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JUNIOR SECONDARY LEVEL

PHYSICS

Module 2: Matter

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JUNIOR SECONDARY LEVEL SCIENCE - PHYSICS

MODULE 1 – Measurement

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MODULE 2

MATTER

INTRODUCTION

You will recall in Module One we classified substances according to whether they are solids, liquids or gases. In this Module, we look at solids, liquids and gases as the three states of matter. Our world is full of matter – in fact we are surrounded by matter. Our bodies form part of matter! We introduce you to the elements that make up matter. Here you will find the kinetic theory of matter very useful - when we come to explaining certain properties of matter.

You will also learn about their elements, symbols and how they are classified.

OBJECTIVES

After completing this Module, you should be able to

- distinguish between the three states of matter in specific terms
- state the basic principles of the kinetic theory (as applied to gases, liquids)
- classify elements
- recognise the grouping of elements and their classification in the periodic table.
- describe numerical relationships in the periodic table.
- perform simple investigations concerning matter and make deductions.

2.1 MATTER AND ITS NATURE

What is matter?

A simple answer is to refer to the definition of matter. Matter is defined as 'anything that occupies space'

Note: This is also covered in Chemistry - Module 2, Unit 1: 1.0 to 1.23.

You will find below a few examples of matter. I am sure you are familiar with most of them.

- water
- air
- rocks
- ice
- glass
- aluminium
- oxygen
- carbon dioxide

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 1

List some examples of matter.
Your list is expected to contain at least 20 items

……	……
……	……
……	……
……	……
……	……
……	……

You will find the answers at the end of the Module.

2.2 THE STATES OF MATTER

It's useful to note that matter exists in THREE DIFFERENT STATES. These are the

- solid state
- liquid state
- gas/vapour state

Each state of matter is made up of particles (in fact very tiny particles). Let's now look at each state in turn.

A few examples of solids are given below

- rocks
- ice
- salt
- sand
- sugar

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 2

Write down other examples of solids.
Your list should include at least 12 items.

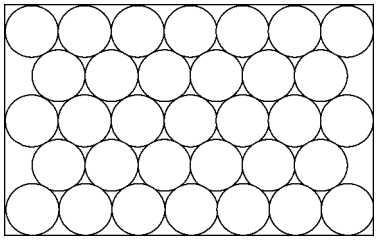
……	……
……	……
……	……
……	……
……	……
……	……

You will find the answers at the end of the Module.

2.2.1 SOLID STATE

Particles in the Solid State

Particles in the solid state are close together. They are almost in contact. We can represent the particles as follows:



It is useful to note that

- there is little space between particles when in a solid state.
- the particles are held together by strong forces of attraction.
- they (the particles) cannot move freely from one place to another.
- they just vibrate continuously about fixed positions.
- the extent of vibrations of the particles (in a solid) can be related to their energy. This, in turn, depends on the temperature.

[We shall consider energy in Module 3]

As a rule, the higher the temperature, the faster are the vibrations.

A given solid usually has a number of characteristics or properties. These include

- shape
- volume
- colour
- smell
- feel
- density
- melting point (this is the temperature at which a solid changes into liquid)

Density means the mass (in Kg) of 1 m^3 of a substance. It is calculated using the relation:

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Density can also be referred to as the mass (in g) of 1 cm^3 of a substance.

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 3

The density of oil is 0.9g per cm^3. Calculate the mass of 20 cm^3 of oil.

……
……

You will find the answer at the end of the Module.

As you noted earlier, particles in a solid just vibrate. These vibrations become faster and the forces of attraction between them weaken when the temperature increases. A stage is reached when the vibrations are so violent that the solid changes into a liquid. In a liquid the forces of attraction are weaker and the particles can move freely from one place to another.

This change in state from solid to liquid is called melting. The constant temperature at which this change takes place is called melting point.

We can now proceed with a simple investigation.

INVESTIGATION 1: The Melting point of naphthalene

For each investigation you will require the materials indicated.

