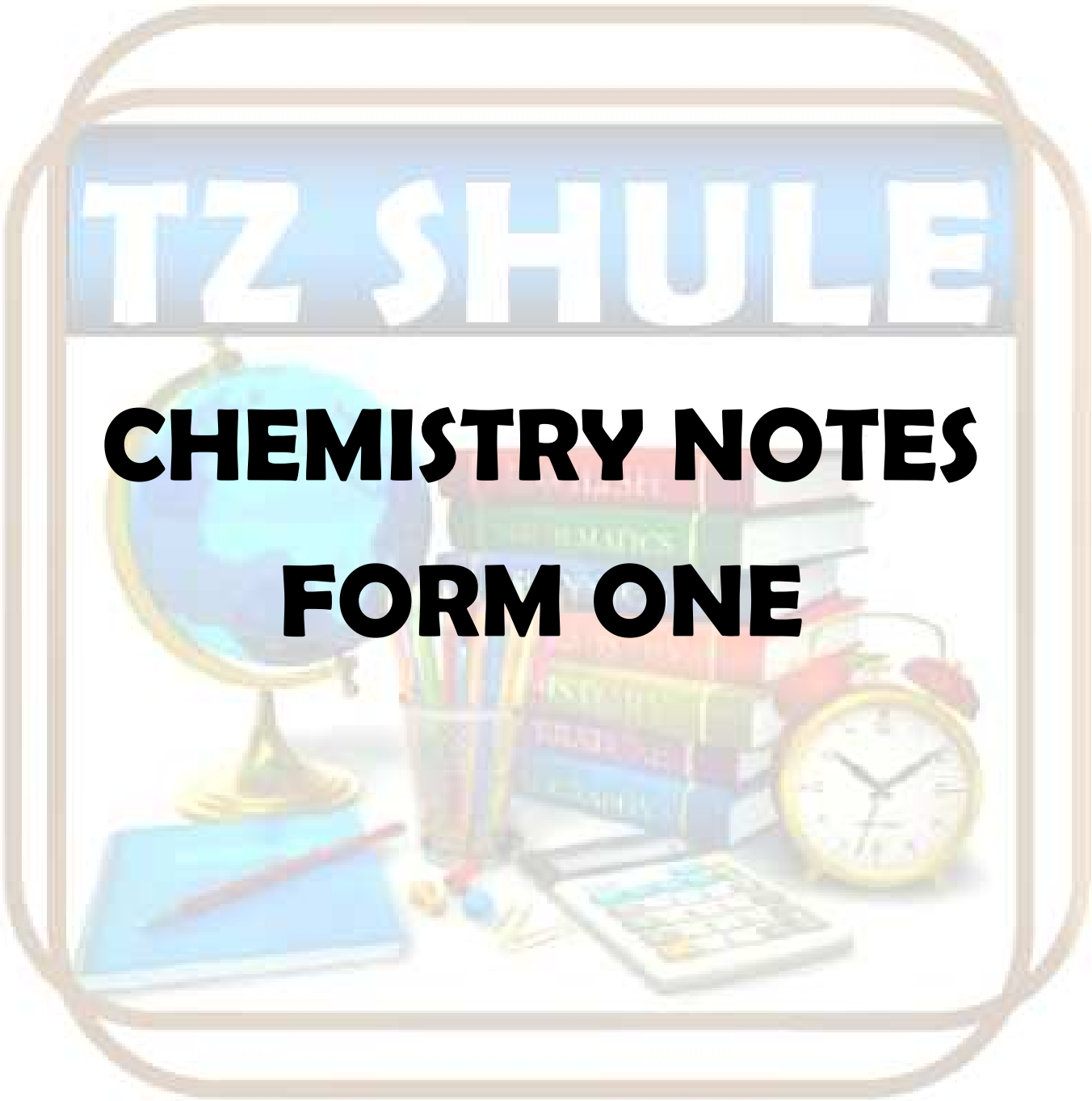


CHEMISTRY NOTES
FORM ONE

FORM ONE NOTES

Introduction to chemistry

By Defn: Chemistry is a science that deals with the composition, structure and properties of matter

Where:

i. ***Matter*** *is anything that has mass and occupies space*. It includes the materials or substances of nature which make up our environment
ii. *The people who study Chemistry are called* ***chemists***. Those who studied Chemistry in ancient times are known as **alchemists**
iii. ***Science*** *is the scientific study of nature*. For example how cooling effect occurs

Scientific Subjects

In order the subject to be a science subject it should involves experiments and practical work. Chemists have to acquire certain skills in order to be successful. These skills include:

i. Careful and thorough observation
ii. Accurate recording of what has been observed
iii. Organizing the observed and recorded information
iv. Repeating tests to make sure observations are accurate
v. Forming conclusions from observations
vi. Predicting possible outcomes of similar experiments

Application of Chemistry

Chemistry is an important subject that is applied in different fields such as agriculture, medicine, manufacturing, education, food and beverage industry, home care and cosmetics industry, among others. This means that Chemistry is applied in

i. Factories
ii. Homes
iii. Hospitals
iv. Laboratories
v. Research centres
vi. Universities

Products made by application of Chemistry

Field	product
Agriculture	Fertilizers, pesticides, weed killers, animal vaccines
Medicines	Drugs, vaccines, food supplements
Home care and cosmetics industry	Detergents, beauty products, soaps, shoe polish, toothpaste, disinfectants, insecticides
Food and beverage industry	Soft drinks, common salt, yeast, baking powder, canned food
Manufacturing industry	Paints, chemicals, varnishes, cement ,plastics
Textile industry	Closes, dyes
transport	Fuels, lubricants, oil, grease, coolants, tyres

Importance of Chemistry

Chemistry is an important subject due to its application in our daily life. The follows is important of chemistry in various aspect

i. Agriculture
ii. Food and beverage industry
iii. Medicine
iv. The manufacturing industry
v. Transport
vi. Communication
vii. Home care products
viii. Beauty products

Agriculture

In a process of growing crops and animal keeping, farmers uses many products made by chemists to get better agricultural yields includes

i. **Fertilizers** – used to improve the quality and quantity of crops and yields respectively
ii. **Weed killers** – are chemical substances used to destroy unwanted plants which harm the crops
iii. **Pesticides** – are chemical substances sprayed or sprinkled on crops to destroy pests that leads low or no yields. Also introduces in animal dips to treat animals from ticks etc
iv. **Animal vaccines** – chemical substance used to protect animal from disease
v. **Processed animal feeds** – animal food which mixed with different nutrients component to improve animal health

Food and beverage industry

i. Preservation of food especially those canned or bottled example bear, canned maize etc
ii. Preparation of certain foods such as bread, cakes and sweet

Medicine
In medicine field Vaccines (prevent illnesses) and medicines (treat diseases) are Produced chemically

The manufacturing industry
In industry many material made chemically used to make product. Examples of product are **cement**, plastic container, textiles, chemicals, rubber and paper

Transport
i. Fuels used on transport are produced chemically
ii. The parts used on transport like car engine and tyres are made chemically

Communication
i. Letters, newspaper and magazine are manufactured chemically
ii. Telephones and computer rely heavily on wires which made chemically

Home care products
Product used to make home and its environment which used to clean (soap and detergents), kill insect (disinfectants) and decoration (air fresh and paints) are made chemically

Beauty products
Product used to improve human physical appearance like nail varnish, creams, lotions, perfumes and deodorant are made chemically

Chemistry for careers (professional development)
The skills acquired in chemistry are very valuable in different careers like
i. Doctor
ii. Pharmacist
iii. Chemical engineers
iv. Laboratory technician
v. Nurse
vi. Researcher

Laboratory Techniques and Safety

By defn: *laboratory is a special room or building that designed and used for scientific experiments*. Laboratories have special tools and equipments called **Apparatus**

Feature of Laboratory

The laboratory should have the following

i. Water supply system
ii. Drainage system
iii. Electricity supply
iv. Well illuminated
v. Well ventilated
vi. Door open out ward
vii. Gas supply

Laboratory Rules

By defn: *laboratory rule is the set of regulation governing practical activities in the laboratory*

Parts of laboratory activities

Laboratories rules divided into three parts include

i. Before laboratory activities
ii. During laboratory activities
iii. After laboratory activities

Laboratory Rules Before laboratory activities

i. Do not enter the laboratory without the permission or presence of the teacher or laboratory assistant
ii. Dress appropriately for the laboratory activities. Do not wear loose or floppy clothing. Tie back long hair. Roll up long sleeves. Do not wear shorts, or walk barefoot or in sandals
iii. Keep the windows open for proper ventilation.
iv. Master the location of all exits

