Elements, Compounds, Symbols & Formulae

Matter−Pure or Impure

You must have seen cartons of milk, ghee etc., with markings on them stating that the products inside are pure. Do you think the products are pure?

You might say that they are pure. This is because most people use the term "pure" to describe a product that is not adulterated or a product that is free from harmful substances such as bacteria, fungi, etc.

However, for a scientist, a substance is "pure" if it is composed of only one type of particles or molecules.

Let us first define the term 'substance'.

Substance: A substance may be defined as a form of matter that has a definite chemical makeup. Some substances can be separated into other types of matter by physical processes, while some cannot.

Pure substance: It is a substance composed of only the same type of particles. It has definite properties throughout.

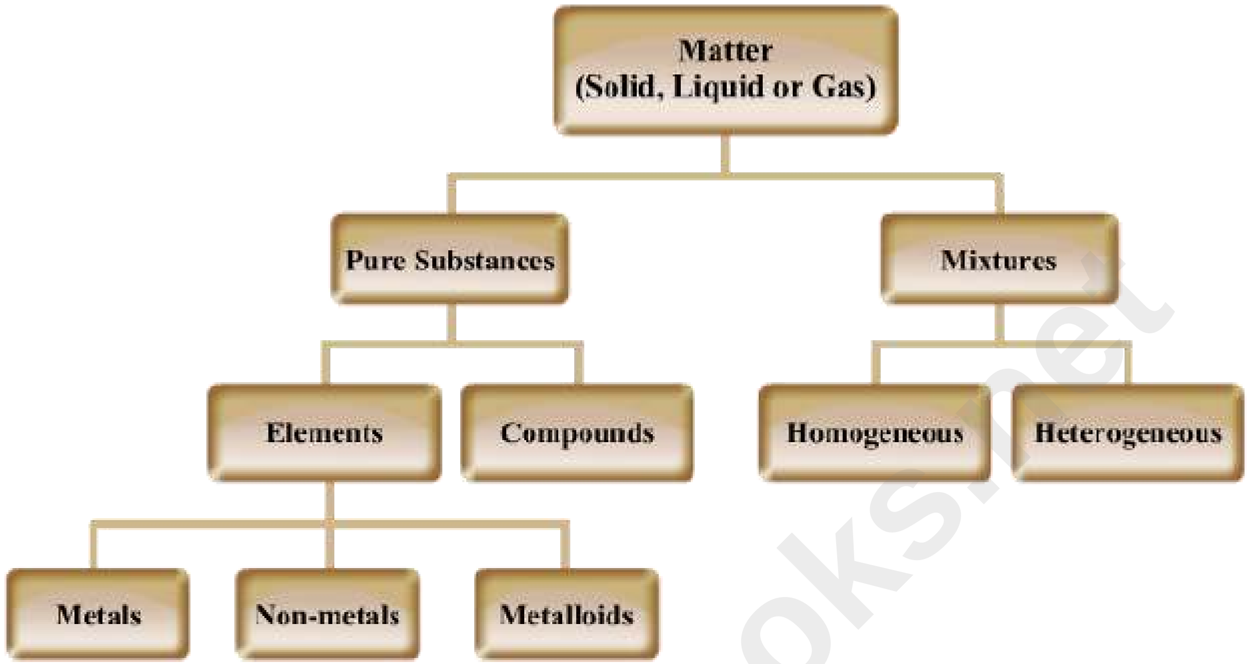
Milk is not made up of the same type of molecules. It consists of molecules of water, proteins, fats, etc. Therefore, chemically, milk is not pure.

Salt-water solution is not pure as salt can be separated from its solution by evaporation (a physical process).

However, salt (sodium chloride) is a pure substance and cannot be separated into its constituents by any physical process.

Most of the substances that we see around us are actually impure form of matter. Examples: gold in ornaments, steel or aluminium utensils, etc.

Classification of Matter



Pure Substances and Mixtures

Mixture: It may be defined as a material having two or more types of pure forms of matter. For example, milk is a mixture as it contains a combination of water molecules, fat molecules, and protein molecules.

Constituents of a mixture can be separated by physical processes such as evaporation, boiling, etc. Constituents of certain mixtures can also be separated manually. For example, a mixture of stones and sand can be separated manually.

On the other hand, salt cannot be manually separated from a salt-water solution. One needs to boil the mixture to separate salt from water. Some examples of mixtures are air, soil, milk, petrol, brass, blood, salt solution, etc.

Pure substances: Unlike mixtures which contain two or more types of particles, pure substances are composed of the same type of particles. Pure substance can be divided into two parts, that is, elements or compounds.

Pure Substances	Mixtures
1. It is a pure form of matter and has a definite composition. 2. It cannot be separated into its chemical constituents by any physical process. Example: Sodium chloride contains only one kind of pure particle and cannot be	1. It is a substance containing two or more types of pure forms of matter. 2. Constituents of a mixture can be separated from each other by physical processes such as evaporation, boiling, etc.

separated into its chemical constituents by any physical process.	Example: Salt-water solution is a mixture that is made up of more than one pure form of matter.

