

MODULE 2 - UNIT 2

BUILDING BLOCKS OF MATTER

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MODULE 2 - UNIT 2

BUILDING BLOCKS OF MATTER

INTRODUCTION

In Module 2 Unit 1, we discussed matter as consisting of tiny particles. These tiny particles are called **atoms**. Atoms are extremely small, invisible to the naked eye or even under an ordinary microscope.

Atoms in turn are made up of even smaller particles. In this Unit, we further our knowledge on atoms combining together to form molecules.

OBJECTIVES

After completing this Unit, you'll be able to:

- state that atoms combine to form molecules which are the building blocks of all molecules
- describe that atoms combine to form molecules and crystals
- distinguish between elements, mixtures, compounds
- describe the mixing of substances to make solutions
- classify the elements into metals and non-metals
- describe methods for the separation of mixtures and solutions
- discuss water as a solvent and its uses in everyday life
- distinguish between clean/pure and polluted water.

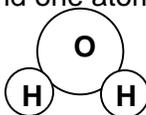
2.0 ATOMS AND MOLECULES

We normally represent an atom as \circ . When 2 or more atoms combine together, a molecule is formed.

Atoms are the smallest particles of matter. Molecules are a group of two or more atoms.

Here is an atom of hydrogen H . Two atoms of hydrogen combine together to form a molecule of hydrogen. H H

Likewise, 2 atoms of hydrogen and one atom of oxygen combine to form a molecule of water. Here it is



 *Before proceeding further, complete the following activity.*

ACTIVITY 1

- (a) Now we take N to represent an atom of Nitrogen. How can we represent a molecule of Nitrogen? (It contains 2 atoms of Nitrogen).
- (b) How can we represent a molecule of Ammonia? (It contains 1 atom of Nitrogen and 3 atoms of Hydrogen).

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

Solids are also made of particles too. In some solids, we notice that these particles arrange themselves in the form of crystals e.g. *naphthalene, diamonds, graphite, snow flakes, table salt*

Others are non-crystalline e.g. *milk powder, flour etc.*

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

ACTIVITY 2

Table salt is chemically sodium chloride. It is a crystal. Take a sodium particle as ● and a chloride particle as ○

- (a) *Assuming sodium chloride to consist of cubic crystals draw a diagram to represent a building unit of sodium chloride.*

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

2.1 ELEMENTS AND COMPOUNDS

- ***Elements*** are made up of ***atoms***. An element is a pure substance. We cannot break it down further into anything simpler.
- Water is a ***compound*** i.e. it contains 2 elements - Hydrogen and Oxygen joined together. We say that a compound consists of 2 or more elements joined together.

Air on the other hand, is a ***mixture*** of several gases.

Mixture will become clearer in 2.2 shortly. For now, let's look at the composition of air as a *mixture*.

Nitrogen claims approximately 4/5 of this mixture and Oxygen 1/5.

Traces of other substances include:

- rare gases 1%,
- water vapour (varies) and
- carbon dioxide (0.03%).

 *Before proceeding further, complete the following activity.*

ACTIVITY 3

- (a) Which of the components of air
- (i) are compounds?
- (ii) are elements?
- (b) Can you represent the component in (i) diagrammatically

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

The earth's crust is the outer layer of earth. The crust is also a **mixture** of many different substances. As a matter of interest let us tell you that gold was the first metal to be obtained from earth.

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

ACTIVITY 4

What are the various components of the earth's crust?

.....

.....

.....

.....

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

2.2 MIXTURES

We can think of a mixture as the putting together of different substances and then stirring them. The amounts of the substances do not really matter. The substances do not react either in a mixture. It could therefore be easy to separate them.

It is useful to know that mixtures can be **heterogeneous** (e.g. iron and sulphur) or **homogeneous** (e.g. a solution of sugar or salt in water).

In 2.5, we'll be looking at how to separate mixtures.

 Before proceeding further, complete the following activity.

ACTIVITY 5

How can we prepare a:

(i) mixture of stones of different sizes ?

.....
.....

(ii) mixture of iron and sulphur ?

.....
.....

(iii) mixture of silt and water?

.....
.....

(iv) mixture of oil and water?

.....
.....