Laboratory Rules During laboratory activities

i. Read instructions carefully before you start any activity
ii. If you do not understand something, ask your teacher before proceeding
iii. Read the labels on **reagent bottles** carefully to make sure you have the right substance. Do not interchange labels
iv. Do not eat, drink, smoke, play or run in the laboratory
v. Do not taste or smell chemicals unless advised on how it should be done
vi. Use the **fume chamber** when carrying out experiments where harmful gases and vapours are produced
vii. Only perform the intended experiments. Do not set up your own experiments or interfere with someone's experiment.
viii. Do not spill liquids on the floor
ix. Report any breakages or accidents to the teacher or laboratory assistant immediately
x. When heating substances, direct the mouth of the test tube away from you or others. Do not point burners or hot substances towards yourself or other people
xi. Use lighter or wooden splints to light burners. Do not use papers. Always strike the match before turning on the gas tap
xii. In case of a gas leak, turn off all the gas taps and open the windows. Leave the room immediately
xiii. Do not touch any electrical equipment with wet hands
xiv. Do not use dirty, cracked or broken apparatus
xv. Turn off any gas or water taps that are not in use
xvi. No chemical or equipment should be removed from the laboratory
xvii. Replace covers and stoppers on the container after you are through with the chemicals
xviii. Keep inflammable substances away from naked flames
xix. Wash off any chemical spillage on your skin or clothes with plenty of clean water
xx. Do not taste things during experiments

Laboratory Rules After laboratory activities

i. Appropriately dispose of any wastes Use the litter bins, not the sink, to dispose of solid waste. Do not return unused substances to their original containers
ii. Clean up the equipment and store it safely
iii. Turn off gas and water taps.
iv. Clean the working surfaces, benches and sinks
v. Wash your hands with soap and running water.

Laboratory Safety measure

By Defn: *laboratory safety is the condition in which measures of risk avoided during laboratory activities*

List of Laboratory Safety Measures

The laboratory safety measures includes

i. Laboratory should well ventilated and his door should open outward
ii. Fire extinguishers should be fitted in an accessible position with using instruction
iii. Laboratory floors should not polished to avoid slippery
iv. Cabinets and drawer must present for storing apparatus
v. All apparatus should checked regularly to ensure they are safe to use
vi. Emergence exit should present and easy to access and use
vii. The laboratory should be equipped with working fire extinguishers and other working fire equipment with clear instructions on how to use them in case of a fire
viii. **Cupboards**, **storage cabinets** and **drawers** should have locks
Reason: This is to ensure one does not accidentally get into contact with harmful substances or interfere with equipment
ix. All chemicals should be **well-labelled**
Reason: prevent accidental use of the wrong substance
x. Emergency exits should be present and easy
xi. There should be a **manual or instruction guide** on how to treat spills of different chemical substances.
xii. Any chemical spills should be cleaned immediately
xiii. The **fume chamber** should be labelled. It should be kept in good working condition to minimize unexpected gas leaks or emissions
xiv. Gas cylinders should be labelled, stored well and supported. They should be in good working condition at all times.
xv. laboratory should contain **First Aid kits**
xvi. Refrigerators and freezers used should be labelled '***For chemical use only***'
Reason: avoid contamination of other substances. They should be clean and free of any spills
xvii. Equipment for monitoring contamination should be installed to give alerts of any possible dangers.
xviii. Chemicals that easily react with each other should never be stored together
xix. Containers for chemicals should be checked regularly to ensure they do not leak. They should have stoppers or covers which should be secured when the chemicals are not in use
xx. Stored chemicals should be inspected regularly to ensure they have not expired.
xxi. All apparatus should be checked regularly to ensure they are safe for use
xxii. All persons using the laboratory should ensure they wear appropriate protective clothing to minimize exposure to hazards to access and use.

First Aid

By Defn: *First aid is the help given to a sick/injured person before getting professional medical help*

Importance of First Aid

i. It helps to preserve life
ii. It prevents the victim's condition from becoming worse
iii. It promotes recovery by bringing hope and encouragement to the victim
iv. It helps to reduce pain and suffering
v. It prevents infection

First Aid Kit

By Defn: *first aid kit is the small box contains items that are used to give help to a sick person*. Usual labelled as "**FIRST AID**" and stored in a safe and easily accessible place

Items Found In First Aid Kit

Items	Uses
First Aid Manual	Contains guidelines on how to use the items in the first aid kit
antiseptic	Cleaning wound to kill germs
Soap	washing hands, wounds and equipment
cotton wool	Cleaning and drying wounds

Disposable sterile gloves	Preventing direct contact with victim's body fluids
Liniment	Reducing muscular pain
Painkillers	Relieving pain
Adhesive bandage (plaster)	Covering minor wounds
Bandage	Keeping dressings in place and immobilizing injured limbs
Thermometer	Measure body temperature
Sterile gauze	Covering wounds to protect them from dirty and germs
Safety pins, clips and tape.	Securing bandages or dressing.
Scissors and razor blades	Cutting dressing materials.
Petroleum jelly	Smoothening and soothing skin
Torch	Source of light
Whistle	Blow to call for help
Gentian violet	For fungal infection of the skin and mouth. Also used for the treatment of serious heat burns

Causes of Laboratory Accident

i. Slippery floor
ii. Incorrect use and handling of apparatus
iii. Gas leakages from faulty gas taps
iv. Fires
v. Failure to follow the right experimental procedures and laid down safety rules

First Aid Procedure

When accident occur we have to help the victim by following the follows procedures, consider the follows accidents

i. Burns
ii. Suffocation
iii. Choking
iv. Bruises
v. Shock
vi. Electrical shock
vii. Fainting
viii. Bleeding
ix. Poisoning
x. vomiting

Burns

By defn: *Burns is an injuries resulting contact with heat or harmful chemicals*. Burns cause by liquids or vapour is called **scalds**

Effect of burns

Burns cause blisters on skin and if severe the skin becomes charred and peels off

Procedure to follow in giving first aid

i. Lay the victim down and protect the burnt area from coming contact with ground, if possible
ii. Gently pour cold water on the burn for about 10 minutes to cool it and reduce pain
Note: if the burn is severe, immediately call for medical help
iii. Check the breath and pulse and prepare to resuscitate the victim, if necessary
iv. Gently remove any Jewellery, shoes or burnt clothing from the injured area
Note: loosen any tight clothing. Do not remove any sticking clothing to the skin
v. Cover the burn with sterile gauze and wrap it loosely to avoid pressure on the skin
Note: do not use fluffy cotton. Bandage the wound reduce pain and infection
vi. Give the victim a pain reliever and treat them for shock
vii. Seek medical help immediately

Caution!

i. Do not ice as it further damages the skin
ii. Do not apply ointment or butter to the burn since this prevents proper healing
iii. Do not break any blisters as this can cause infection
iv. Burns to the face and in the mouth or throat are serious as they cause rapid inflammation of air passage and may cause suffocation. In such case seek medical help immediately

Suffocation

When dealing with a victim of electric shock, remember to take the following action

Choking

By defn: *Chocking is the blockage of the upper part of the airway by blood or other object*

Sign of chocking
Defaulting in speaking and breathing

Procedure to follow in giving first aid
i. Encourage the victim to cough up the object
ii. If the subject remain stuck, give firm but gentle taps between the shoulder blade
iii. If the object is still stuck, perform the **Heimlich manoeuvre (procedure)**. This the procedure involve the following
   a. Stand behind the victim
   b. Grasp fist placed near the top of the victim's stomach
   c. Make quick upwards thrusts to dislodge the object
   d. Repeat the thrusts until the object comes out

Bruises
By defn: *Bruise an injury appearing as an area of discoloured skin on the body*. It caused by a blow or impact break/bust underlying blood vessels

Procedure to follow in giving first aid
i. Apply a cold compress on injure for (20 – 30) minutes to reduce swelling and speed up recovery
ii. If bruise is on leg/foot and covers large area, keep the leg elevated if possible for first 24 hours
iii. After 48 hours , apply a warm wash cloth for 10 minutes, three times a day to increase blood flow to the affected area and thus speed up healing

Shock
By defn: *shock is a condition in which the body system is unable to take enough blood to the vital organs*. Vital organs include heart, lungs and brain

Symptoms of shock
i. A victim has the follows symptoms
ii. Fast pulse rate
iii. Pale skin, lips and fingernails
iv. Skin becomes cool and moist
v. Limbs may tremble and become weak

Effect of shock
i. If it develops the victim may experience
ii. Nausea and even vomiting
iii. Become restless, anxious, aggressive and finally unconscious

Procedure to follow in giving first aid
i. Control sources of shock
ii. Lay the victim down in a shock position. If victim vomiting turn him/her to the side
iii. Loose tight clothing, laces and belts
iv. Maintain the victim body temperature using a warm covering
v. Prepare to resuscitate the victim if necessary
vi. Seek medical help immediately

Electric Shock
Electrical shock occur when a person comes into contact with electricity

Procedure to follow in giving first aid
i. Put off the main switch
ii. Break contact between victim and electrical sources by using dry wooded stick or insulator material
iii. Check whether the victim is breathing. If breathing stopped begin resuscitation
iv. If the victim breathing but unconscious put him or her in the recovery position
v. Administer First Aid for burns, shock or other injuries sustained by the victim
vi. Seek medical help