Classification of Elements

The term 'element' was first used by Robert Boyle. Later, a French chemist, Lavoisier defined elements as: '*the basic form of matter which cannot be broken down into simpler substances by chemical reactions*.' Examples of elements are iron, carbon, mercury and oxygen. Elements can be further classified as metals, metalloids and non-metals.

Properties of metals:

- They are generally hard and strong.
- They have lustre (shine) and can be polished.
- They are good conductors of heat and electricity.
- They are ductile. It means that they can be drawn into thin wires.
- They are malleable. It means that they can be hammered into thin sheets.
- They are sonorous. It means that they make ringing sound when struck.
- They generally have high boiling and melting points.
- Iron, gold, silver, copper, sodium, potassium, etc., are the examples of metals.

Classification of Elements

Properties of non-metals:

- They are generally soft and are not strong like metals.
- They are dull in appearance and are bad conductors of heat and electricity.
- They are not ductile. They break on stretching.
- They are not malleable. They break into pieces when hammered.
- They are not sonorous.
- They have lower melting and boiling points.
- Hydrogen, oxygen, carbon, iodine, etc., are the examples of non-metals.

Metalloids are the elements which exhibit certain properties of metals and non-metals. Boron, silicon, germanium, etc., are some examples of metalloids.

Know More

The metalloids are also called semiconductors. They are used in the manufacture of microchips.

Noble gases are the elements which do not react with other elements or compounds. These are also called as inert gases. Helium, neon, argon, krypton, xenon and radon are the only six inert gases of the periodic table.

Distinguishing Metals, Non-Metals and Metalloids

Metals	Metalloids	Non-metals
1. They are generally hard and strong.	1. These are elements having properties intermediate to those of metals and non-metals.	1. They are not strong like metals. They are generally soft.
2. They are shiny (lustrous) and can be polished.	2. Boron, silicon and germanium are examples of metalloids.	2. They are dull in appearance.
3. They are good conductors of heat and electricity.		3. They are bad conductors of heat and electricity.
4. They are ductile, so they can be drawn into thin wires.		4. They are not ductile, so they break when stretched.
5. They are malleable, so they can be hammered into thin sheets.		5. They are not malleable, so they break into pieces when hammered.
6. They are sonorous, so they make a ringing sound on being struck.		6. They are not sonorous, so they do not make a ringing sound on being struck.
7. They generally have high boiling and melting points.		7. They have low melting and boiling points.
8. Iron, gold, silver, copper, sodium and potassium are examples of metals.		8. Hydrogen, oxygen, carbon and iodine are examples of non-metals.
9. Mercury is the only metal, which is liquid at room temperature.		9. Bromine is a non-metal, which is liquid at room temperature.

Compounds

Compound is defined as the substance composed of more than one element. These elements which make up a compound are combined in a definite proportion.

Water, copper sulphate, ammonium chloride, sodium chloride (common salt), etc., are some examples of compounds.

• Compounds are formed when two or more elements combine chemically in fixed proportions.

• For example, water is a compound. It is formed when two atoms of hydrogen combine chemically with one atom of oxygen. This composition of water is constant throughout the universe, no matter where or how it is formed.

• The physical and chemical properties of a compound may or may not be similar to its constituents. For example, hydrogen is a combustible substance and oxygen supports combustion. However, water (a compound of hydrogen and oxygen) neither burns nor supports combustion. In fact, it is used as a fire extinguisher.

Compounds

Know Your Scientist

Robert Boyle (1627–1691) was a chemist and physicist of Anglo-Irish origin. He is one of the first modern chemists and a pioneer of the modern experimental scientific method. He is best known for Boyle's law which depicts that at a constant temperature, the pressure of a gas is inversely proportional to its volume in a closed system. He is considered to be one of the 'fathers of modern chemistry'.

Antoine-Laurent de Lavoisier (1743–1794) was a prominent chemist and biologist of French origin. He is considered to be one of the 'fathers of modern chemistry'. He is credited with the identification and naming of oxygen and hydrogen gases. He also predicted silicon to be an element. He was among the first to list down the known elements. He discovered that mass always remains the same irrespective of the changes in matter.

Compounds

Characteristics of compounds:

1. A compound is formed by mixing two or more elements in a fixed ratio by mass. For example, water is formed by mixing hydrogen and oxygen in the fixed ratio of 1:8 by mass.

2. The properties of a compound are entirely different from the properties of its constituents.

For example, oxygen supports combustion and hydrogen is an inflammable gas, while water is neither combustible nor does it support combustion.

3. Whenever a compound is formed, it releases or absorbs heat. For example, when nitrogen and hydrogen combines to form ammonia, it releases a lot of heat.

4. Since a compound is a pure substance, it will have fixed melting and boiling points. For example, ice melts at 0ºC, while water boils at 100ºC.