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

 *Before proceeding further, complete the following activity.*

ACTIVITY 6

Answer, in each case, by 'Yes' or 'No'

Can we have a **solution** of

- (i) Ink in water?
- (ii) Pebbles in water?
- (iii) Sand in water?
- (iv) Dye in water?
- (v) Alcohol in water?
- (vi) Oil in water?
- (vii) Carbon-dioxide in water?-----
- (viii) Oxygen in water?-----
- (ix) Glucose in water?-----

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

2.3 METALS AND NON-METALS

Scientists have identified over 100 elements. While some occur naturally in the earth's crust, others are man-made. Some elements are very rare such as an element called **astatine**. Scientists have estimated only 0.029g of this element in the whole earth.

We can divide the elements into groups. One way we can do that is to group them into metals and non-metals. Of the 100 or so elements, 84 are metals. The rest are non-metals.

 Before proceeding further, complete the following activity.

ACTIVITY 7

(a) Iron and aluminium are examples of metals.

Draw a list of 10 other metals.

- | | |
|--------|---------|
| 1..... | 6..... |
| 2..... | 7..... |
| 3..... | 8..... |
| 4..... | 9..... |
| 5..... | 10..... |

(b) Oxygen and carbon are 2 examples of non-metals.

Enumerate 10 other non-metals.

- | | |
|--------|---------|
| 1..... | 6..... |
| 2..... | 7..... |
| 3..... | 8..... |
| 4..... | 9..... |
| 5..... | 10..... |

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

2.3.1 PROPERTIES

Metals

Metals have properties. We recognise some as typical of metals. But remember that all metals do **not** have the same properties. We can therefore attribute some general properties to metals. Because of such properties, metals have found numerous uses in our daily living. Our pots and pans in our kitchens, for example, are made of metals because they conduct heat very well.

You must surely have noticed the electrical wiring in your house. It is made of copper wires. Can you think why? This is because copper wires will allow electricity to flow through them when you switch the power on.

Metals usually have bright surfaces. They can be beaten into sheets or drawn into wires. Most metals are solids except mercury (a liquid)

 *Before proceeding further, complete the following activity.*

ACTIVITY 8

Delete as required

- (a) *Metals have dull/shiny appearances.*
- (b) *Metals are good/poor conductors of electricity and also of heat.*
- (c) *Metals can/cannot be converted into sheets and wires.*
- (d) *All metals are solids/liquids except mercury, which is a solid/liquid.*

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

 Before proceeding further, complete the following activity.

ACTIVITY 9

In the table below, a list of metals is given.

For each, indicate one use in everyday life.

METAL	ONE USE
Gold	
Mercury	
Aluminium	
Copper	
Zinc	
Iron	
Nickel	
Chromium	
Lead	
Tin	
Magnesium	

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

Non-Metals

We said earlier that some elements are non-metals. We can classify those non-metals into:

- Solids - e.g. carbon, sulphur
- Liquids - e.g. Bromine
- Gases - e.g. oxygen nitrogen
- They are poor conductors of electricity
- They have low melting points
- They break up easily
- They have low density i.e. they feel light

Just like metals have their uses in our life, non-metals too have uses. Again these depend upon their properties.

This is not all about metals and non-metals. We shall be looking at them again in a bit more detail in Module 5 Unit 1.

 *Before proceeding further, complete the following activity.*

ACTIVITY 10

Here is a list of non-metals:

carbon, oxygen, nitrogen, silicon, neon, helium, argon, fluorine, chlorine, bromine, iodine, sulphur, hydrogen, phosphorus.

In which column will each non-metal fit best?

SOLID	LIQUID	GAS

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

 Before proceeding further, complete the following activity.

ACTIVITY 11

Many non-metals are put to use in everyday life.

Complete the use/application for each non-metal given in the list below.

Non-metals	One use /application	Non-metals	One use /application
<i>Hydrogen</i>		<i>Silicon</i>	
<i>Helium</i>		<i>Sulphur</i>	
<i>Diamond</i>		<i>Argon</i>	
<i>Graphite</i>		<i>Oxygen</i>	
<i>Chlorine</i>		<i>Nitrogen</i>	
<i>Iodine</i>			

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

2.4 WATER

You should know by now that water exists in 3 forms:

- Solid i.e. ice
- Liquid i.e. water
- Gas i.e. steam.