Caution!
i. Do not touch the victim who still in contact with electric current
ii. Do not go near the area if you suspect that the area has high voltage electricity. Instead call for professional help immediately

Fainting
By defn: *Fainting is a sudden loss of consciousness cause by lack of sufficient blood and oxygen to the brain*. Victim feels **weak**, **sweats** finally **falls down**

Procedure to follow in giving first aid
i. Take the person to a cool place or under a shade of plenty air

ii. Loosen or remove any tight clothing from the victim
iii. Let him/her lie on his back with his legs raised higher than the head
iv. Dip a clean handkerchief in water and press on his forehead.
v. Give him/her clean water to drink when he regain consciousness
vi. If not, take the victim to the nearest hospital

Bleeding

By defn: *Bleeding is the loss of blood and usually occurs from a visible wound or internal organ*

Procedure to follow in giving first aid

Procedure of bleeding may be

i. Light bleeding (small cut or wound)
ii. Severe bleeding (large cut or wounds)
iii. Noise bleeding

Light bleeding

i. Place the victim in a comfortable resting position
ii. Elevate the injured part
iii. Wash your hands using soap and cleaning water.
iv. Put on your gloves
v. Wash your wounds using salt water or antiseptic and clean cloth
vi. Cover the wounds or cut using sterile gauze. Gently clean the surrounding skin and dry it using sterile dressing
vii. Dress the wound and bandage it
viii. If bleeding continue, take the person to hospital

Severe bleeding

i. Let the victim lay under a shade or allow her to sit comfortably
ii. Wash your hands using soap and clean water
iii. Put on your gloves
iv. Prevent further blood loss by applying pressure over the wound using a folded but clean handkerchief or cloth
v. Use another cloth to secure the first one in place
vi. Take the injured person to hospital

Noise bleeding

i. Lessen clothing around the neck and chest
ii. Let the victim sit with the head tipped slightly forward
iii. Have the victim pinch their nose and ask them to breathe through the mouth for a few minutes
iv. Place a wet piece of cloth at the back of the victim neck
v. When bleed stop, gently clean the nostril
vi. If bleed continue, take the victim to hospital

Poisoning

By defn: *Poison is any substance that can harm the body if swallowed, inhaled or absorbed into the body*. Poison includes laboratory chemical, drug, medicine etc.

Sign of poison

i. Nausea
ii. Vomiting
iii. Abnormal cramps
iv. Pain
v. Difficulty in breath
vi. Diarrhoea
vii. Abnormal skin colour

Procedure to follow in giving first aid

i. Call for medical assistance immediately
ii. Find out what cause the poison
iii. If poison is in eye
   a. Wash eye with a lot of clean water
   b. Ask victim to blink as much as possible
   c. Do not rub the eye
iv. If poison is in skin
   a. Remove any clothing from affected part
   b. Wash affected area thoroughly with a lot of clean water
   c. Do not apply any ointment
v. If poison swallowed
   a. Induce vomiting if the poison is non-corrosive (medicine and soap) by putting your finger in victim's throat
   b. Do not Induce vomiting if the poison is corrosive (kerosene, bleach, detergent, laboratory acid, disinfectant etc)
vi. If poison has been inhaled
   a. Move the person to plenty of fresh air
   b. Make sure you protect from inhaled the poison

Vomiting

By Defn: *Vomiting is the removal of the contents of the stomach through the mouth*

Result of vomiting

i. Food poisoning
ii. Drinking contaminated water
iii. Inhaled poisonous fumes or over eating

Procedure to follow in giving first aid

i. Give the victim lots of clear fluid(oral rehydration drink)
ii. Get medical assistance if
   a. Persistent vomiting
   b. Victim vomiting blood
   c. Victim has high fever
   d. Victim is very dehydrated (observed mouth and skin become very dry)

Laboratory Apparatus

By Defn: *laboratory apparatus is the special equipment that used in the laboratory*

Used of Laboratory Apparatus

They are used for various purposes such as

i. Heating
ii. Testing
iii. Measure
iv. Filtering
v. Grinding
vi. Holding
vii. Storage
viii. Scooping
ix. Safety

Heating

The following apparatus are used when heating substance. Consider the table below

Items	Uses
Spirit lamp	used for heating substance
Bunsen Burners	used for heating substance
Boiling tube	Used to heat substance
Tripod stand	providing a platform for heating for stability
Wire gauze	For providing equal distribution of heat while burning
Crucible	Container used to heat substance to very high temperature
Evaporating dish	Heat and evaporate liquid and solution
Deflagrating spoon	Used to heat small amount of substance inside gas jar

Testing

The following apparatus are used when testing substance. Consider the table below

Items	Uses
Beaker	container used for holding, heating and mixing liquids
Test tube	Used for holding chemical for heating for short time Used to test some simple chemical reaction
Dropper	Used to add liquids drop by drop
Flasks	For holding liquids during experiment
Watch glass	Used as • Evaporate surface • Hold substance • Cover for beaker
Gas jar	• Used to collect gas • Used with deflagrating spoon to burn
Thistle funnel	Used to add reagents into flasks

Measure

The following apparatus are used when Measure substance. Consider the table below

Items	Uses
Measuring cylinder	For measuring **volume** of liquids
Thermometer	For measuring **temperature** of substances
Triple beam balance	Measuring **mass**
Measuring syringe	• Suck in • Measure specific **volume** of liquids/gas
Pipette	Transferring and measure specific but small **volume** of liquids
Burette	measuring **volume** of

	liquid
Electronic balance	measuring **mass** in more precise values
Stop watch	Measure accurately **time**

Filtering

The following apparatus are used when filtering. Consider the table below

Items	Uses
Filter funnel	Used to separate solid from liquids
Filter paper	Placed in filter funnel to separate solid from liquids

Grinding

The following apparatus are used when grinding substance. Consider the table below

Items	Uses
Mortar and pestle	Used for crush/grinding things

Holding

The following apparatus are used when holding substance. Consider the table below

Items	Uses
Test tube rack	Placing test tubes
Test tube holder	Holding a test tube while heating
Retort stand and clamp	Hold apparatus e.g. Burettes
Tongs	Hold hot substance and apparatus

Storage

The following container are used when storage substance. Consider the table below

Items	Uses
Reagent bottles	Store different chemicals
Plastic wash bottle	Store distilled water

Scooping

The following apparatus are used scooping substance. Consider the table below

Items	Uses
Spatula	Scooping small quantity of powder

Safety

The following apparatus are used for Safet during experiment. Consider the table below

Items	Uses
Safety goggles	Protect eyes from chemical spill, strong light and harmful vapour

Nb:

After experiment apparatus should be cleaned and return/stored to their position

Warning Signs

Warning sign is the symbol established to ensure safety in the laboratory and in othe field like goods or commodities. This sign should obeyed to avoid accidents, include the follows

i. Toxic
ii. Irritant/harmful
iii. Flammable
iv. Oxidizing agent
v. Corrosive
vi. Radio active
vii. Danger of electric shock
viii. Fragile
ix. Explosive
x. Careful
xi. Keep away from water

Toxic

Toxic symbol means that a substance i dangerous and can cause death within a short time. Toxic substances containing poisonous ingredients, Example of toxic substance is **jik**, **mercury** etc.

Diagram:

Toxic Substance Enter the Body Through

i. Ingestion (by eating and drink)
ii. Inhalation (by breathing)
iii. By injection (by syringe, bite or insect)
iv. Contact (by touching)

Irritant/Harmful

Harmful symbol means that a substance is dangerous and can affect our health for long time. Example of harmful substance is alcohol, paint, insecticide, tobacco, ammonia etc, mercury etc

Diagram of harmful

Diagram of Irritant

This substance can annoy parts of the body

Flammable

Flammable symbol means that the substance can catch fire easily. For example gasoil, kerosene, petrol, butane, methane, spirit, nail polish remover, turpentine etc

Diagram:

Oxidizing Agent

Oxidizing agent symbol means that the substance can speed up the rate of burning. For example oxygen gas, chlorine gas, fluorine gas and hydrogen peroxide

Diagram:

Corrosive

Corrosive symbol means that the substance cause gradual change if contact with various materials. For example concentrated sulphuric acid, concentrated hydrochloric acid, concentrated nitric acid, concentrated sodium hydroxide, concentrated ammonia etc

Diagram:

Radio Active

Radioactive symbol means that the substance emits harmful radiations that penetrate human body and cause damage. For example uranium, plutonium etc

Diagram;

Danger of Electric Shock

Danger of electric shock symbol means that the substance has high voltage which should not touch.

Diagram:

Fragile

Fragile symbol means that the substance should handle with care to prevents them from breaking. For example glass etc.