5. The constituents of a compound cannot be separated using simple physical methods.

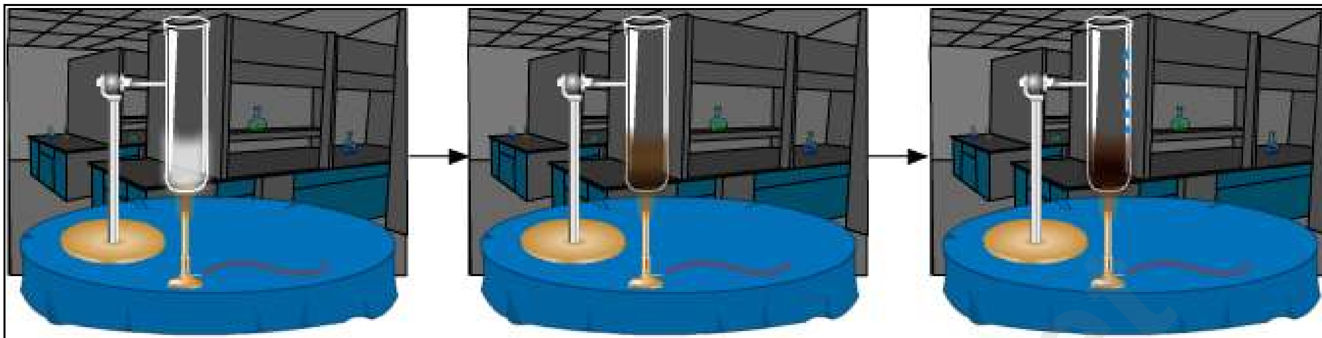
For example, water cannot be reduced to hydrogen and oxygen just by heating or filtering. Electrolysis of acidified water is the only way to separate the constituents.

6. Any compound is homogenous in nature.

Let us perform an activity to show that sugar is a compound.

Activity Time

Take some sugar in a test tube and heat it over a flame. **What do you observe?** You will see that the sugar will melt and change its colour from white to brown. If you heat it further, you will observe a black mass.



Charring of sugar

What do you call it?

This is known as charring of sugar.
At the bottom of the test tube, you will observe water droplets. These are formed by the decomposition of sugar and not by the condensation of water vapours. This shows that sugar is formed by carbon and water. It also proves that sugar is a compound.

Classification of compounds:
Compounds can be classified into two categories. They are as follows:

(a) Organic compounds: Compounds obtained from living things, such as plants and animals, are called organic compounds. For example: carbohydrates, proteins, fats, etc. obtained from plants and animals.

(b) Inorganic compounds: Compounds obtained from non-living things, such as rocks, minerals, etc., are known as inorganic compounds. For example: chalk, washing powder, sodium hydroxide, etc.

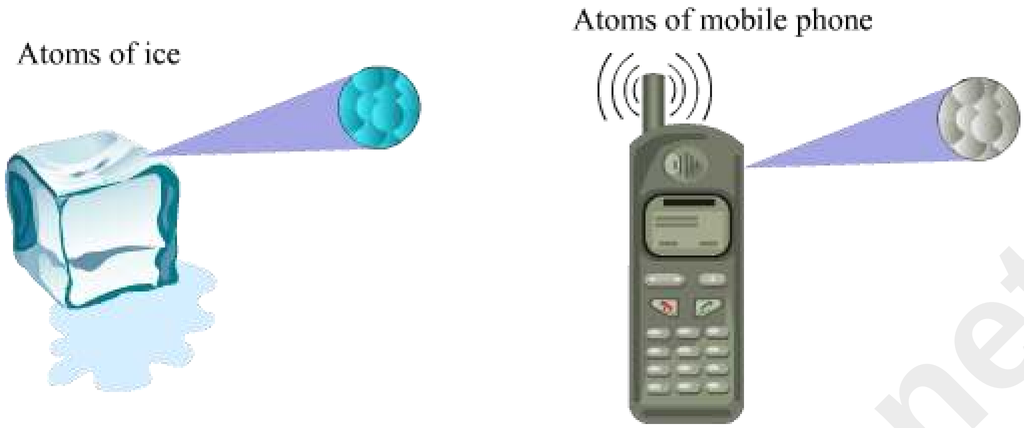
In this lesson you will study about atoms, molecules, elements and compounds.

Atoms

You must be familiar with the different types of matter around us and the state in which they exist. Do you know what the whole matter around us is made up of?

In the previous learning piece, we studied that matter is made up of minute particles called molecules. But, do you know that molecule is not the only tiny particle of matter? It further consists of a group of very small particles called **atoms**.

So, we can say that **'matter consists of very small particles called atoms'.**



Let us get very clear knowledge about atoms through this lesson.

The word 'atom' is derived from the Greek word '*atomos*' which means 'indivisible'. It was the Greek philosopher Democritus who coined the term.

Before coming to the point of describing atoms, let you be introduced to another new term called **elements**. Elements are the pure substances or matters that consist of only one kind of atoms. For example, Iron is an element that consists of all the atoms of iron. In other words, we can say that one type of atom represents one element or vice versa.

