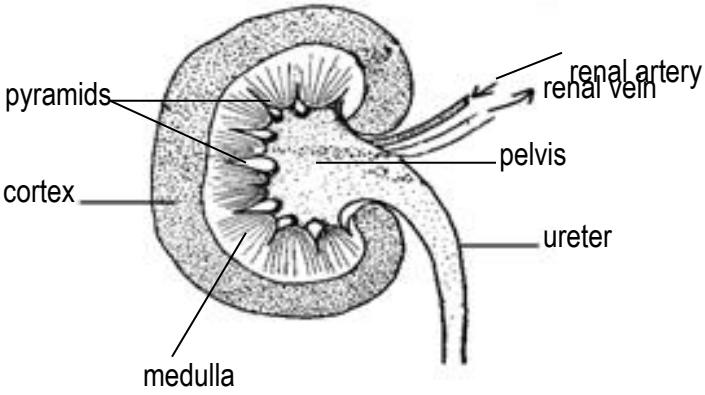
How do kidneys purify blood?

How do kidneys regulate the amount of water in the body?

Position of the kidney in the human body



The kidney



Functions of the parts

Aorta . it's a passage of oxygenated blood from the heart to all body parts

Vena cavait's a passage of de-oxygenated blood from the body to the heart

The renal arteryit's a passage of oxygenated blood from the aorta to the kidney

Renal vein: it's a passage of de-oxygenated blood away from the kidney to the venacava

Cortex: it is where filtration of blood takes place.
Medulla: It is where **selective reabsorption** of required substances occurs e.g. mineral salts, glucose, amino acids,vitamins,
Pelvis: It is where urine collects before it leaves the kidney
Ureter: It takes urine from the kidney to the urinary bladder
Urinary bladder: It stores urine before it is passed out of the body.
Urethra it lets out urine from the urinary bladder
Sphincter musclesthey control the flow of urine from the urinary bladder
How is selective re-absorption important to the body?
Why can't babies control urination?s
Mention the factors that affect the amount of urine produced?
How do the following affect the amount of urine produced;
(a) Fluid in take **(b)** temperature **(c)** blood pressure
Why do people urinate more frequently on cold days:?

DISEASES OF THE KIDNEY

- **Cancer of the kidney:** treatment is surgical removal
- **Kidney failure:** the kidney fails to work and can be treated by renal dialysis.
- **Kidney stones:** caused by obstruction of the ureter and bladder due to salts that solidify
- **Nephritis:** it is caused due to infection of nephrons.

Qn . **Mention the diseases of the urinary system**

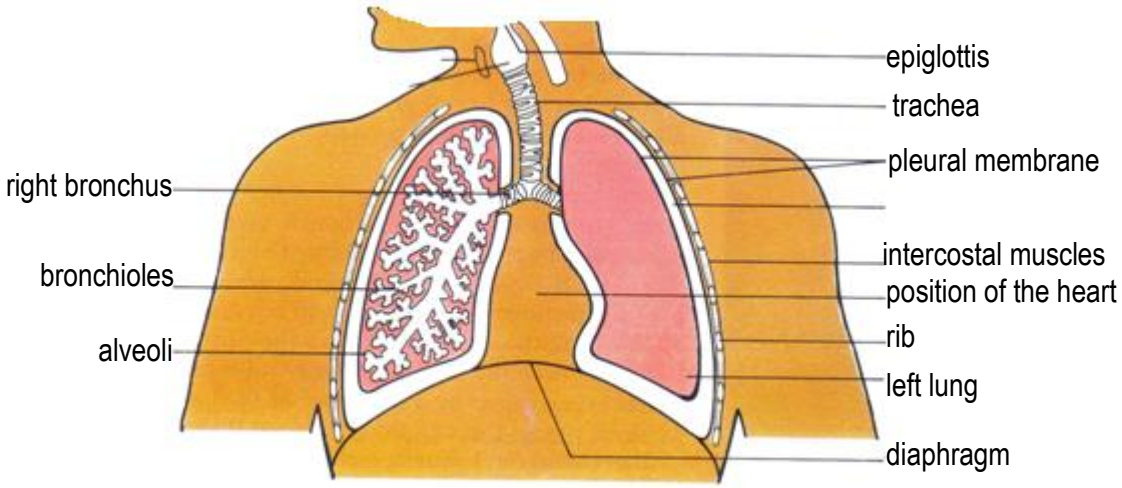
Good habits for proper functioning of kidneys and the urinary system

- Drink plenty of safe clean water and natural fruit juices
- Eat the right portion of salt in foods
- Avoid excessive drinking of alcoholic drinks
- Eat foods rich in a balanced diet
- Have regular physical exercises
- Have regular medical checkups.
- Emptying the urinary system regularly

Lungs

There are two lungs in the human body located in the chest cavity. They are elastic and sponge like

Parts of the lungs



The lungs are called excretory organs because they remove carbon dioxide and water vapour from the body

The lungs are also called respiratory organs because they supply oxygen needed for respiration.