Diagram:

Explosive

Explosive symbol means that the substance can erupt/explode easily. Always sore in a special container

Diagram:

Nb:

Never store explosive material in glass container because when explode pieces of glass would fly all over and injure people

Careful

Careful symbol that is the caution advice you to be carefully

Diagram:

Keep Away From Water

Keep away from water symbol that is the caution advice you to keep item away from the water. For example computer, mobile phones, radio etc

Diagram:

Heat sources and flame
In this topic we will study source of Heat and flame

Heat
By Defn: *Heat is the condition of being hot*

Source of heat
Heat can be obtained in two ways
i. Natural source of heat
ii. Artificial source of heat

Natural source of heat
By Defn: *Natural source of heat is the kind of heat in which cannot made by human*. For example heat from the **sun**

Artificial source of heat
By Defn: *Artificial source of heat is the kind of heat in which made by human*. For example heat from the **spirit lamp**, **Kerosene stove**, **Bunsen burner** and **gas stove**

Nb:
i. Heat is the energy
ii. All chemical processes (reaction) whether combination or decomposition involves heat energy

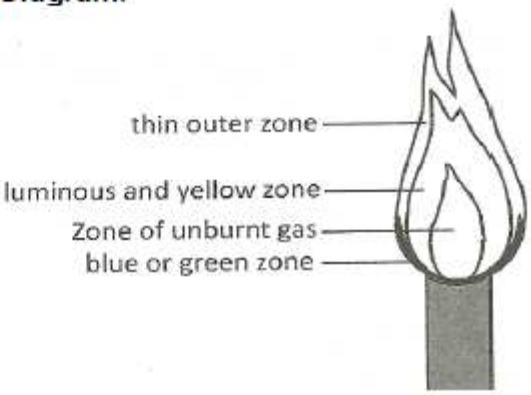
Heat sources in the laboratory
In the laboratories is the different source of heat which can be used in the chemistry laboratory for various purposes. For example
i. spirit lamp
ii. Kerosene stove
iii. Bunsen burner
iv. gas stove

Flame
By Defn: *flame is a zone of burning gases that produces heat and light*. It is the visible glowing part of a fire
Diagram:

Nb:
i. Flame formed due to burning of fuel
ii. The colour and temperature of flame depend on the type of fuel burning and the source of the flame
iii. In order flame to happens the component of **fire triangle** should be completed which is **fuel**, **oxygen** and **heat**

Types of flame
They are two main types of flame includes
i. Luminous flame
ii. Non luminous flame

Luminous flame
By Defn: *Luminous flame is the flame with yellow colour, produces soot and does not give more heat*. It produced when the oxygen supply is usually not enough to complete burn up the fuel
Diagram:



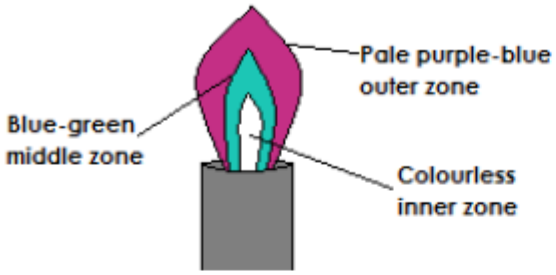
Parts of Luminous Flame
It consists four parts includes
i. Thin outer zone
ii. Luminous and yellow zone
iii. Zone of unburnt gas
iv. Blue or green zone

Why produce soot?
It produces soot because oxygen supplied is not enough to complete burn up the fuel

Why produce less heat?
It produces less heat because oxygen supplied is not enough to complete burn up the fuel

Non luminous flame
By Defn: *Non Luminous flame is the flame with blue colour does not produce soot and give more heat*. It produced when the oxygen supply is usually enough to complete burn up the fuel

Diagram:



Parts of Non Luminous Flame

It consists three parts includes

i. Colourless inner zone
ii. Blue-green middle zone
iii. Pale purple-blue zone

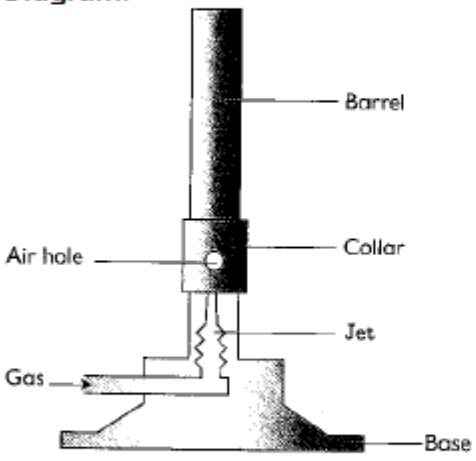
Different between Luminous flame and Non luminous flame

Luminous flame	Non luminous flame
Yellow in colour	Blue in colour
Produces soot	Does not Produces soot
Produce less heat	Produce more heat
Has a wavy flame	Has a triangular flame
Burns quietly	Burns with a roaring noise

Bunsen burner

By Defn: *Bunsen burner is a laboratory heat source consisting of a vertical metal tube connected to a gas source*

Diagram:



Parts of Bunsen burner

i. **Barrel** – round pipe whereby oxygen and gas burn at its top
ii. **Air hole** – it allow air (oxygen) to support burning of gas
iii. **Collar** - it turn around the barrel in order to vary size of air hole
iv. **Jet** – gas pass through it to barrel
v. **Gas** – fuel which burnt to produce flame
vi. **Base** – give stability to Bunsen burner

How Bunsen produce luminous flame

It produce luminous flame when collar turn to reduce size of air hole to results not enough air (oxygen) to complete burn up the fuel

How Bunsen Produce Non Luminous Flame

It produce luminous flame when collar turn to increase size of air hole to allow enough air (oxygen) to complete burn up the fuel

Uses of Luminous flame

i. It used for light

Uses of Non luminous flame

i. It used for heating purpose
ii. It used for Flame test of certain chemical substance
iii. It used for welding
iv. It used for cooking

The scientific procedure

Scientific Investigation

By defn: scientific method is a set of techniques used by scientists to investigate a problem/answer question. Also called *scientific procedure or scientific investigation or scientific methods*

Steps of a Scientific Method

The following is the steps followed when carrying out a scientific investigation

i. Identify the **Problem**
ii. Formulation the **hypothesis**
iii. Experiment and **observe**
iv. Data collection and **analysis**
v. Data **interpretation**
vi. Draw a **conclusion** from data

Identify Problem

In this step the physicist makes a puzzling observation. For example **does temperature affects the solubility of common salt in water?**

Formulation of Hypothesis

A hypothesis is an intelligent guess that tries to explain an observation. Example **does not temperature affects the solubility of common salt in water?**

Experiment and observe

By defn: *An experiment is the test under controlled conditions*. The aim of experiment is to test whether hypothesis is true or false. It based on variable to test hypothesis

By defn: *variable is the condition in which changes to obtain set of values*

Types of Variable

There are three types include

i. Dependent variable
ii. Independ variable
iii. Controlled variable

Dependent Variable

By defn: *Dependent variable is the condition (depend other factor) to measure or observed to obtain the results*. For example **solubility**

Independ Variable

By defn: *Independ variable is the conditions (does not depend other factor) manipulate to obtain the results*. For example **temperature**

Controlled Variable

By defn: *Controlled variable is the condition may changes (kept constant) to obtain the results*. For example **amount of water**

Data Collection and Analysis

It Concern recording what you have observed during experiment. Always kept in the table for example

Temperature	solubility
10	200
20	400
30	600
40	800

Data Interpretation

In this step we look trend or patterns and explain why they occur that way. For example **from the table above when temperature increase also solubility increase**

Draw a Conclusion

In this step, it concerning about summary of the experiment. It includes a statement that either proves or disproves the hypothesis. For example **in our experiment change in temperature affects solubility of common salt**

Application of Scientific Procedure

i. **carrying out experiment**: to study what happens and gain new knowledge
ii. **project work**: to find information on subject/problem
iii. **Field study/work**: to test hypothesis. A field study also called field work

Significance of the Scientific Procedure

i. It helps us to solve scientific problems
ii. It helps us to gain new knowledge
iii. It helps us to conduct project work
iv. It helps us to carry out field study
v. It helps us to solve problems or answer scientific questions

Matter

By defn: matter is anything that has mass and occupies space. Matter can be change state with vary in temperature. Example of matter is **stones**, **vegetation**, **air**, **food**, **water** and **our bodies**

State of Matter

Matter exist in three physical states include

i. Solid state
ii. Liquid state
iii. Gas (vapour) state

Structure of matter

Matter is made up of tiny particles. The particles are either **atom** or **molecules**

Atom

By defn: *atom is the smallest part of an element, which can take part in chemical reaction*. For Example Sodium atom (Na), hydrogen atom (H) etc

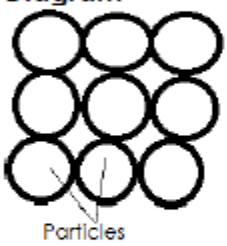
Molecules

By defn: *a molecule is a group of atoms*. For Example water molecule (H_2O), hydrogen molecules (H_2)