Elements can be solid like gold, liquid like mercury and gaseous like oxygen. They are classified into metals (for example: silver, gold, copper, etc.), non-metals (for example: chlorine, nitrogen, phosphorus, etc.) and inert gases (for example: helium, neon, argon, etc.). Till now more than 109 elements have been discovered, out of which 102 are found in nature.

Now, we can define atom as the smallest particle of an element that posses all the properties of that element.

Dalton's Atomic Theory

In the early nineteenth century, an English chemist named John Dalton (1766- 1844), proposed a theory about **atoms** known as 'Dalton's atomic theory'. It proved to be one of the most important theories of science. The various laws of chemical combination also supported Dalton's theory. Dalton asserted that 'atoms are the smallest particles of matter, which cannot be divided further'.

The postulates of Dalton's atomic theory are as follows:

• All matter is made up of very tiny particles. These particles are called atoms.

• An atom cannot be divided further, i.e., atoms are indivisible.

• Atoms can neither be created nor destroyed in a chemical reaction.

• All atoms of an element are identical in all respects, e.g. in terms of mass, chemical properties, etc.

• Atoms of different elements differ from each other, i.e., they have different masses and chemical properties.

• Atoms of different elements combine whole-number ratios to form compounds.

• In a given compound, the relative numbers and types of atoms are constant.

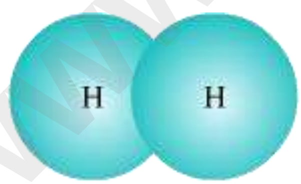
Now, let us study how these tiny particles combine to form molecules and how these molecules are represented with symbols of atom through molecular formula.

Molecules

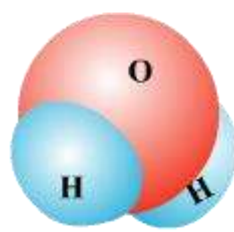
Most atoms are not stable in their free state. So, they combine with other atoms to form molecules.

The term ‘**molecule’** originates from the French word ‘*molecule*’, which means ‘extremely minute particle’.

A molecule may consist of one or more same or different atom(s). For example, a hydrogen molecule is formed when two hydrogen atoms combine with each other. Similarly, a sulphur molecule consists of 8 sulphur atoms. A water molecule consists of two atoms of hydrogen and one atom of oxygen.



Hydrogen molecule



Water Molecule

Now, we can easily understand that molecules are of two types:

• **Molecules of element**: Molecules that consist of similar atoms, for example, hydrogen molecule

• **Molecules of compound**: Molecules that consist of dissimilar atoms, for example, water molecule

Compounds are pure substances consisting of two or more atoms of different elements that combine chemically in definite ratio.

For example, water is a compound (molecule of compound) which consists of two hydrogen atoms and one oxygen atom. Atoms that constitute compounds do not show the properties of compound.

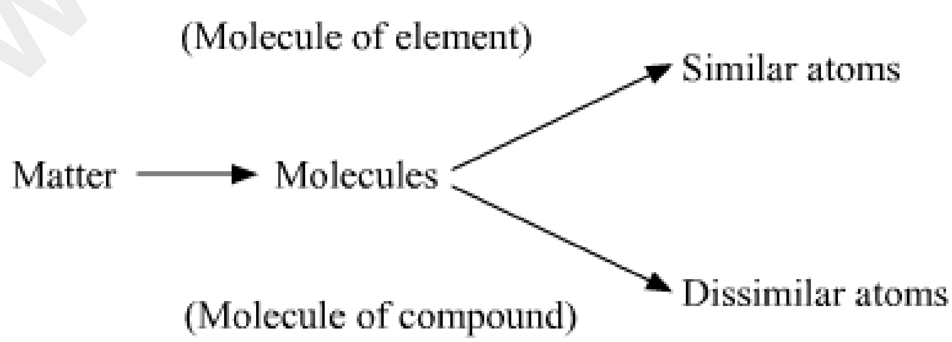
Compounds can be solid like potassium permanganate ($KMnO_4$), liquid like water (H_2O), or gaseous like carbon dioxide (CO_2).

After reading the above discussion about molecules, we can now easily define the molecules.

'Molecules are defined as small particles of elements or compounds that are capable of independent existence'.