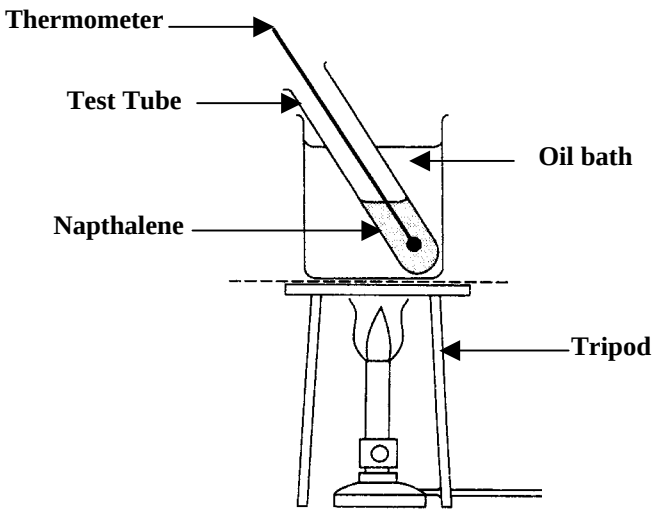
You should record your answers in the space provided.

Materials needed:

- Naphthalene
- Hard glass test-tube
- Paraffin /oil bath
- Thermometer
- Stirrer (glass rod)
- Tripod (with wire gauze)
- Burner

Method:

Place a small spoonful of naphthalene in a hard glass test tube. Insert a thermometer in the test tube lower the test tube in liquid bath as shown.



Heat the liquid i.e. the oil and stir with the glass rod. Observe carefully. When the solid naphthalene melts, stop heating. Record the temperature. This is the melting point of naphthalene.

Melting point of naphthalene ……°C

I am sure that the value you obtained by experiment is not far from that expected i.e. about 80°C.

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 4

Insert the melting point of each solid listed below.

Ice ……

Naphthalene ……

Iron ……

You will find the answers at the end of the Module.

2.2.2 THE LIQUID STATE

Water is a common liquid – in fact it is the commonest liquid on our planet.

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 5

Draw up a list of five liquids

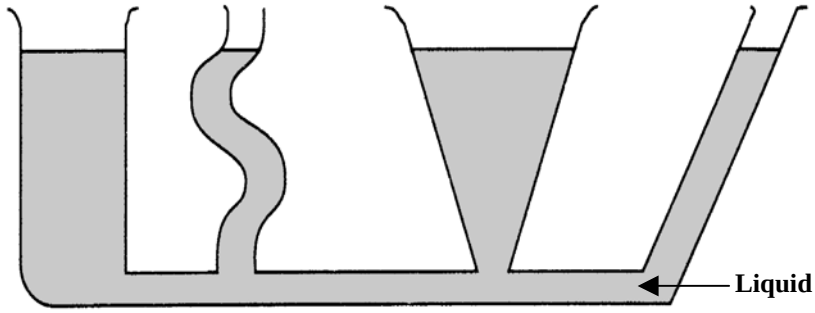
……
……
……
……
……

You will find the answers at the end of the Module.

Just as in case of solids, you will note that liquids share a number of characteristics.

A liquid is usually characterised by

- No shape of its own compared to that of solids. As you must have realised, a liquid takes up the shape of its container. This is made clear in the figure below.



- a definite volume
- physical properties (such as colour, taste, boiling point etc.)

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 6

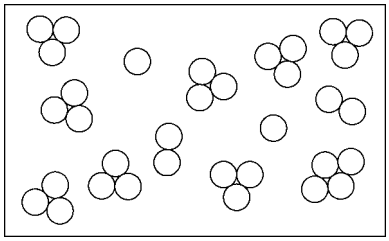
Make a list of 4 items considered as physical properties.

……
……
……
……

You will find the answers at the end of the Module.

Particles in the liquid state

In the liquid state the particles are close together – but not as close as in the solid state. There is space between them (see diagram below)



- There are forces of attraction between the particles. However, these forces are weaker than in solids.
- They can move about continuously inside the bulk of the liquid.
- They are in constant disorderly motion.

Let's now proceed with the following investigation.