Solid State

By Defn: *Solid substance has definite shape and definite volume*. Particle in solid substance are closely packed together. For Examples of solid substances are **Ice**, **firewood**, **metal**, **Wood**, **Stone**, **Books**, **Shoes**, **Plastic** etc

Diagram



NB:

i. The particles vibrate in fixed position
ii. The particle are not free to move because they held by strong inter particle force

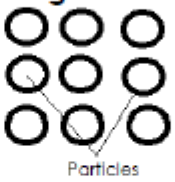
Properties of Solid Matter

i. Particles are closely packed together
ii. Has definite shape and volume
iii. Has strongest inter-particle force
iv. Particles are not free to move
v. Has high density due to small volume
vi. Particle move very slow

Liquid State

By defn: *Liquid substance has fixed volume but variable in shapes*. Particles in liquid are slightly father apart. For example **water**, **kerosene**, **milk** etc

Diagram



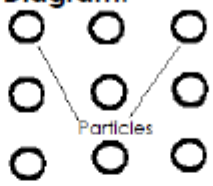
Properties of Liquid Matter

i. Particles are slight father apart
ii. Have definite volume
iii. Have not definite shape
iv. Has medium density due to medium volume
v. Has medium motion
vi. Inter-particle force is weak

Gas State

By defn: *Gas has not definite shape or size. Particles are moving so fast and are so far apart that they do not interact with each other at all*. For example **oxygen gas**, **hydrogen gas**, **nitrogen gas** etc

Diagram:



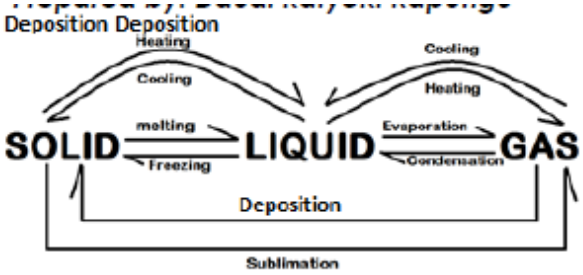
Properties of Gas Matter

i. Has not definite shape
ii. Has not definite volume
iii. Has largest inter particle distance
iv. Has low density due to largest volume
v. Has weakest inter particle force
vi. Particle move at high speed

Change of State in Matter

Matter can change solid, liquid and gas and vice versa. Consider the diagram below.

Diagram:



Melting
By defn: Melting is the change of state from solid to liquid

Melting Point
By defn: Melting point is the definite temperature of a pure substance to melt

Freezing
By defn: *Freezing is the change of state from liquid to solid*

Sublimation
By defn: *Sublimation is the change of state from solid to gas*

Deposition
By defn: Deposition *is the change of state from gas to solid*

Freezing point
By defn: Freezing point is the Temperature at which a liquid changes into a solid without a change in temperature

Boiling
By defn: Boiling state at which all liquid change into gas

Boiling Point
By defn: Boiling point is the temperature at which all liquid change into gas

Boiling Point of Some Pure Substance

Substance	Boiling point (°C)
Helium	-269
Hydrogen	-253
Oxygen	-183
Ethyl alcohol	78.4
Benzene	80.2
Water	100
Mercury	357
Aluminium	2 467
Copper	2 567
Iron	2 750

Evaporation
By defn: Evaporation is the change of state from liquid to gas (vapour)

Different Between Boiling and Evaporation

Boiling	Evaporation
Occurs at a definite temperature which is boiling point	Occurs at any temperature
Occurs within a liquid with formation of bubbles	Occurs at the surface of the liquid
Has no cooling effect	Has cooling effect
Takes place rapidly	Takes place slowly

Importance of Changes of States of Matter
Changes of states of matter it has a wide important. Consider the follows important
i. Water cycle
ii. Refrigeration/ Air Condition
iii. Refinery
iv. Metallurgy
v. Steam engines
vi. Drying of materials

Water cycle
Water change to vapour appear as clouds and finally rain

Refrigeration/ Air Condition
Water change to vapour absorb energy (heat) from the surround and final cause cooling effect

Refinery
Refinery of petroleum and other liquids refinery due to boiling point, if the mixture of high and low liquid, the liquid with **higher boiling point** start first to evaporate which collected as vapour/gas and the one with **lower boiling** point remain at the mixture. The **simple distillation** and **fractional distillation** is employed in petroleum refineries

Metallurgy
Metallurgy Involves in the following
i. Purification of metals from their ores
ii. Manufacture of alloys

Purification of metals from their ores
Purification of metals from their ores made due to its boiling point of combined

substance contains in the ores, if the ore contain substance of high and low liquid, the required metal of **higher boiling point** start first to evaporate which collected as vapour/gas cool to obtain solid metal and the one (impurity) of **lower boiling** point remain as residue

Manufacture of alloys

By defn: Alloy a metal made by combining two or more metallic elements to give greater strength or resistance to corrosion

How alloys made?

The vapour/gas of two or more metals cooled to make an alloy

Steam engines

The liquid (fuel) of low pressure evaporate to make vapour/gas/steam of high pressure used to push **piston.** The downward movement of the piston pushes a rod that turns a **crankshaft**

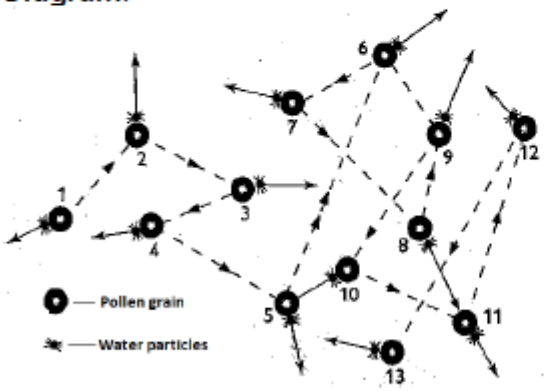
Drying of materials

Material dry when contaminated liquid evaporates, Example when wet clothes exposed in a sun dry because water contaminated change to vapour/gas

The Particulate Nature of Matter

Scientist called **Robert brown** used a microscope and observed that pollen grains suspended in water moved short distance in an irregular zigzag manner. After that observation Robert brown concluded by the law called **Brownian motion**

Diagram:



Brownian motion

Brownian motion state that

"Matter is made up of tiny particle that are in a state of continuous random motion"

Kinetic Theory of Matter

It describes the physical properties of matter in terms of the behaviour of its component atom or molecules. It state that

"All matter is made up of very small particles that are in constant motion"

Nb:

Motion of solid particles is in vibration

Motion of liquid and gas particles are in random

Properties of Gases, Liquids and Solids

properties	Gas	Liquid	Solid
Shaped	no definite shape	Takes shape of container	Fixed shape
Movement of particle	Move past one another	Move/slide past one another	Rigid (locked into place)
Compressibility	Compressible	Not easily Compressible	Not easily Compressible
Space	Large space	Moderate space	No space
Flow	Flow easily	Flow easily	Do not flow
Volume	Takes volume of container	Has a Fixed volume	Has a Fixed volume

Physical changes

By Defn: *Physical changes are the changes which do not change the identity of matter/substance*. It physical properties must vary which may be size, state etc. For example tearing, crushing, melting, dissolving, freezing, evaporation, condensation and sublimation

Changes undergoes Physical changes

i. Aluminium foil cuts into half
ii. Clay is moulded into a new shape
iii. Butter melts on warm toast
iv. Water evaporates from the surface of ocean
v. The juice in a bottle freezes
vi. Drying of wet clothes
vii. Grinding a piece of chalk
viii. Burning of a candle
ix. Dissolving sugar in water
x. Crushing stone into fine powder
xi. Melting of ice
xii. Water vapour condenses on the outside of your eyeglasses

Chemical changes

By Defn: *Chemical changes are the changes which change the identity of matter/substance*. It chemical properties vary which may be smell, colour etc. For example **rusting**, **burning**, **decaying**, **rotting**, **fermentation of fruit** and **souring of milk**

Changes undergoes chemical changes

i. Milk turns sour
ii. Jewellery tarnishes (changes colour)
iii. Toasting bread
iv. Nails or iron sheets rust
v. Wood is burnt
vi. Food scraps are turned into compost in a compost pit
vii. A match is lit
viii. An antacid settles your stomach upset
ix. Your body digests food
x. An egg is fried
xi. Food is cooked

Different between Physical Changes and Chemical Changes

Physical Changes	Chemical Changes
Change physical	Change chemically
No new substance formed	new substance formed
No product given off	product given off
Changes is reversible	Changes is irreversible
Does not affect component of substance	affect component of substance

Elements, compound and mixtures

Element

By Defn: Element is a pure chemical substance which cannot be split into simple substance by a simple chemical process. For example **iron**, **silver**, **gold**, **copper**, **oxygen**, **hydrogen** etc

Names and chemical symbol of elements

All known element have name, usually the names represents by letter (abbreviation or short representation of the name) called **chemical symbol**

