8th Science Lesson 4 Notes in English

4] Matter Around Us

Introduction:

In the universe all manifestations, phenomena and evolution of life are caused by matter and energy. All the objects which exist around us are made of some kind of matter. We perceive these objects through our senses like sight, touch, hearing, taste and smelling. A glass tumbler can be seen, agarbatti burning can be recognized by its smell whereas wind blowing can be felt. All kinds of matter possess mass and occupy space. Of course some are heavy and others are light. Thus, matter can be defined as anything which has definite mass and occupies space.

As we know already, matter exists as solids (wood, stone, sand, iron etc.), liquids (water, milk, fruit juice, etc.) and gases (oxygen, nitrogen, carbon dioxide, steam, etc.). Matter in any physical state is composed of smaller particles such as atom, molecules or ions. An atom is the smallest particle of an element which exhibits all the properties of that element. Atoms of the same element or different elements combine to form a molecule. Atoms or group of atoms having a charge (positive or negative) are called ions.

Hence, atoms are the building blocks of matter. In this lesson, we will study about symbols of elements, metals and non metals, compounds of solids, liquids and gases, and the uses of compounds in daily life.

Elements:

Elements are everywhere. They are the building blocks of everything on Earth: pencil, desk, mountains, car, book, etc. Do you know that when you are breathing you are actually inhaling air? The air you breathe is made up of many elements like oxygen, nitrogen and argon.

An element is a pure substance that cannot be broken down by chemical methods into simpler components. For example, the element gold cannot be broken down into anything other than gold. If you keep hitting gold with a hammer, the pieces would get smaller, but each piece will always be gold.

Elements consist of only one type of atoms. An atom is the smallest particle of an element that still has the same properties of that element.

All atoms of a specific element have exactly the same chemical makeup, size, and mass. Each atom has an atomic number, which represents the number of protons that are in the nucleus of a single atom of that element. There are a total of 118 elements. Many elements occur naturally on Earth; however, some are created in laboratory by scientists.

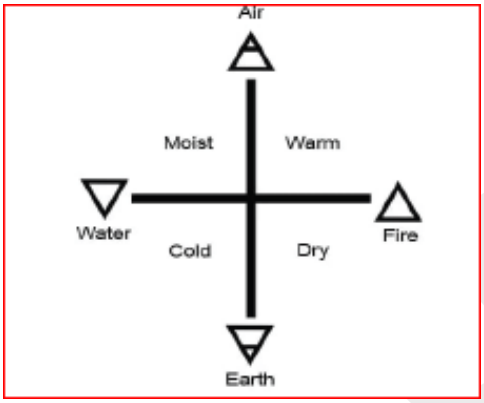
Symbols of Elements:

A symbol is an image, object, etc., that stands for some meaning. For instance, a dove is a symbol of peace. Similarly, we denote mathematical operations by symbols. For example '+' denotes addition; '–' denotes subtraction etc. In the same way in chemistry each element is denoted by a symbol. Writing out the name of an element every time would become too troublesome. So, the

name of an element is represented by shortened form called as symbol. Let us learn the brief history of symbols of elements.

a. **Greek Symbols:**

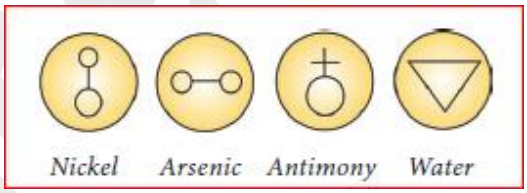
The symbols in the form of geometrical shapes were used by the ancient Greeks to represent the four basic elements around us such as earth, air, fire and water.



Greek symbols

b. **Alchemist Symbols:**

In the days of alchemists, different materials that people used were represented by different symbols while they tried to change less valuable metal into gold. That process was called alchemy and the men who did this work were known as alchemists.



Symbols used by Alchemist

c. **Dalton Symbols:**

In 1808, John Dalton, English scientist tried to name various elements based on pictorial symbols. Those symbols are difficult to draw and hence they are not used. It is only of historical importance.