As a liquid it is a very good solvent. This means it will allow a wide range of substances to dissolve in it. You must surely have noticed what happens when a spoon full of sugar or salt is stirred in a glass of water. The salt or sugar is the solute. Likewise a solute like ammonium sulphate which is a fertilizer also readily dissolves in water.

Water is also a very important liquid. There is a saying that *water is life. Without it, life doesn't exist.* Your body is about 70% water. So we must not underestimate its importance in life.

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

ACTIVITY 12

Make a list of other uses of water.

.....

.....

.....

.....

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

2.4.1 WATER POLLUTION

River water in forests and uninhabited regions is unpolluted. Human activities pollute water. Fertilisers from agricultural lands get washed down into rivers. Effluents from farms may reach nearby rivers. Herbicides being sprayed on crops may be blown into rivers. Discharge of waste water from heavy industries can pollute water. Also oil spillage is another cause of water pollution.

Polluted water is harmful to all forms of life, not only to aquatic life. Humans can be adversely affected as health problems can arise from polluted water e.g. gastro-enteritis, cholera, birth defects, different types of cancers, skin disorders, falling hair, tooth decay, death.

Note: Refer to Biology - Module 8 , Unit 3: 3.7

 *Before proceeding further, complete the following activity.*

ACTIVITY 13

We have to be careful when using water for domestic purposes. We should avoid polluted water.

Give 2 ways in which we can recognise polluted water.

1st

.....

2nd

.....

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

2.5 SEPARATION OF MIXTURES

Although we have mixed substances, it is possible to separate them by various methods. The following investigations will allow you to separate mixtures.

We can now proceed with the following investigation.



INVESTIGATION 2: Sorting by hand

<p>For each investigation you will require the materials indicated.</p>	<p>Material needed:</p>
<p>You should record your answers in the space provided.</p>	<ul style="list-style-type: none">• Mixture having stones of different sizes.
	<p>Method:</p>
	<p><i>Have a look at different sizes of the stones.</i></p>
	<p><i>Now pick out stones of different sizes.</i></p>
	<p><i>Put them separately.</i></p>
	<p>Observation:</p>
	<p>.....</p>

I am sure you found it an easy and interesting investigation.

We can now proceed with the following investigation.



INVESTIGATION 3: Sorting with a magnet

<p>For each investigation you will require the materials indicated.</p> <p>You should record your answers in the space provided.</p>	<p>Materials needed:</p> <ul style="list-style-type: none">• Mixture of iron filings and powdered sulphur• A magnet <p>Method:</p> <p><i>Place a magnet just above the mixture</i></p> <p><i>Observe and record what happens.</i></p> <p>.....</p> <p>.....</p> <p>.....</p> <p><i>I am sure you noticed that the iron filings got attracted to the magnet. The sulphur was left behind.</i></p>
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We can now proceed with the following investigation.



INVESTIGATION 4: Using a separating funnel

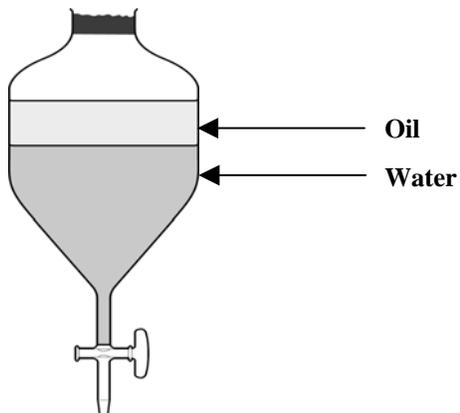
For each investigation you will require the materials indicated.

Materials needed:

- A mixture of oil and water
- A separating funnel
- A clean beaker/flask

Method:

Put the mixture in a separating funnel.



Let it stand for a minute or two, open the tap of the funnel to run out the lower layer into a clean beaker/flask

Record your observations:

.....
.....
.....

I am sure you noted that it is oil that is left in the separating funnel. You must have noticed that oil does not mix with water. This is because oil is of lower density than water and this is why it floats on top.

You should record your answers in the space provided.