Gaseous exchange in the lungs occurs in the alveoli.

Composition of inhaled and exhaled air

Substances	Air inhaled	Air exhaled
Carbon dioxide	0.03%	4%
Oxygen	21%	16%
Water vapor	Little or no	more
Nitrogen	78%	78%
Rare gases	0.97%	0.97%

The main function of the lungs in excretion is to remove carbon dioxide from the body

Diseases of the lungs;

- Pneumonia (bacterial)
- Bronchitis(bacterial)
- Tuberculosis(bacterial)
- Lung cancer (due to smoking)
- Asthma (due to allergies)

Good habits to keep lungs healthy

- Stay in well ventilated places
- Avoid inhaling air containing dust and smoke
- Avoid smoking tobacco and cannabis

- Keep away from people with infectious air borne disease like tuberculosis, whooping cough and pneumonia
- Have regular medical checkups of the respiratory organs
- Eat foods rich in a balanced diet
- Have regular physical exercise
- When handling air pollutants e.g. insecticides, fumigants and pesticides put on protective gadgets
- Avoid living in overcrowded places
- Immunization of newly born with BCG vaccine
- Treat infections immediately
- Treat tuberculosis patients in isolation.

Processes of breathing

Inspiration/inhalation

Is the act of taking in air

Exhalation / expiration

Is the act of taking out used air

During in halation	During exhalation
The diaphragm contracts/ flattens	The diaphragm relaxes
The ribs go upwards/outwards	The ribs go down wards/inwards
The intercostal muscles contract	The intercostal muscles relax
The lungs expand	The lungs return to their size
The volume of the chest increases	The volume of the chest decreases

The skin

It is a continuous layer covering the surface of the body

It's the largest sense body organ

It's a sense organ for touch

Its major function is to regulate the body temperature

Layers of the skin

- Epidermis (outer layer)
- Dermis(inner layer)

The epidermis/cuticle

- It is outer layer of the skin
- It protects the inner layer from damage/harm

It is divided into 3 layers namely;

- Cornfied layer
- Granular layer

- Malpighian layer

Cornified layer

It's the top most layer of the skin

- Its made of dead cells
- It forms the tough outer coat of the skin
- It prevents entry of germs in the body
- It rloss of water from the body by evaporation
- It is rough on the palms and feet soles **to increase friction**

Why is the cornified layer of the palms and soles of the feet has no air?

Granular layer

It is made of living cells which continuously divide to form the cornified layer.

Malpighian layer

its made of living cells

-**melanin** which **determines the skin colour**

-Melanin also acts as a screen against ultra –violet rays from the sun.

The dermis

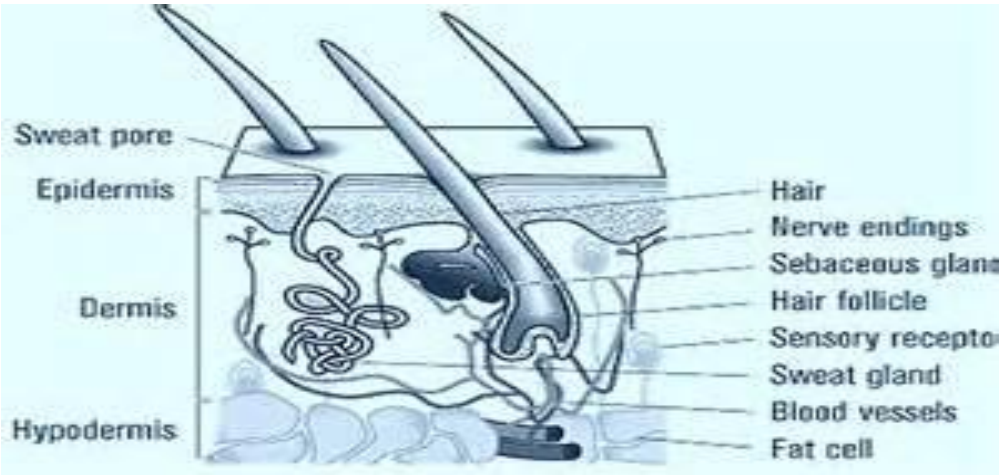
-It is the inner most part of the skin

-It stores fat under it

-It contains sweat glands which secrete sweat

-It has hair follicles, blood vessels, oil glands which produce oil that keeps the skin soft and moist; sensory nerve endings which make us feel pain heat, cold, touch etc