INVESTIGATION 2: Simple investigation about a liquid.

For each investigation you will require the materials indicated. **You should record your answers in the space provided.**	**Materials required** • Alcohol *(Caution: Alcohol catches fire easily, keep alcohol away from the flame. Extinguish all flames during this experiment)* • A small beaker • A large beaker • Water (hot) **METHOD** *Place a little of alcohol in a small beaker.* *Lower it in a larger beaker which contains hot water.* *Observe the alcohol carefully. Record your observations.*

I am sure that you noticed the alcohol gradually decreasing in volume. The liquid changes into vapour i.e. evaporates. If a liquid evaporates away readily, it is referred to as a volatile liquid.

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 7

Write down three liquids which are volatile

……

……

……

Name three liquids which are not volatile

……

……

……

You will find the answers at the end of the Module.

Change of state (Liquid to vapour)

When a liquid is heated, the temperature increases. A stage is reached when the temperature becomes constant that is it does not change. Bubbles form in the liquid. There is a rapid change of the liquid into vapour. The liquid is said to be boiling. The constant temperature at which a liquid changes into a vapour is called a boiling point of the liquid.

Just as a solid has a characteristic melting point, a liquid has a boiling point of its own.

The boiling point of a liquid is the temperature at which it boils. A well known example is the boiling point of pure water – it is 100^{o} C at normal atmospheric pressure.

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 8

Give the names and boiling point of 5 liquids

Liquid	*Boiling Point (^oC)*
1 …….	……..
2. …….	……..
3 …….	……..
4 …….	……..
5 …….	……..

You will find the answers at the end of the Module.

2.2.3 THE GAS STATE

We saw that when a liquid boils, a vapour or gas is produced. Some substances normally exist as gases at room temperature and pressure.

A few examples of substances that are gases include

- Oxygen
- Nitrogen
- Argon
- Carbon dioxide

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 9

Draw up a list of five gases not included in the list.

……
……
……
……
……
……
……

You will find the answers at the end of the Module.

Characteristics of gases

We looked at the characteristics of solids and liquids earlier in this Module. You must have noted the difference between the solid and the liquid state. We can now consider the characteristics of gases. You can then compare the characteristics with those of solids and liquids.

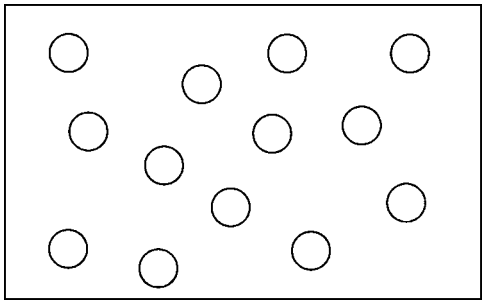
A gas has no shape of its own. It has the same volume as its container (that is a given gas fills entirely the container in which it occurs)

Other properties of gases, include

- colour
- smell
- density

Particles in the gas state

In a gas or vapour the particles are very far apart (as compared to solids and liquids). We can represent them as follows:



Particles in the gas state move about continuously in the container in a highly disorderly manner.

- They collide with one another and with the inner walls of the container.
- They are perfectly elastic – so that there is no energy loss on collision (we'll learn about energy in Module 3).
- They experience very weak forces of attraction between themselves.
- They occupy negligible space (as compared to the volume of the gas).

Investigations about gases

Many gases are colourless and odourless e.g.

- *oxygen*
- *nitrogen*
- *argon*

However, some gases have colour and smell. For example nitrogen dioxide is a gas which is reddish brown with a "choking" smell. It is also poisonous.

Chlorine is a greenish yellow gas and it is poisonous. In very small quantities it is used to kill germs/bacteria during the purification of water.

At this stage, it is useful for us to summarise the distinguishing properties of the three states of matter.

Before proceeding further, complete the following activity.

ACTIVITY 10

Complete the following table:

State	Solid	Liquid	Gas
Spacing of particles			
Force of attraction between particles			
Energy of particles			

You will find the answers at the end of the Module.