Nb:

i. Most Chemical symbol often derived from Latin or Greek name of the element. For example of some elements

Element	Latin name	Symbol
Sodium	Natrium	Na
Gold	Aurum	Au
Potassium	Kalium	K
Copper	Cuprum	Cu
Iron	Ferrum	Fe
Mercury	Hydrargyrum	Hg
Silver	Argentum	Ah
Tin	Stannum	Sn
Lead	Plumbum	Pb

ii. Other Chemical symbol often derived from English name of the element. For example of some elements

Element	English name	Symbol
Carbon	Carbon	C
Iodine	Iodine	I
Fluorine	Fluorine	F
Hydrogen	Hydrogen	H
Calcium	Calcium	Ca
Aluminium	Aluminium	Al
Argon	Argon	Ar

Criteria used to generate chemical symbol

i. Elements can be represented by a symbol delivered from the first letter

Element	Symbol
Carbon	C
Iodine	I
Fluorine	F

ii. Elements can be represented by a symbol delivered from the first and second letter

Element	Symbol
Calcium	Ca
Aluminium	Al
Chlorine	Cl
Cobalt	Co
Magnesium	Mg
Manganese	Mn
Argon	Ar

iii. Elements can be represented by a symbol delivered from their Latin names

Element	Symbol
Sodium	Na
Gold	Au
Potassium	K
Copper	Cu
Iron	Fe

Common elements

There are twenty common elements which we were using most in our o'level chemistry course. Consider the table below

Element name	Element symbol
Hydrogen	H
Helium	He
Lithium	Li
Beryllium	Be
Boron	B
Carbon	C
Nitrogen	N
Oxygen	O
Fluorine	F
Neon	Ne
Sodium	Na
Magnesium	Mg
Aluminium	Al
Silicon	Si
Phosphorus	P
Sulphur	S
Chlorine	Cl
Argon	Ar
Potassium	K
Calcium	Ca

How to remember common 20 elements

You should sing a Swahili simple song In order to remember common elements as

Element	Word to sing	Stand for
Hydrogen	**H**allo	H
Helium	**He**medi	He
Lithium	**Li**le	Li

Beryllium	**Be**beru	Be
Boron	**B**ora	B
Carbon	**C**hinja	C
Nitrogen	**N**a	N
Oxygen	**O**ndoa	O
Fluorine	**F**igo	F
Neon	**Ne**ne	Ne
Sodium	**Na**	Na
Magnesium	**Mg**eni	Mg
Aluminium	**Al**iye	Al
Silicon	**Si**mama	Si
Phosphorus	**P**ale	P
Sulphur	**S**erengeti	S
Chlorine	**Cl**ub	Cl
Argon	**Ar**udishwe	Ar
Potassium	**K**wao	K
Calcium	**Ca**nada	Ca

Significance of chemical symbol

i. Help to understand quickly element instead of memorize full names
ii. Possible to write chemical equation instead to write in full name
iii. show clear quantity of element

Compound

By defn: *compound is a pure substance that is made up of more than one element in a chemical combination*. Example **sugar**, **salt**, **water** etc

Nb:

i. Combination is always in fixed ratio. For example
   a. **carbon dioxide (CO_2)** is made up of **two parts of oxygen** for every **one part of carbon**
   b. **water (H_2O)** is made up of **two parts of hydrogen** for every **one part of oxygen**
ii. they are separated chemically

Properties of compound

i. Compound cannot be seen separated
ii. Constituent elements can be separated by chemical means
iii. Constituent elements Have definite ratio
iv. When formed involve chemical change
v. Its properties differ from its Constituent elements

Mixture

By defn: *Mixture is a physical combination of two or more substances in any ratio*. Example **muddy water**, **mixture of sand and salt**, **mixture of oil and water**, **mixture of maize and sand** etc

Nb:

They separated physically

Types of mixture

They are two types include

i. Homogenous mixture
ii. Heterogeneous mixture

Homogenous mixture

By defn: *Homogenous mixture is the kind of mixture in which has uniform composition, appearance and properties*. Example

i. Mixture of salt and water
ii. Mixture of sugar and water

Heterogeneous mixture

By defn: *Heterogeneous mixture is the kind of mixture in which has difference composition, appearance and properties*. Example

i. Mixture of water and sand
ii. Mixture of ice and water

Properties of mixture

i. mixture can be seen separated
ii. Constituent elements can be separated by physical means
iii. Constituent elements Have no definite ratio
iv. When formed involve physical change
v. Its properties same from its Constituent elements

Different between compound and mixture

Compound	**Mixture**
Compound cannot be seen separated	mixture can be seen separated
Constituent elements can be separated by chemical means	Constituent elements can be separated by physical means
Constituent elements Have definite ratio	Constituent elements Have no definite ratio
When formed involve chemical change	When formed involve physical change
Its properties differ	Its properties same

from its Constituent elements	from its Constituent elements

Solution

By defn: solution is a homogenous mixture of two or more substances (solvent and solute)

Where

i. **By defn:** solvent is a substance dissolves the other substance (solute)
ii. **By defn** solute is a substance dissolved by other substance (solvent)

Example of solute and solvent

i. Mixture of sugar and water to form a solution
   a. Sugar is a solute
   b. Water is a solvent
ii. Mixture of salt and water to form a solution
   a. Salt is a solute
   b. Water is a solvent

Types of solution

Their three types of solution, includes

i. Unsaturated solution
ii. Saturated solution
iii. Supersaturated solution

Unsaturated Solution

By defn: *Unsaturated solution is the solution that can dissolve more solute at a given temperature*

Saturated Solution

By defn: *Saturated solution is the solution that cannot dissolve more solute at a given temperature*

Supersaturated Solution

By defn: *Supersaturated solution is the solution that temporarily holds more solute than the saturated solution at a given temperature*

Application of saturation

It uses when

i. Separating certain mixtures in the laboratory
ii. Extracting some minerals such as **common salt (NaCL)**

Classification of solution into state of matter

Solution can be solid, liquid or gas. Even solute and solvent can exist in three state of matter. Consider the table follows

		Solutes		
		Solid	**Liquid**	**Gas**
solvent	gas	Naphthalene slowly sublimes in air to form a solution	water vapour in air	oxygen and other gases in air
	liquid	sucrose (sugar) in water and salt in water	ethanol (alcohol) in water and various hydrocarbons in each other (petroleum)	carbon dioxide in water(carbonated water
	solid	steel and other metal alloys	mercury in gold and hexane in paraffin wax	hydrogen in metals

Uses of solvents

i. **Varnish removal:** solvent used to removal varnish
ii. **Degrease:** solvent used to remove excess grease or fat from. For example when we wash our hand if contaminated with oil
iii. **Thinning paint:** a volatile solvent used to make paint or other solutions less viscous
iv. **Bleaching agent:** it make white or much lighter by a chemical process or by exposure to sunlight
v. **Stain removal:** solvent used mark or discolour with something that is not easily removed
vi. **Cleaning:** solvent (soap) removal dirt (solute) by form solution

Properties of solution

i. Homogenous mixture
ii. transparent/clear
iii. Particles completely dissolved
iv. Components separate by **Evaporation**

Suspension

By defn: *Suspension is heterogeneous mixture of liquid and fine particles of a solid*

Nb:

i. Suspended particles are slight visible

ii. Particles Settle at bottom if undisturbed
iii. Suspension formed either by liquid droplets or fine particle float in a gas is called **Aerosols**
iv. The blood in our body also is suspension
v. Suspension used at homes as **insecticides**, **body spray** and **medicine(syrup)** always labelled ''***Shake well before use***''

Properties of suspension
i. Heterogeneous mixture
ii. Opaque (not clear)
iii. Particles separate without dissolving
iv. Components separate by filtration

Different between solution and suspension

Solution	Suspension
Homogenous mixture	Heterogeneous mixture
transparent/clear	Opaque (not clear)
Particles completely dissolved	Particles separate without dissolving
Components separate by Evaporation	Components separate by filtration

Emulsion
By defn: *emulsion is a mixture of liquids that do not completely mix*. Example of emulsion
i. **Milk**, which is drops of butterfat in water
ii. **Emulsion paint**, which is drops of coloured oils in water

Nb:
i. Liquids do not mix at is called **immiscible**
ii. Liquids mix is called **miscible**
iii. Usually formed from two liquids (oil and water)
iv. When emulsion shakes form droplets (oil and water)
v. When emulsion harder shakes become **homogenous solution**

Methods of separating mixture
Mixture can be separated according to properties of substance (mixture). The follows methods used to separate are follows
i. Decantation
ii. Evaporation
iii. Distillation
iv. Sublimation
v. Filtration
vi. Chromatography
vii. Solvent extraction
viii. Layer separation
ix. Magnetization

Decantation
By defn: *Decantation is the process of separating a heterogeneous mixture of a liquid and solid by pouring out of the liquid only and leaving the solid at the bottom of the container*