Structure of the mammalian skin



Functions of the parts of the skin

Pore: outlet for sweat from the skin

Hair: it regulates body temperature

Sweat duct: transport sweat from the sweat glands to the pores

Sweat glands: secrete sweat

Sebaceous gland: produces sebum (oil) which keeps the skin smooth and soft
Fat layer: (subcutaneous fat) it insulates the body against heat loss
Blood capillaries: carry blood to and from the skin

Functions of the skin

- It protects the inside parts of the body from external injury and invasion by germs
- It excretes sweat from the body
- It is a sense organ for feeling cold, heat pressure, touch and pain
- It regulates body temperature
- It maintains water balance
- It manufactures vitamin D with the help in presence of the sun
- It stores fats

Temperature regulation by the skin

- Through vaso dilation on hot weather
- Through vaso constriction on cold weather
- Through shivering on cold weather
- Through sweating on hot weather

Diseases of the skin

- Ring worm (fungal)
- Scabies (itch mites)
- athletes foot (fungal)
- leprosy (bacterial)
- chicken pox (viral)
- measles(viral)
- Impetigo (bacteria)

Care for the skin

- wash the body regularly with clean water and soap
- wear clean loose clothing
- treat wounds and cuts while covered
- immunize infants against measles
- treat leprosy patients in isolation
- avoid playing with objects that can cause injuries to the skin
- protect skin from sharp and hot objects
- avoid sharing clothes and beddings with infected people
- have regular body exercises
- eat foods rich in a balanced diet

The liver

The liver is a large reddish brown organ which lies just below the diaphragm and partly covers the stomach.

It receives oxygenated blood through the hepatic artery

It receives blood rich in digested food through the hepatic portal vein.

De – oxygenated blood leaves the liver through tee hepatic vein

Functions of the liver

- it excretes bile pigments formed from the breakdown of dead red blood cells
- it produces bile which emulsifies fats during digestion
- it regulates blood sugar by converting excess glucose to glycogen
- it stores vitamins and mineral salts (vitamins A and D, iron and potassium)
- Detoxication it converts poisonous substances in the body into harmless ones and they are sent to the kidney.
- It produces heat energy
- Deamination: It converts excess amino acids into glycogen and urea
- It stores carbohydrates as glycogen
- Makes cholesterol needed to repair cell membranes
- Produces fibrinogen used by platelets in clotting blood

Diseases of the liver

- Cirrhosis of the liver (hardening due to alcoholism and malnutrition)
- Hepatitis (waterborne – viral)
- Liver abscess caused by boils that form pus in the liver

How to maintain the liver

- Avoid taking a lot of alcoholic drinks
- Drink boiled water
- Eat food rich in a balanced diet
- Have regular physical exercises
- Have regular medical checkups

Self testing exercise

1. What is excretion?
2. How does excretion differ from defecation?
3. Why should waste products be removed from the body?
4. Name any 3 major excretory organs in the human body.
5. Which waste products are excreted by:-
   (a) skin
   (b) kidney-
   (c) lungs
   (d) liver

6. What name is given to the process by which harmful metabolic waste products are removed from the blood?
7. Apart from the excretion, state one other function of the kidney?
8. How are the lungs similar to the kidney in their function?
9. In what way are alveoli in mammals similar to gills of fish?
10. Why does the air breathed out contain more carbondioxide than the air breathed in?
11. Mention 4 ways of maintaining the lungs in proper working conditions?
12. In which group of animals are wastes excreted by diffusion through the cell membranes?
13. Match items in A correctly with those in B

A	B
Lungs	kidney stones
Liver	ring worm
Skin	cirrhosis
Kidney	tuberculosis

14. Complete the following statements correctly
    - Part of the kidney which filters impurities form blood
    - Part of the kidney where water and sugar are reabsorbed
    - Part of the kidney where urine collects
    - Tubes which conduct urine to the urinary bladder
15. What is the main importance of excretory organs?
16. Suggest 3 functions of the skin in the human body
17. Give one way people can care for the skin
18. Below is a diagram of kidney. Use it to answer questions that follow
    (a) Name the parts labeled A, B, C, D and E
    (b) In which way is blood carried by blood vessel A different from blood carried by blood vessel B?
19. Which part of an insect has a similar function as that of the lungs in a human being?
20. Why aren't we advised to eat a lot of salt in food?