You will recall that particles move freely from one place to another in liquids and gases. This is why liquids and gases are referred to as fluids. The continuous random motion of particles results in

- mixing of particles of 2 liquids
- mixing of particles of 2 gases

This continuous random motion of particles is called diffusion. This is what we discuss next.

2.3 DIFFUSION

Diffusion in Liquids

The movement of particles in the liquid state gives rise to “mixing up” or “diffusion”.

Note: Diffusion is dealt with in Chemistry - Module 2, Unit 1: 1.4 and also in Biology - Module 2, Unit 4: 4.0 to 4.4

We can now proceed with a simple investigation.

INVESTIGATION 3: To show diffusion in liquids

For each investigation you will require the materials indicated. **You should record your answers in the space provided.**	**Materials needed -** • Beaker (or glass) • Tap water • Blue ink • Watch/clock **Method**: *Take about 100 cm^3 of tap water in a beaker (or glass). Carefully add 2 – 3 drops of blue ink. Describe what you observe.* …… …… *Now leave the beaker (or glass) with the water and ink aside for 5 – 6 hrs. Record your observations after* *2 hrs ……* *4 hrs ……* *6 hrs ……* *What do you deduce*

I am sure that at first you noticed the ink sinking to the bottom.

After 2 hrs, the blue ink will have spread in the water.
After 4 hrs, the spreading should be more.
After 6 hrs, the blue ink will have mixed up uniformly with the water.

The particles of water and the particles of blue ink have “mixed” together to produce a uniformly blue solution. The mixing is due to the random/disorderly

movement of the particles. That is, diffusion has taken place.

Diffusion in gases

Particles of gas/vapour also undergo diffusion. In fact, diffusion is faster in gases or vapours.

You will recall particles of gases or vapours move faster compared to those in liquids.

We can now proceed with the following investigation.

INVESTIGATION 4: Diffusion of vapour/gas

For each investigation you will require the materials indicated. **You should record your answers in the space provided.**	**Material needed -** A bottle of alcohol or a container of (strong) perfume. **Method**: *Remove the stopper of the bottle of alcohol or container of perfume in one corner of the room.* *Move to the other corner of the room.* *Can you smell the alcohol or perfume at the other corner?* …… …… …… …… *What has happened?* …… …… …… …… …… …… …… …… ……

I am sure you have detected the smell of the alcohol or perfume at the other corner of the room.

How do we explain this?

The liquid alcohol (or perfume) has evaporated and the vapour particles have moved randomly. They move in all directions – so that you can detect their presence in the other corner.

The vapour particles have diffused. You must have realised that diffusion in gases/vapours takes place faster than in liquids. Why is this? Write down the reason(s) for this.

……
……
……

You will recall that

1° Particles in gas/vapours are more energetic. (They have more energy)

2° Forces of attraction between particles of gases/vapours are negligible.

3° In a gas/vapour the movement of particles is more disorderly.

We can now proceed with another simple investigation concerning diffusion, using water and a coloured solid.

INVESTIGATION 5: Using water and a coloured solid

For each investigation you will require the materials indicated. **You should record your answers in the space provided.**	**Materials needed -** • A beaker (or glass) • A dye (initially as solid) **Method**: *Put about 100 cm^3 of water in the beaker (or glass). Drop a pinch of the dye in the water.* *Observe carefully at intervals of 3 hrs.* *3 hrs …….* *6 hrs …….* *9 hrs …….* *12 hrs ……..* *Overnight ……* *How can you account for the observations?*

I am sure that you noticed the solid gives rise to colour around it. The colour spreads slowly. Ultimately a uniformly coloured mixture is observed.
To account for the changes, we can visualise the following stages:

1° Particles of water get into the spaces between particles of the dye.

2° Particles of the dye start to get separated by water particles moving about.

3° Particles of the dye spread inside the beaker (or glass).

So far we have considered diffusion in liquids and gases. What about diffusion in solids? Is diffusion possible between two solids?

……
……

You will recall that particles in solids cannot move from one place to another freely. They just vibrate. Diffusion is too slow to be observed in solids.