Dalton Symbols

Hydrogen	Copper
Nitrogen	Lead
Carbon	Water

Sulphur	Ammonia
Phosphorus	Olefiant
Alumina	Carbonic oxide
Soda	Carbonic acid
Pot ash	Sulphuric acid
Oxygen	

d. Berzelius Symbols:

In 1813, Jon Jakob Berzelius devised a system using letters of alphabet rather than signs. The modified version of Berzelius system follows under the heading 'System for Determining Symbols of the Elements'.

e. Present system for determining symbols of the elements:

1. The symbols of the most common elements, mainly non-metals, use the first letter of their English name.

Elements having first letter as symbol

Element	Symbol	Element	Symbol
Boron	B	Oxygen	O
Carbon	C	Phosphorus	P
Fluorine	F	Sulphur	S
Hydrogen	H	Vanadium	V
Iodine	I	Uranium	U
Nitrogen	N	Yttrium	Y

2. If two elements have same first letter, then the first and second letters of the name are used as symbols. The first letter is in uppercase and the second letter is in lowercase.

Elements with same first letter

Element	Symbol	Element	Symbol
Aluminium	Al	Hydrogen	H
Barium	Ba	Helium	He
Beryllium	Be	Nickel	Ni

Bismuth	Bi	Neon	Ne
Bromine	Br	Silicon	Si
Cobalt	Co	Sulphur	S

3. If the first two letters of the names of the elements are same, then the symbol consists of first letter and second or third letter of English name that they do not have in common.

Elements with same two letters

Element	Symbol	Element	Symbol
Argon	Ar	Calcium	Ca
Arsenic	As	Cadmium	Cd
Chlorine	Cl	Magnesium	Mg
Chromium	Cr	Manganese	Mn

4. Some symbols are used on the basis of their Greek name or Latin name of the elements. There are eleven such elements.

Greek or Latin name of elements

Element	Latin Name	Symbol
Sodium	Natrium	Na
Potassium	Kalium	K
Iron	Ferrum	Fe
Copper	Cuprum	Cu
Silver	Argentum	Ag
Gold	Aurum	Au
Mercury	Hydrargyrum	Hg
Lead	Plumbum	Pb
Tin	Stannum	Sn
Antimony	Stibium	Sb
Tungsten	Wolfram	W

5. Some elements are named using the name of the country / scientist / colour / mythological character / planet.

Elements named using name of the country, scientist etc.

Name	Symbol	Name derived from
Americium	Am	America (Country)
Europium	Eu	Europe (Country)
Nobelium	No	Alfred Nobel (Scientist)
Iodine	I	Violet (Colour, Greek)
Mercury	Hg	God Mercury (Mythologic character)
Plutonium	Pu	Pluto (Planet)
Neptunium	Np	Neptune (Planet)
Uranium	U	Uranus (planet)

Writing the Symbols:

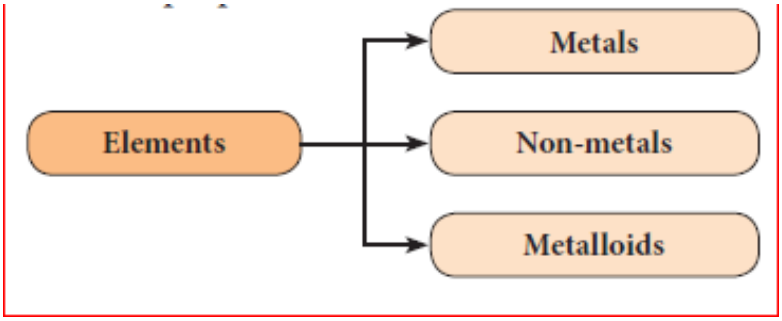
While writing the symbol for an element, we should adhere to the following rules.

1. If the element has a single English letter as a symbol, it should be written in capital letter.
2. For elements having two letter symbols, the first letter should be in capital followed by small letter

Metals and Non-metals:

The progress of man towards civilization is linked with the discovery of several metals and non-metals. Even today, the index of prosperity of a country depends upon the amount of metals and non-metals it produces. The wealth of a country is measured by the amount of gold in its reserve.

An element can be identified as metal or non-metal by comparing its properties with the general properties of metals and non-metals. In doing so, we find that some elements neither fit with the metals nor with non-metals. Such elements are called semimetals or metalloids. Elements are classified into metals, non-metals, and metalloids based on their properties.