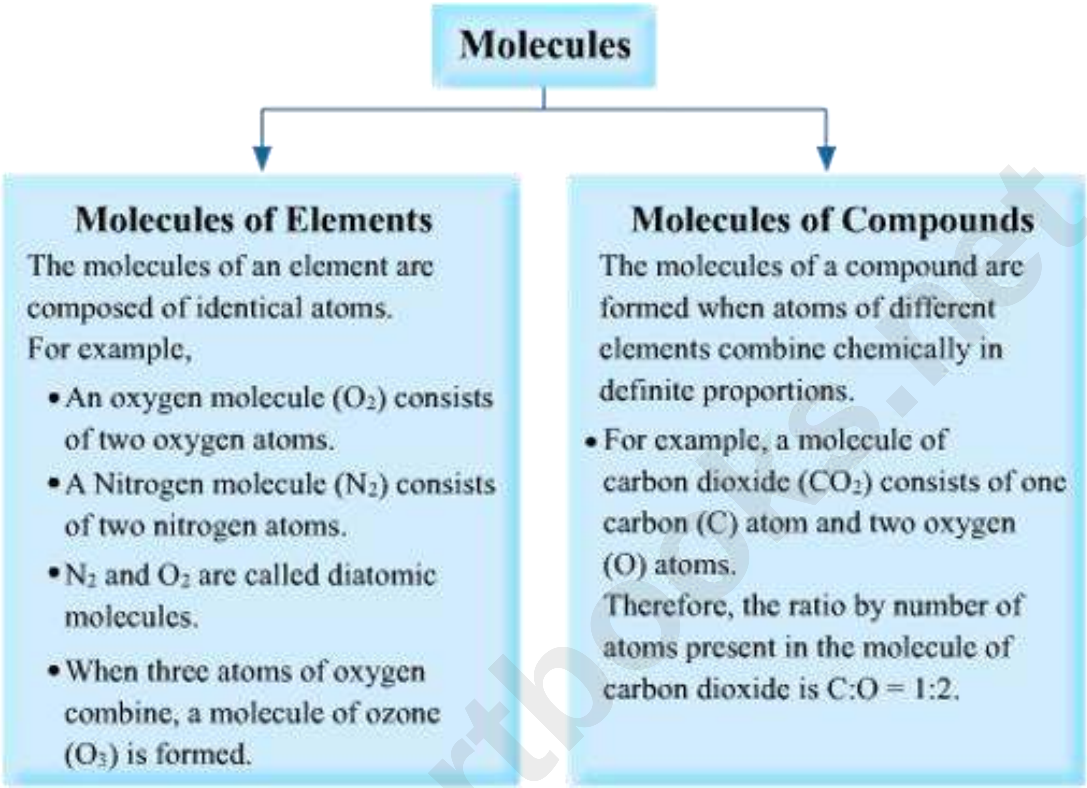
To understand more clearly about molecules, let us take the example of crystals of sugar. If we keep on breaking the crystals of sugar, the smallest particle or crystal of the sugar obtained possess all the properties of the sugar and is called a molecule. If this particle of sugar is further divided, it will reach a point when the sugar molecule will not be divisible further. We will get minute particles of carbon, oxygen and hydrogen atoms of which sugar is made up of. These atoms will not possess the properties of the sugar any more.

Summarising the above discussion



We will study about elements and compounds in the next learning piece.

Molecules



Did You Know?

The term ‘**molecule’** originates from the French word ‘*molécule*’, which means ‘extremely minute particle’. It was coined by the French philosopher and mathematician Rene Descartes in the early seventeenth century.

In view of John Dalton’s laws of definite and multiple proportions, the existence of molecules was accepted by many chemists since the early nineteenth century.

However, it is the work of Jean Baptiste Perrin on the Brownian motion (1911) of particles of liquids and gases which is considered to be the final proof of the existence of molecules.

Atomicity of Molecules

The number of atoms constituting a molecule is known as its atomicity. The given table lists the atomicity of some common elements.

Elements	Atomicity
Helium (He), Neon (Ne), Argon (Ar)	Monoatomic (1 atom per molecule)
Oxygen (O_2), Hydrogen (H_2), Nitrogen (N_2) Chlorine (Cl_2), Fluorine (F_2)	Diatomic (2 atoms per molecule)
Phosphorus (P_4)	Tetratomic (4 atoms per molecule)
Sulphur (S_8)	Polyatomic (8 atoms per molecule)

Did You Know?

Buckminsterfullerene is an allotrope of carbon in which sixty carbon atoms are bonded together.

Molecular Formula: A Brief Overview

Just like each atom has a unique symbol, each compound has a unique molecular formula.

The molecular formula of a compound provides information about the names and numbers of atoms of the different elements present in a molecule of that compound.

Molecular formula is a **chemical formula** that indicates the kinds of atoms and the numbers of each kind of atom in a molecule of a compound.

Examples

- The molecular formula of glucose is $C_6H_{12}O_6$. One molecule of glucose contains 6 atoms of carbon, 12 atoms of hydrogen and 6 atoms of oxygen.
- The molecular formula of water is H_2O. One molecule of water contains 2 atoms of hydrogen and 1 atom of oxygen.

Salient features of chemical formula:

- Compounds are formed when two or more elements combine chemically. Hence, compounds can also be represented using symbols.
- The notation used for representing any compound is called chemical formula of that compound.
- Each compound has a unique chemical formula.
- The chemical formula of any compound tells us about : The different elements which combine to form the compound and the number of atoms of each element present in a molecule of the compound
- For example, H_2O is the chemical formula of water. This denotes that there are two atoms of hydrogen and one atom of oxygen present in one molecule of water.

Chemical Formulae

Let us understand the information derived from chemical formulae by taking the example of carbon dioxide. The chemical formula of carbon dioxide is CO_2. Using this formula, we can derive the following information about carbon dioxide.