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 11

Complete the blanks in:

Diffusion is:

Faster in …….

Slower in …….

Slowest (almost negligible) in …….

You will find the answers at the end of the Module.

Let's summarise what we have learnt so far. You will note that solids, liquids and gases are made up of particles. In liquids and gases, the particles are in constant random motion, while in solids, they just vibrate. This is in fact the core of the kinetic theory of matter.

According to the kinetic theory of matter, matter is made up of particles. In the gas state and in the liquid state, the particles are in constant random motion. In the solid state, the particles keep on vibrating about mean positions.

2.4 SYMBOLS FOR ELEMENTS

Matter contains elements. For example, water contains two elements, namely hydrogen and oxygen. There are over 100 common elements. Each element is represented by a symbol.

Note: We also look at Chemical symbols in Chemistry - Module 1, Unit 1 - 1.0 to 1.1.

The symbol for an element is often the first letter (capital) in the name of the element, e.g.

Element	*Symbol*
Hydrogen	*H*
Oxygen	*O*
Nitrogen	*N*

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 12

What is the symbol for

- *Sulphur?*
- *Phosphorous?*
- *Boron?*
- *Fluorine?*
- *Uranium*
- *Iodine*

You will find the answers at the end of the Module.

You will realise that there are over 100 elements and there are only 26 letters of the alphabet! I'm sure you foresee the problem.

The symbol for Hydrogen is H. What is the symbol for Helium? It cannot be again H.

The symbol for many elements consists of the first two letters. The first one is capital. For example the symbol for

Helium is He
Barium is Ba

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 13

What is the symbol for each of the following?

- *Calcium ……..*
- *Silicon ……*
- *Argon ……..*
- *Aluminium……*
- *Neon ……*
- *Lithium ……*
- *Beryllium ……*

You will find the answers at the end of the Module.

The symbol of other elements is not so straightforward. You will have to memorise them. The symbol for

Sodium is	Na	Iron is	Fe
Potassium is	K	Lead is	Pb
Magnesium is	Mg	Zinc is	Zn
Silver is	Ag	Copper is	Cu

A few other important elements

Let's now have a look at the names of symbols of a few more elements. These are listed as follows:

Name	Symbol
Bromine	Br
Mercury	Hg
Gold	Au
Tin	Sn

Before proceeding further, complete the following activity.

ACTIVITY 14

Give one use of each of the elements listed below.

Element	***Use***
Iron	
Copper	
Zinc	
Bromine	
Silver	
Tin	
Gold	
Mercury	
Lead	
Uranium	

You will find the answers at the end of the Module.

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 15

	Name of element	*Symbol*
1.	Hydrogen	H
2.	Helium	He
3.	Lithium	
4.	Beryllium	
5.	Baron	
6.	Carbon	
7.	Nitrogen	
8.	Oxygen	
9.	Fluorine	
10.	Neon	
11.	Sodium	
12.	Magnesium	
13.	Aluminium	
14.	Silicon	
15.	Phosphorus	
16.	Sulphur	
17.	Chlorine	
18.	Argon	
19.	Potassium	
20.	Calcium	

You will find the answers at the end of the Module.

2.5 THE STRUCTURE OF THE ATOM

We saw earlier that matter is composed of elements. Each element has a symbol. In this section, you will learn that elements are composed of atoms. In fact the symbol of an element represents one atom of the element.

The word “atom” was first coined by Sir John Dalton (atom = indivisible). According to his theory:

“elements are made up of tiny particles called atoms”.

Atoms of an element are all alike in all respects. They differ from atoms of other elements.

- Atoms cannot be created or destroyed.
- Atoms combine in small whole numbers.

Research that was carried out in physics led to the development of the nuclear model of the atom.

Many famous scientists carried out researches. The famous persons include:

- Ernest Rutherford
- Marie and Pierre Curie
- Sir William Crooke
- Sir Joseph John Thompson
- Niels Bohr

They contributed to the nuclear model of the atom. In fact, Ernest Rutherford proposed this nuclear model.