Metals:

Iron, copper, gold, silver, etc. that we use in our daily life are metals. The properties and uses of metals are given below.

a. Physical properties of Metals:

- Metals are solid under normal conditions of temperature and pressure.
- Most metals are hard.
- All metals are shiny. The typical shine of metals is called metallic lustre.
- Metals generally have high density.
- Metals in general have high melting point and boiling point.
- Metals can be hammered into very thin sheets. This tendency of metals is called malleability. Using this property aluminum is transformed into silvery foils.
- Metals can be drawn into thin wires. This property of metals is called ductility. Example: Copper wires.
- Generally metals are good conductors of heat and electricity.
- On being hit, metals produce a typical sound. Hence, they are said to be sonorous.This property is being made used in making temple bells.

Shining metal

b. Uses of Metals:

- Iron is used for making bridges, engine parts, iron-sheets and bars.
- Copper is used for making electrical wires, coins and statue.
- Silver and gold are used for making jewels, and for decorative purposes and photography.
- Mercury is used in thermometers and barometers because of its high density and uniform expansion at different temperature.
- Aluminium is used in electrical wires, cables and in aerospace industries.
- Lead is used in automobile batteries, X-ray machines.

Non-metals:

Elements like sulphur, carbon, oxygen etc. are non-metals. Some of the properties and uses of non-metals are given below.

a. Properties of Non-metals:

- Non-metals occur as solids, liquids or gases at normal temperature. For example, sulphur and phosphorus occur in solid state while bromine occurs in liquid state. Elements like oxygen, nitrogen etc., occur in gaseous state.
- Non-metals are generally not hard except diamond (a form of carbon).
- Non-metals have a dull appearance.

- Non-metals are generally soft and have low densities. The exception here is diamond (a form of carbon) which is the hardest naturally occurring substance.
- Non-metals have low melting point and boiling point.
- Non-metals are non-malleable.
- Non-metals are not ductile. Carbon fibre is highly ductile.
- Non-metals are generally bad conductors of electricity. Graphite (a form of carbon) is an exception.
- Non-metals do not produce sound (nonsonorous) when hit.

b. Uses of Non-metals:

- Diamond (a form of carbon) is used for making jewels, cutting and grinding equipments. Graphite is used in making pencil lead.
- Sulphur is used in the manufacturing of gun powder and vulcanization of rubber.
- Phosphorus is used to make match boxes, rat poison etc.
- Nitrogen is used for manufacturing ammonia.
- Chlorine is used as a bleaching agent and in sterilizing water.
- Hydrogen is used as a rocket fuel and hydrogen flame is used for cutting and welding purposes. Hydrogen is also used as a reducing agent.

Diamond

Difference between Metals and Non-metals

Property	Metal	Non Metal
Physical state at room temperature	Usually solid (Occasionally liquid)	Solid, liquid or gas
Malleablity	Good	Poor (Usually soft or brittle)
Ductility	Good	Poor (Usually soft or brittle)
Melting point	Usually high	Usually low
Boiling point	Usually high	Usually low
Density	Usually high	Usually low
Conductivity (Thermal and Electrical)	Good	Very poor

Metalloids:

The elements which exhibit the properties of metals as well as non-metals are called metalloids. Examples: Boron, Silicon, Arsenic, Germanium, Antimony, Tellurium and Polonium.

a. Physical properties of Metalloids:

- Metalloids are solids at room temperature.
- They can form alloys with other metals.
- Some metalloids, such as silicon and germanium, can act as electrical conductors under specific conditions. Thus, they are called semiconductors.
- Silicon which is a metalloid appears lustrous, but it is neither malleable nor ductile. It is brittle - a characteristic of some non metals. It is a much poorer conductor of heat and electricity than the metals.
- The physical properties of metalloids tend to be metallic, but their chemical properties tend to be non-metallic.

b. Uses of Metalloids:

- Silicon is used in electronic devices.
- Boron is used in fireworks and as a fuel for ignition in rocket.

Compounds:

A compound is a pure substance which is formed due to the chemical combination of two or more elements in a fixed ratio by mass. The properties of a compound are different from those of its constituents. Water, carbon dioxide, sodium chloride etc. are few examples of compounds. A molecule of water is composed of one oxygen atom and two hydrogen atoms in the ratio 1:2 by volume or 8:1 by mass.