- Two elements are present in carbon dioxide: carbon(C) and oxygen (O).
- CO_2 represents one molecule of carbon dioxide.
- Since one atom of carbon combines with two atoms of oxygen, the **valency** of carbon is twice that of oxygen.
- CO_2 is a neutral molecule. It has no charge.
- The relative atomic masses of carbon and oxygen are 12 u and 16 u respectively. So, the ratio by mass between carbon and oxygen is 12 : 32, i.e., 3 : 8.

Writing Chemical Formulae

To write the chemical formula of a compound, one should have prior knowledge of two things.

- **The symbols of the constituent elements.**
- **The combining capacity of the atom of each element constituting the compound.**

The number of atoms of other elements with which one atom of an element combines is decided by the valency of that element.

For example, both hydrogen (H) and chlorine (Cl) have a valency of 1. Therefore, one atom of hydrogen reacts with one atom of chlorine to form one molecule of hydrogen chloride (HCl).

The valency of an ion is equal to the charge on it.

Chemical Formulae

The valencies of some common ions are given in the following table.

Names of ions	Symbols	Valencies	Names of ions	Symbols	Valencies
Aluminium	Al^{3+}	3	Sulphite	SO_3^{2-}	2
Ammonium	NH_4^{+}	1	Bromide	Br^{-}	1
Calcium	Ca^{2+}	2	Carbonate	CO_3^{2-}	2
Copper(II)	Cu^{2+}	2	Chloride	Cl^{-}	1
Hydrogen	H^{+}	1	Hydride	H^{-}	1

Chemical Formulae

The valencies of some common ions are given in the following table.

Names of ions	Symbols	Valencies	Names of ions	Symbols	Valencies
Iron(II)	Fe^{2+}	2	Hydrogen carbonate	HCO_3^{-}	1
Iron(III)	Fe^{3+}	3	Hydroxide	OH^{-}	1
Magnesium	Mg^{2+}	2	Nitrate	NO_3^{-}	1
Nickel	Ni^{2+}	2	Nitrite	NO_2^{-}	1
Potassium	K^{+}	1	Oxide	O^{2-}	2
Silver	Ag^{+}	1	Phosphate	PO_4^{3-}	3

Sodium	Na^+	1	Sulphate	SO_4^{2-}	2
Zinc	Zn^{2+}	2	Sulphide	S^{2-}	2

Chemical Formulae

The following rules need to be kept in mind while writing the chemical formulae of compounds.

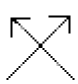
•The valencies or charges on the ions must be balanced. The charge on a cation must be equal in magnitude to the charge on an anion so that the opposite charges cancel each other out and the net charge of the molecule becomes zero.

Examples

- In case of CaO, the valency of Ca is +2 and that of O is –2. These are then crossed over and the compound formed is CaO.

Formula of calcium oxide

Symbols Ca O



Charges 2+ 2–

- The charge on Mg^{2+} is +2 and that on Cl^- is –1. Thus, one Mg^{2+} ion combines with two Cl^- ions to form a molecule with the formula $MgCl_2$.
- In case of a compound consisting of a metal and a non-metal, the symbol of the metal is written first.

Chemical Formulae

Example

- In calcium chloride ($CaCl_2$) and zinc sulphide (ZnS), calcium and zinc are metals, so they are written first; chlorine and sulphur are non-metals, so they are written after the metals.

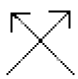
- In case of compounds consisting of polyatomic ions, the polyatomic ions are enclosed in brackets before writing the number to indicate the ratio.

Example

- In case of aluminium sulphate, to balance the charges, two SO_4^{2-} ions combine with one Al^{3+} ion. Thus the formula for aluminium sulphate is $Al_2(SO_4)_3$. Here, the brackets with the subscript 3 indicate that three sulphate ions are joined to two aluminium ions.

Formula of aluminium sulphate

Symbols Al SO_4



Charges 3+ 2–

Chemical Formulae

Naming Certain Compounds

Compound	Rule	Example
A metal and a non-metal	Metal is written first Non-metal is written last with suffix –*ide*	Calcium nitride (Ca_3N_2)
Two non-metals	Less electronegative non-metal is written first In case, more than one atom of a non-metal is present then prefix like –*di*, –*tri*, –*tetra* etc. is added	Phosphorous pentachloride (PCl_5)
Two elements and oxygen	Oxygen is placed at end of the formula Following prefixes or suffixes are used depending on the number of oxygen atoms present: Less than two oxygen atom: *hypo* (prefix) Two oxygen atoms: –*ite* (suffix) Three oxygen atoms: –*ate* (suffix) More than three oxygen atoms: –*per* (prefix)	Sodium hypochlorite ($NaClO$) Sodium chlorite ($NaClO_2$) Sodium chlorate ($NaClO_3$)

Compound	Rule	Example
		Sodium perchlorate ($NaClO_4$)
Acids	Binary acids Prefix: *hydro* Suffix: *−ic* with the name of second element Polyatomic radicals Suffix: *−ic* on the basis of second element Prefix not used	Hydrochloric acid (HCl) Sulphuric acid (H_2SO_4)
Trivial names	Used for specific compounds No systemic rule followed	Ammonia (NH_3) Water (H_2O)

Chemical Formulae

Solved Examples

Easy

Example 1:

Give two examples each of molecules having one atom, two atoms and three atoms.