Note: Physics - Module 4, Unit 1: 1.3 to 1.4 also deals with atoms and atomic structure.

It is now recognised that atoms contain three fundamental particles. This is what we turn to next.

2.5.1 THE NUCLEAR MODEL OF THE ATOM

As we mentioned earlier this model takes into account the three fundamental particles which occur in atoms. These are the:

- Protons
- Electrons
- Neutrons

Their relative masses and charges are as follows:

Fundamental Particle	***Relative mass***	***Change***
Proton	1	+1
Electron	Negligible ($^1/_{1850}$)	-1
Neutron	1	0

We now visualise the atom as consisting of a nucleus and a number of shells or orbits.

The nucleus is the tiny central part of the atom that contains all neutrons and protons in the nucleus. The nucleus is positively charged. Can you suggest why?

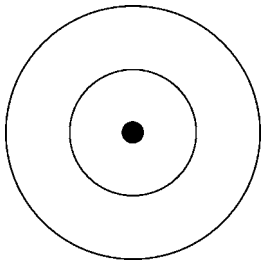
The electrons are found in shells or orbits around the nucleus.

Before proceeding further, complete the following activity.

ACTIVITY 16

On the diagram of the atom shown, mark

The nucleus
The shells
The first shell
The second shell



You will find the answers at the end of the Module.

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 17

Write True or False for each of the following about the atomic nucleus. It is

of same size as the atom _____

tiny compared to the size of atom _____

massive _____

centrally located _____

negatively charged _____

positively charged _____

the 'residing place' of protons and neutrons _____

You will find the answers at the end of the Module.

Thus an atom consists of an atomic nucleus surrounded by a number of shells.

2.5.2 THE SHELLS (OR ORBITS) IN ATOMS

They occur around the nucleus

They contain electrons. How many electrons can each accommodate?

The first shell can contain 2 electrons

The second shell can contain up to 8 electrons

The third shell can accommodate a maximum of 18 electrons.

We can tabulate this as follows:

Shell	Maximum number of electrons
First shell	2
Second shell	8
Third shell	18

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 18

Bearing in mind that an atom is neutral i.e. with no net charge.
What can you say about the number of protons and electrons in an atom?

……

……

……

……

……

……

……

You will find the answers at the end of the Module.

As the number of protons in an atom is equal to the number of electrons, an atom is neutral.

2.5.3 ATOMIC NUMBER OF ELEMENTS

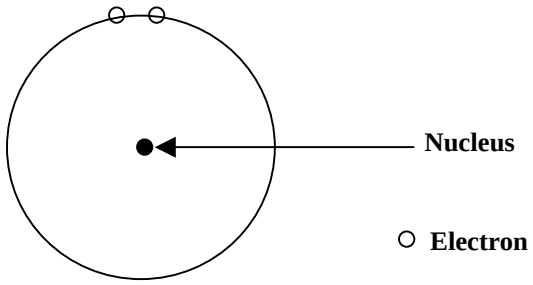
Each element is characterised by its atomic number. **The atomic number of an element refers to the number of protons (in the nucleus) or the number of electrons (in the shells) in an atom**. You will recall that the number of protons is equal to the number of electrons in an atom. You will note that, for the first 20 elements, the ordinal number of the element is also its atomic number. For instance, the second element is Helium. Its atomic number is 2. The atom has 2 electrons in the first shell. The nucleus has 2 protons (and also 2 neutrons in the case). Let us take the case of the eleventh element. It is sodium. Its atomic number is 11. The atom has 11 electrons arranged as:

2 in the first shell
8 in the second shell
1 in the third shell

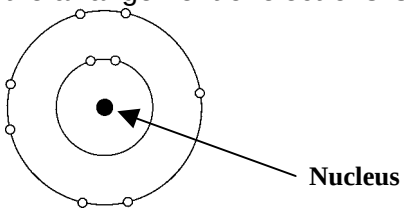
In the sodium atom, the nucleus has 11 protons. The number of neutrons in an atom of sodium is 12. **The total number of all protons and neutrons in the nucleus of the atom is called the nucleon number or mass number of the element.** Thus mass number or nucleon number of sodium is 11 + 12 = 23.