Classification of Compounds:

Based on the origin of chemical constituents, compounds are classified as inorganic compounds and organic compounds.

a. Inorganic compounds:

Compounds obtained from non living sources such as rock, minerals etc., are called inorganic compounds. Example: Chalk, baking powder etc.,

b. Organic compounds:

Compounds obtained from living sources such as plants, animals etc., are called organic compounds. Example: Protein, carbohydrates, etc.,

Both inorganic and organic compounds exist in all three states ie., solids, liquids and gases. Let us learn about some important compounds in solid, liquid and gaseous states.

Some compounds that exist in solid state are given.

Compounds in solid state

Compounds	Constituent Elements

Silica (Sand)	Silicon, Oxygen
Potassium hydroxide (Caustic potash)	Potassium, Hydrogen, Oxygen
Sodium hydroxide (Caustic soda)	Sodium, Oxygen, Hydrogen
Copper sulphate	Copper, Sulphur, Oxygen
Zinc carbonate (Calamine)	Zinc, Carbon, Oxygen

Compounds which exist in liquid state are given.

Compounds in liquid state

Compounds	Constituent Elements
Water	Hydrogen, Oxygen
Hydrochloric acid	Hydrogen, Chlorine
Nitric acid	Hydrogen, Nitrogen, Oxygen
Sulphuric acid	Hydrogen, Sulphur, Oxygen
Acetic acid (Vinegar)	Carbon, Hydrogen, Oxygen

Some compounds exist in gaseous state also. They are given.

Compounds in gaseous state

Compounds	Constituent Elements
Carbon dioxide, carbon monoxide	Carbon, Oxygen
Sulphur dioxide	Sulphur, Oxygen
Methane	Carbon, Hydrogen
Nitrogen dioxide	Nitrogen, Oxygen
Ammonia	Nitrogen, Hydrogen

Uses of Compounds:

We use a number of compounds in our daily life. Some of them are listed in table.

Uses of Compounds

Common Name	Chemical Name	Constituents	Uses

Water	Dihydrogen monoxide	Hydrogen and Oxygen	For drinking and as solvent.
Table salt	Sodium chloride	Sodium and Chlorine	Essential component of our daily diet, preservative for meat and fish.
Sugar	Sucrose	Carbon, Hydrogen and Oxygen	Preparation of sweets, toffees and fruit juices.
Baking soda	Sodium bicarbonate	Sodium, Hydrogen, Carbon and Oxygen	Fire extinguisher, preparation of baking powder and preparation of cakes and bread.
Washing soda	Sodium carbonate	Sodium, Carbon and Oxygen	As cleaning agent in soap and softening of hard water.
Bleaching powder	Calcium oxy chloride	Calcium, Oxygen and Chlorine	As bleaching agent, disinfectant and sterilisation of drinking water.
Quick lime	Calcium oxide	Calcium and Oxygen	Manufacture of cement and glass.
Slaked lime	Calcium hydroxide	Calcium, Oxygen and Hydrogen	White washing of walls.
Lime stone	Calcium carbonate	Calcium, Carbon and Oxygen	Preparation of chalk pieces.

Points to Remember:

- Anything which occupies space and has mass is called matter.
- Material which has a definite shape and definite volume at room temperature with any number of free surfaces is called solid.
- The molecule of a substance that contains two or more atoms of different elements combined together in a definite ratio, is said to be a molecule of a compound.
- Material which has a definite volume, but no definite shape and has one free surface, is called liquid.
- Material which has neither definite shape nor definite volume, is easily compressible and has no free surface is called gas.
- Metals are elements that are hard and shiny in appearance. Some metals used in our daily life are iron, copper, gold, silver, etc. Metals conduct heat and electricity.

- Elements that generally do not shine, that are neither too hard nor too soft are non-metals. All gases are non-metals. Some non-metals are sulphur, carbon, oxygen etc.
- Elements which have the properties of metal and non-metals are called metalloids. Some examples are arsenic, germanium etc.
- On being hit, metals produce a typical sound. They are said to be sonorous. This property is being made used in making temple bells.
- The easiest way to represent the element and to write the chemical formula is using symbols.

Glossary:

Disinfectant - Chemical substance which kills or prevents the disease causing microorganism.

Semiconductor - Substance which acts as bad conductor at low temperature and as good conductor at high temperature.

Reducing - agent Substance which undergoes oxidation reaction.

Carbohydrate - Compound which contains carbon, hydrogen and oxygen.

Bleaching agent - Substance which is used to remove the colour

Preservative - Substance which prevents food being spoiled by microorganism.