Solution:

Molecules having one atom (/monatomic molecules): Argon (Ar) and Neon (Ne)

Molecules having two atoms (/diatomic molecules): Nitrogen (N_2) and Oxygen (O_2)

Molecules having three atoms (/triatomic molecules): Nitrogen dioxide (NO_2) and carbon dioxide (CO_2)

Medium

Example 2:

The valencies of a few ions are provided below.

H^+ = 1, SO_4^{2-} = 2, Br^- = 1, Mg^{2+} = 2 and K^+ = 1

Write the formulae for magnesium bromide, magnesium sulphate, hydrogen bromide and potassium sulphate.

Solution:

•Magnesium bromide: $MgBr_2$

•Magnesium sulphate: $MgSO_4$

•Hydrogen bromide: HBr

•Potassium sulphate: K_2SO_4

Hard

Example 3:

Write the names of the following compounds.

i) H_2CO_3

ii)KNO_3

iii)$(NH_4)_3PO_4$

iv)Na_2CO_3

v)$Al(NO_3)_3$

vi)$NaHCO_3$

Solution:

i)H_2CO_3: Hydrogen carbonate

ii)KNO_3: Potassium nitrate

iii)$(NH_4)_3PO_4$: Ammonium phosphate

iv)Na_2CO_3: Sodium carbonate

v)$Al(NO_3)_3$: Aluminium nitrate

vi)$NaHCO_3$: Sodium hydrogen carbonate

Uses of Metals and Non-Metals

We are familiar with a number of substances, which are very hard and shiny in nature such as iron, aluminium, gold, silver, and copper. You must have observed that these materials produce a sound on being struck. Such substances are called **metals**.

Substances which are dull in appearance and not very hard are called **non-metals** such as carbon, sulphur, iodine, etc.

There are 92 naturally occurring elements, which are classified into metals and non-metals. Among them, most elements are metals with less than 20 elements as non-metals. Here, we will discuss the properties and uses of metals and non-metals.

Metals are hard and shiny in appearance. They are malleable, ductile, and good conductors of heat and electricity. As a result of all these properties, metals have many uses.

1. Metals such as gold and silver are very shiny in appearance. These metals are quite ductile and malleable in nature. Also, these metals are expensive and do not corrode easily (though silver becomes black after some time due to corrosion). Hence, these metals are used in making jewellery.

2. Metals such as copper and aluminium are used to make wires as they are very good conductors of electricity. Also, they are very ductile. Copper and aluminium wires are widely used in electrical fittings in houses.

3. Metals such as iron, copper, and aluminium are good conductors of heat. Hence, they are used for making cooking utensils and water boilers.

4. Metals are malleable. Hence, they can be hammered into very thin sheets. For example, silver and aluminium foils are made by hammering these metals. Silver foils are used for decorating food items, whereas aluminium foils are used for wrapping food items such as chocolates and many such materials.

5. Metals are hard and rigid. Hence, they can be used in making machinery, automobiles, aeroplanes, trains, satellites etc. Aluminium is used for making parts of aeroplanes as it is very light in comparison to other metals.

Do You Know:

Silver is shiny and is a good reflector. It reflects about 90 percent of light falling on it. Hence, it is used for making high reflecting mirrors.

Like metals, non-metals also have various uses. We will now discuss the uses of non-metals.

1. Oxygen, which is a non-metal, is essential for life. It is used by plants and animals for the process of respiration. Oxygen is also used in factories, homes etc. as it supports combustion.

2. Nitrogen, a non-metal, is used in fertilizers to enhance the growth of plants.

3. Chlorine has the ability to kill germs. Hence, it is used in water purification as a disinfectant.

4. Tincture iodine is a solution of iodine in alcohol, which is used as an antiseptic.

5. Non-metals are also used in manufacturing crackers.

Some Common Uses of Metals

Uses of aluminium

- Aluminium is cheap and resistant to corrosion, so it is used for making cooking vessels, picture frames and household fittings.
- It is used in high-voltage electric transmission wires.
- Aluminium foils are used for packing purposes.
- It is used for making alloys like duralumin and magnalium.
- It is also used in paints.
- It is used in making mirrors of telescopes as it is an excellent reflector of light.
- It is used in thermite welding.
- Thermit (a mixture of 3 parts of Fe_2O_3 and 1 part of Al powder) is covered with an ignition mixture (Potassium chlorate and magnesium powder) in a crucible.
- The ignition mixture is ignited using a fuse of burning magnesium.
- In the reaction, Fe_2O_3 is reduced to Fe with the evolution of a large amount of heat.
- The molten Fe falls between the broken pieces and solidifies, joining the pieces in turn.
- $Fe_2O_3 + 2\ Al \rightarrow Al_2O_3 + 2\ Fe + Heat$

Curiosity Corner

Aluminium-air batteries, also called **Al-air** batteries, are batteries in which the reaction of oxygen present in the air with aluminium is used to produce electricity.