2.5.4 ARRANGEMENT OF ELECTRONS IN ATOMS

For the Helium atom the 2 electrons are as shown



For an atom of fluorine, the arrangement of electrons is



The nucleus which is positively charged attracts the electrons which are negatively charged.

2.5.5 VALENCY SHELL

The valency shell of an atom is the last shell that contains electrons. For example, the last that contains electrons in the fluorine atom is the second shell, it is the valency shell. It has seven electrons.

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 19

For the elements listed below complete the arrangement of electrons in the shell(s)

	← shells →			
	1st	2nd	3rd	4th
H				
He				
Li				
Be				
B				
C				
N				
O				
F				
Ne				
Na				
Mg				
A1				
Si				
P				
S				
CI				
Ar				
K				
Ca				

You will find the answers at the end of the Module.

2.5.6 ATOMS OF NOBLE GASES

Atoms of noble gases have shells which are full of electrons. As such they have stable electronic structures.

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 20

Complete the blanks to show the electronic arrangement (of electrons in the respective atoms).

Atom	***Electronic Arrangement***
He	.....
Ne	.....
Ar	.....

You will find the answers at the end of the Module.

2.5.7 THE PERIODIC TABLE

You will recall that we classified substances according to their states - solids, liquids and gases.

Here we shall be more concerned about classification of elements. What we learnt about symbols will be useful. Elements can be classified on the basis of their atomic number and electronic structure. One such classification is the periodic table.

Note: This is also dealt with in Chemistry - Module 4,Unit 1: 1.2.

The classification of the first twenty elements may be represented as follows:

GROUPS ⟵ ⟶

PERIODS ↑ ↓

	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**
1	H							He
2	Li	Be	B	C	N	O	F	Ne
3	Na	Mg	A1	Si	P	S	Cl	Ar
4	K	Ca						

You will note that the periodic table has vertical sets of elements. Each vertical set is called a **group.** Within a group the elements have similar properties. Roman numerals are used to name the groups, e.g.

I II III IV V VI VII VIII.

Group I has elements
Lithium, Li
Sodium, Na
Potassium, K

We shall neglect hydrogen (H) for the time being.

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 21

How many groups are there in the Periodic Table?

……
……
……
……

You will find the answers at the end of the Module.

The elements in a group resemble each other. In fact, elements within the same group have similar properties. For example lithium, sodium and potassium are reactive metals. They are in group 1. Helium, neon and argon are noble gases. They are unreactive. They are all in group VIII.

✍ ***Before proceeding further, complete the following activity.***

Activity 22

Give one property common to the elements in the group VIII

Helium, Neon and Argon

……
……
……
……

You will find the answers at the end of the Module.

✍ ***Before proceeding further, complete the following activity.***

Activity 23

The elements lithium, sodium, potassium form a group. Give one property common to the 3 elements.

……
……
……
……
……

You will find the answers at the end of the Module.

You must have noted that the periodic table also has horizontal sets of elements. Each horizontal set is called a **period**. Period 2 has the elements

Li	Be	B	C	N	O	F	Ne

The four periods shown in the periodic table are marked as

1

2

3

4

Before proceeding further, complete the following activity.

Activity 24

Give 2 examples of periods in the Periodic Table.

……
……
……
……

You will find the answers at the end of the Module.

From activity 19, you will note that the number of electrons in the valency shell of an element is equal to the group number of the element in the periodic table.

✍ ***Before proceeding further, complete the following activity.***

ACTIVITY 25

(a) What is the group number of Magnesium?

……

(b) What is the number of electrons in the outer shell of the Magnesium atom?

……

(c) To which group number does chlorine belong?

……

(d) Give the number of electrons in the outer shell of the chlorine atom.

……

You will find the answers at the end of the Module.