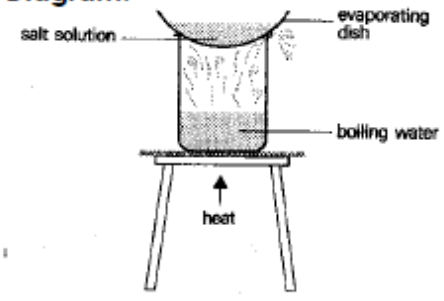
Nb:
i. The process of some components of mixture settling at the bottom is called **Sedimentation**

Decantation can be used to separate
i. Water from muddy water
ii. **Blood test**: Clearer part of blood from mixture of clear blood and its solid components

Separation Application of Decantation
i. Water treatment systems
ii. Separate of components of blood

Magnetization
This process involve the separation of iron (magnetic material) from a mixture where by magnetic material is attracted to magnet and leaves behind other components of mixture

Evaporation
By defn: *Evaporation is the method in which solvent converted from liquid to gas and solute remains as residue*. Example Mixture of water (solvent) and salt (solute), when heated water evaporates and salt remains
Diagram:



Separation Application of Evaporation
i. In extraction of common salt

Distillation

By defn: *Distillation is the method of separating mixture due to components boiling point and finally obtains the wanted substance.* The wanted substance (low boiling point) is cooled until back to liquid. The cooled vapour is called **Distillate**

Types of Distillation

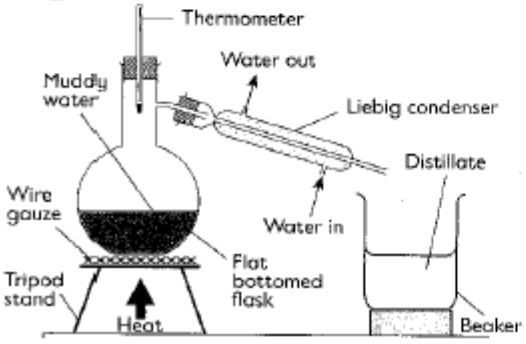
There are two types include

i. Simple Distillation
ii. Fraction Distillation

Simple Distillation

By defn: Simple Distillation *is the method of separating mixture of liquid contains dissolved substance*

Diagram:



Simple Distillation can be used to separate

i. Distilling water from muddy water
ii. Distilling water from salt water

Nb:

If Liebig condenser absent, the distillate can collect in a test tube that dipped in beaker contain very cold water or ice

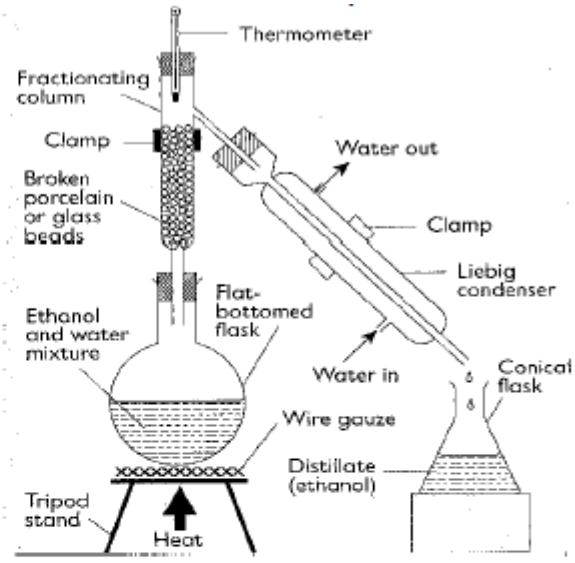
Separation Application of distillation

i. Purification of water
ii. Manufacture of alcohol

Fraction Distillation

By defn: Fraction Distillation *is the method of separating mixture (homogeneous solution) of two or more liquids due to its boiling point by means of fraction columns*

Diagram:



Fraction Distillation can be used to separate

i. Distilling ethanol from mixture of ethanol and water
ii. Distilling petrol from crude oil (petroleum)

Nb:

i. Fraction distillation can collect more than one component at the same time at the **fraction distillation columns**
ii. The liquids with lower boiling point first collected as **distillate**
iii. Each components collected is called **fraction**

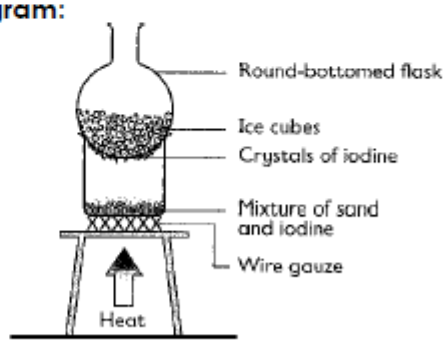
Separation Application of Distillation

i. Purification of water
ii. Manufacture of alcohol

Sublimation

By defn: *Sublimation is the is the method of separate mixture whereby a solid (wanted substance) changes state directly to gas final form Solid that forms after the gas cools*

Diagram:



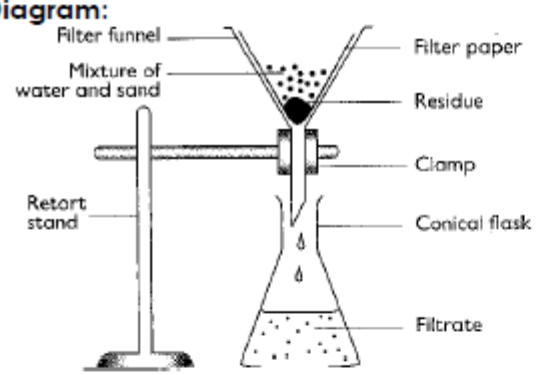
Nb:

i. Solid that forms after the vapour cools is called **sublimate**
ii. This method Used to separate mixture where one component sublimes
iii. **Iodine** and **ammonium chloride** are few compounds can sublimes
iv. The reverse process of change from vapour to solid on cooling is called **Deposition**

Sublimation Can Be Used To Separate
i. Separate iodine from mixture of sand and iodine
ii. Separate ammonium chloride from mixture of salt and ammonium chloride

Separation Application of Sublimation
i. Purification of substance

Filtration
By defn: *Filtration is the method of separate heterogeneous mixture of a solid and liquid by using porous filter*
Diagram:



Nb:
i. Solid remain is called **residue**
ii. Liquid pass through filter is called **filtrate**

Fraction Distillation can be used to separate
i. Water from muddy water

Separation Application of Filtration
i. Purification of water
ii. Extraction of juice from fruit
iii. Extraction of cream from milk

Chromatography
By defn: *Chromatography is the method of separate mixture using moving solvent on material absorbs the solvent*

...

i. Moved solvent is called **mobile phase**
ii. Absorbed solvent is called **stationary phase**
iii. Substance separated is called **Analyte**

Uses of chromatography
Used in many different ways
i. Medicine
ii. Security
iii. Chemistry
iv. Health

Medicine
Used as follows
i. Used to analyses blood and urine sample
ii. Study blood cells in blood
iii. Detect types of drugs in blood

Security
Used as follows
i. Used to analyses blood and urine sample
ii. Detect different fibres

Chemistry
Used as follows
i. Test purity of organic substance
ii. Separates mixture

Health
Used as follows
i. Causes of pollution
ii. Test for blood contamination

Separation Application of Chromatography
i. In medical diagnosis and studies
ii. In security for crime detection
iii. In chemical analysis and tests

Solvent extraction
By defn: *Solvent extraction is the method of separate mixture essential oil from plant materials*. This process referred as **solid-solid extraction**

From the diagram above can be used to separate
i. Oil seeds from seed

Mechanism how separated
Extract oil seed by using water to get mixture of oil and water then mixture separated by distillation to get oil

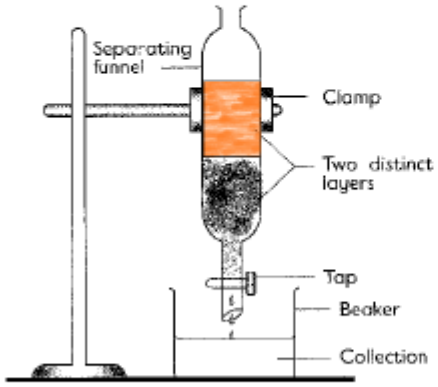
Separation Application of Solvent extraction

i. Extraction of certain edible oils from seeds
ii. Extraction of some metals from sludge mixture

Layer separation

By defn: *Layer separation is the method of separating immiscible mixture by using separating funnel if its components allowed settling form distinct layers.*

Diagram:



Nb:

i. Denser component(higher density) settles at bottom
ii. Less Denser component(low density) stay at top

Separation Application of Layer separation

i. Recovery of liquids from contaminations

Air, combustion, firefighting and rusting

Air

By defn: *Air is colourless, homogenous mixture of gases in the atmosphere*

Composition of air

Mixture of gases include the following

i. Nitrogen
ii. Oxygen
iii. Carbon dioxide
iv. Noble gases (helium, krypton, argon, neon and xenon)
v. Water vapour