ANSWERS TO ACTIVITIES

Activity 1

Paper	Glycerine
Ink	Alcohol
Pen	Vinegar
Wood	Table salt
Coal	Sugar
Steel	Nitrogen
Sulphur	Neon
Tin	Mercury
Lead	Silver
Phosphorus	Gold

Activity 2

Coal	Leather
Iron	Camphor
Tin	Naphthalene
Lead	Zinc
Table salt	Silver
Porcelain	Copper

Activity 3

$$\text{Density} = \frac{mass}{volume}$$

$$0.9 = \frac{mass}{20}$$

Mass = (0.9 x 20) grams
= 18 grams

Activity 4

Ice = 0 ^{o}C
Naphthalene = 80 ^{o}C
Iron = 1535 ^{o}C

Activity 5

Oil
Alcohol
Turpentine
Mercury
Bromine

Activity 6

1. Colour
2. Smell
3. Taste
4. Density

Activity 7

Volatile
- Ether
- Acetone
- Alcohol

NOT Volatile
- Mercury
- Oil
- Glycerine

Activity 8

	LIQUID	**Boiling Point (^{o}c)**
1.	Water	100
2.	Alcohol	78
3.	Mercury	357
4.	Acetone	56
5.	Ether	35

Activity 9

Helium
Neon
Carbon monoxide
Water vapour
Chlorine

Activity 10

	SOLID	LIQUID	GAS
SPACING	Closely packed	Slightly spaced	More spaced
FORCE	Strong	Weak	Negligible
ENERGY	Vibrational	Kinetic	Kinetic

Activity 11

Faster in gases
Slower in liquids
Slowest in solids

Activity 12

Sulphur	S
Phosphorus	P
Boron	B
Fluorine	F
Uranium	U
Iodine	I

Activity 13

Calcium	Ca
Silicon	Si
Argon	Ar
Aluminium	Al
Neon	Ne
Lithium	Li
Beryllium	Be

Activity 14

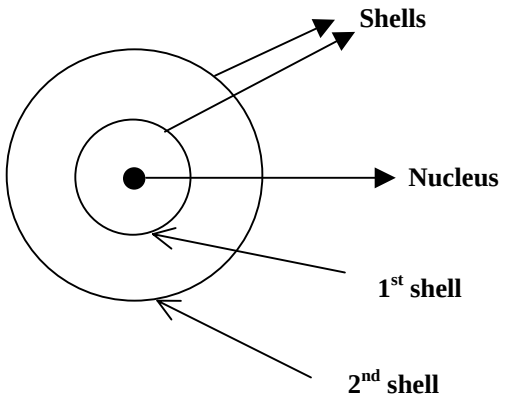
Element	***One use***
Iron	Construction of bridges, buildings
Copper	Making electrical conductors
Zinc	Outer case of dry cells
Bromine	To make silver bromide (used in photography)
Silver	Making silverware
Tin	Cans for food
Gold	In jewels
Mercury	In thermometers
Lead	In batteries
Uranium	In nuclear power stations

Activity 15

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

Activity 16



Activity 17 (In order)

False
True
True
True
False
True
True

Activity 18

The number of protons in an atom = the number of electrons in the atom.

Activity 19

	Shells →			
	1st	2nd	3rd	4th
H	1			
He	2			
Li	2	1		
Be	2	2		
B	2	3		
C	2	4		
N	2	5		
O	2	6		
F	2	7		
Ne	2	8		
Na	2	8	1	
Mg	2	8	2	
Al	2	8	3	
Si	2	8	4	
P	2	8	5	
S	2	8	6	
Cl	2	8	7	
Ar	2	8	8	
K	2	8	8	1
Ca	2	8	8	2

Activity 20

He ---------- 2
Ne ---------- 2, 8
Ar ---------- 2, 8, 8

Activity 21

There are 8 groups in the Periodic Table.

Activity 22

They are chemically inert.

Activity 23

They react violently with cold water liberating hydrogen.

Activity 24

1st example (in symbol form)

Li	Be	B	C	N	O	F	Ne

2nd example (in symbol form)

Na	Mg	Al	Si	P	S	Cl	Ar

Activity 25

(a) Two
(b) Two
(c) Seven
(d) Seven