Nb:

The components of air in atmosphere have definite proportions by volume which can be approximate to percentage. Consider the table below

Gas	Percentage
Nitrogen	78%
Oxygen	21%
Carbon dioxide	0.03%
Noble gas	0.94%
Water vapour	0% – 4%

Test for gases in air

Consider the table below which show how gases tested

Gas	Tester reagent (colour)	Product (colour)
Oxygen	Copper (**brown**)	Copper oxide (**black**)
Carbon dioxide	Lime water (**colourless**)	Calcium carbonate (**milky**)
Water vapour	Anhydrous copper (II) sulphate (**White**)	Anhydrous copper (II) sulphate (**blue**)

Combustion

By defn: *combustion is the chemical reaction involves the burning of a substance in the presence of oxygen to releases energy (heat and light)*

Nb:

i. Material which catch fire and burn easily is called **combustible**
ii. enclosed space (closed system) in which combustion takes place, especially in an engine or furnace is called **combustion chamber**
iii. different material are combustible but some burn up faster than others

Application of combustion

It's applied in many areas, includes

Industries

i. Engine or furnace
ii. In large boilers
iii. Incinerators for burning wasters
iv. welding and smelting (extract metal)

Domestic

v. Cooking
vi. Heating homes
vii. Burning wastes

Laboratory

viii. Sterilization
ix. During experiments

Fire Fighting

By defn: *Fire Fighting is the process extinguishing harmful fires*

Fire

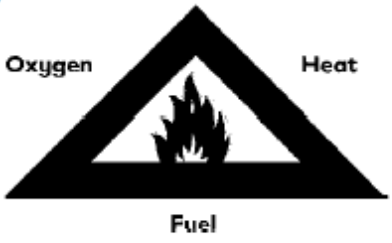
By defn: *fire is the state/process of combustion result* ***light***, ***heat***, ***smokes*** *and* **flame**

Diagram:

Fire Triangle

By defn: *fire triangle is the components needed to start a fire*

Diagram:



Component of fir triangle

This include
i. Fuel
ii. Oxygen
iii. Heat

Caused Of Laboratory Fire
i. Electrical faults
ii. Smoking materials
iii. Carelessness
iv. Ignorance
v. negligence

Basic Principles of Fire Prevention
i. No light of open fires near buildings
ii. No smoking in prohibited areas
iii. No interference with electrical installations
iv. all electrical appliances must off after use
v. all sources of heat should not kept near the bench edge where they can easily be knocked down
vi. all flammable substances should be locked up in drawers or cabinets

Fire Extinguisher
Fire extinguisher is the one in which used to fight/stop fire to continue

Types of Fire Extinguisher
The follows is types of extinguisher include
i. water/APW extinguisher
ii. Sand extinguisher
iii. Fire Blanket extinguisher
iv. (DC) Dry chemical extinguisher
v. Carbon dioxide extinguisher
vi. Halons extinguisher
vii. Foam extinguisher
viii. Wet chemical extinguisher
ix. ABC extinguisher

Water/APW Extinguisher
Component: Air pressurize water
Suitable for: class A
Unsuitable for: class B, C and D
Reason for Unsuitable: the flame will spread

Sand extinguisher
It used to extinguishes small fire
Component: sand collected on basket
Suitable for: class B and A

Blanket extinguisher
It used to extinguishes small fire
Component: sand collected on basket
Suitable for: class B and A

(DC) Dry chemical extinguisher
Component: Fine sodium bicarbonate powder pressurize by nitrogen
Suitable for: class A, B, C and E
Unsuitable for: class D, Aircraft and electronics
Reason for Unsuitable: it is corrosive

Carbon dioxide extinguisher
Component: carbon dioxide gas under extreme pressure
Suitable for: class B, C and E
Unsuitable for: class A (material can reignite)

Halons extinguisher
Component: Bromochloro-Difluoro-Methane
Suitable for: class A and E
Unsuitable for: class B and C (least suitable)

Foam extinguisher
Component: protein and fluoro-protein
Suitable for: class A and B
Unsuitable for: class E

Wet chemical extinguisher
Component: potassium acetate
Suitable for: class F
Unsuitable for: class E

ABC extinguisher
Component: mono-ammonium phosphate with a nitrogen carrier
Suitable for: class A, B and C
Unsuitable for: electronic equipment

Mechanism of Fighting For Fire
Fire extinguisher stop fire by prevent one among of the fire components/fire triangle

Class of Fire
Fire classified according to materials burnt; therefore we have six class of five namely
i. Class A
ii. Class B
iii. Class C
iv. Class D
v. Class E
vi. Class F

Class A

The burning materials is organic/ordinary solid combustible materials such as **paper**, **wood**, **plastic**, **wool**, **clothing** etc

Suitable Fire Extinguisher
Use any type of Fire extinguisher except carbon dioxide. But water is suitable

Question: Why carbon dioxide not suitable?
Answer: when molecules of carbon dioxide reach fire gain heat and result lowered its density then escape away for fire and the fire continue

Class B
The burning materials is flammable liquids such as **petrol**, **paraffin**, **alcohol**, **kerosene** etc

Suitable Fire Extinguisher
i. Use fire blanket or sand extinguisher if fire is a small
ii. Use dry powder, foam or carbon dioxide extinguisher if fire is large

NB: water extinguisher is not suitable

Question: Why water not suitable?
Answer: water is denser than flammable liquid so flammable liquids will float over water results the fire continues

Class C
The burning materials is flammable gas such as methane, butane, propane etc

Suitable Fire Extinguisher
Use **dry powder** and **carbon dioxide** extinguisher

Class D
The burning combustible metals such as magnesium, sodium, lithium etc

Suitable Fire Extinguisher
Use dry powder, foam or foam extinguisher

Class E
The burning electrical equipment such as damaged electrical cables, switchboards etc

Suitable Fire Extinguisher
Use carbon dioxide extinguisher

NB: first switch off power from the mains switch

Class F
The burning cooking appliances with oils and fats at high temperature

Suitable Fire Extinguisher
Use wet chemical extinguishers

Steps to use portable fire extinguisher
There are four procedure in easy to remember just remember acronym '**PASS**' which stand for **Pull**, **Aim**, **Squeeze** and **Sweep** as follows

i procedure: **Pull:** Pull the pin to make the extinguisher ready for use

ii procedure: **Squeeze:** Squeeze the top lever to release extinguishing agent

iii procedure: **Aim:** Aim at the base not at the fire, otherwise the fire only spreads

iv procedure: **Sweep:** Sweep from side to side until the fire is out

Precaution when using fire extinguisher
The following precaution should take when using fire extinguisher

i. Keep reasonable distance (such as 3 metres) from the fire as it may suddenly change direction
ii. Never use a portable extinguisher on people instead us a fire blanket

iii. Do not test a portable extinguisher to see if works
Why: it may leak and afterwards fail to work during and emergence/accident
iv. Do not retain a used portable extinguisher to the wall
v. When a fire gets out of control, abandon it and notify the nearest fire fighting squared (fire brigade)

Rusting
By defn: *Rusting is the reddish brown occurs in iron/steel in presence of air and water*. The reddish brown coat occurs in metals (iron or steel) is called **Rust**

Condition for rusting
There are two condition includes
i. Air (oxygen)
ii. water

Methods used to prevents rusting
To prevent rusting should prevent contamination of water and air in iron and steel and to avoid using material made from iron or steel. The follows is the methods which we can use
i. Painting
ii. Oiling
iii. Galvanization
iv. Anodizing
v. Tin plating
vi. Use of silica gel
vii. Use of plastic

Painting
Paint when introduce on iron/steel prevent iron/steel to contact with water and oil

Oiling
Oil when introduce on iron/steel prevent iron/steel to contact with water and oil

Galvanization
By defn: *Galvanization is the process of mix iron/steel with metal that does not rusting*. When iron/steel mix with metal that does not rusting tend to prevent an iron/steel from rusting. Example
i. Iron sheets are galvanized with zinc

Anodizing
Iron is joined to reactive metals (e.g. Magnesium) by wire. Examples
i. Bridges are anodized to protect it from rusting
ii. pipelines are anodized to protect it from rusting

Tin plating
By defn: *plating is the coating of iron/steel with tin (metal) that does not rusting*. When iron/steel mix with metal that does not rusting tend to prevent an iron/steel from rusting. Example
i. Iron/steel Can is coated inside to prevent rusting so as suitable for canning a foods

Use of silica gel
By defn: *silica gel is a substance in the form of grains and absorbs moisture*. Silica gel prevent presents of water so that prevent iron/steel from rusting. Example
i. silica gel bags put inside cameral parts which made from iron/steel to prevent rusting

Use of plastic
Uses of plastics tend to avoid cost of damage parts or instruments and household made from rusting

END OF FORM ONE TOPICS