Uses of magnesium

Magnesium is a silvery white metal.

- A mixture of powdered magnesium and potassium chlorate is used in fireworks.
- It is used as a fuse wire in thermite welding.
- It is used as a reducing agent in the extraction of metals.
- It is also used for the preparation of alloys like magnalium.

Uses of mercury

- It is used as a thermometric liquid in labs.
- It is used in thermometers.
- It is also used as an amalgam in dentistry for filling tooth cavities.

DO YOU KNOW?

As a liquid mirror, mercury is used as an alternative to big telescopes.

Uses of zinc

- It is used for galvanising iron.
- It is used for making containers of the dry cell.
- It is used in the preparation of alloys.
- It is also used in the extraction of gold and silver.

DO YOU KNOW?

The most exploited zinc ore is sphalerite or zinc sulfide; the largest exploitable deposits are found in Germany, Canada and the United States

Uses of iron

- Wrought Iron (carbon content 0.1 - 0.25%) is used for making tin roofing, buckets, trunks and electromagnets.
- Cast iron (carbon content 2.5 - 5%) is used for making drain pipes, manhole covers and machinery.
- It is also used for manufacturing steel.

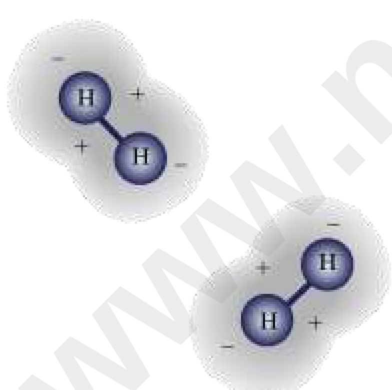
Uses of copper

- It is used for making electric transmission wires.
- It is used in the coils of electric motors and electric generators.
- It is used for making alloys such as brass and bronze.
- It is used in the radiators of automobiles.
- It is also used for making coins and printed circuits.

Some Common Uses of Non-metals

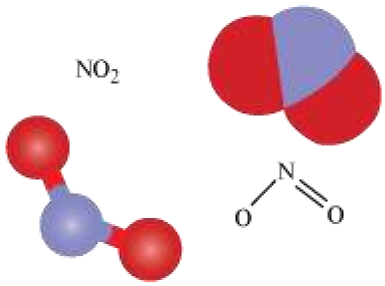
Hydrogen - It is the lightest element. It is found in the gaseous state.

- It is used as a non-polluting fuel. It is present in coal gas and water gas.
- Oxy-hydrogen flame is used for cutting and welding metals.
- It is also used for filling weather observation balloons.



Nitrogen

- It dilutes the activity of oxygen, so it is used for controlling the rate of combustion.
- It helps plants manufacture proteins.
- It is used in the manufacture of ammonia gas.
- It is also used for preserving packaged food.



Oxygen

- It is essential for the respiration of living beings. It is also needed for artificial respiration.
- It is required for the combustion of fuels and is also used in rocket fuels.
- As dissolved oxygen, it keeps water fresh and is used for respiration by marine organisms.
- It is also used for cutting and welding purposes.

Do you know?

The diamagnetic form of molecular oxygen (O_2) is commonly known as molecular oxygen.

Chlorine

- It is used in bleaching powders.
- It is used for sterilising drinking water.
- It is also used in pesticides and acids.

Do you know?

Insecticides and pesticides are used for killing insects. They include fungicides, larvicides and rodenticides.

Iodine

- In the form of sodium iodide or potassium iodide, it is required for the proper functioning of the body.
- In the form of silver iodide, it helps in making photographic films.

- It is also used for dressing wounds.
- In the form of iodoform, it is used in medicines.

Do you know?

Iodoform is a compound of iodine with the chemical formula CHI_3. It is a pale-yellow solid which was quite commonly used in antiseptics and disinfectants.

Carbon

- It is used in the electrodes of electrolytic cells.
- In the form of graphite, it is used as a dry lubricant, and as pencil lead.
- Graphite is also used as electrode material in electrolytic cells because it is a good conductor of electricity.
- It is used for making heat-resistant crucibles.
- It is employed in nuclear reactors.
- It is used in carbon arc lamps.
- Coal is used as a fuel in homes, industries, pharmaceutical and textile sectors.
- Diamond is the most crystalline form of carbon and is used as a precious gem. The impure gem is used for grinding hard substances and drilling heads.

Do you know?

Coke is the dry solid material left after heating coal to a very high temperature.

Sulphur

- It is used in the chemical industry for manufacturing sulphuric acid, sodium thiosulphate, carbon disulphide, etc.
- It is used in insecticides and fungicides
- It is used in medicines.
- It is also used for vulcanising rubber.

Do you know?

Natural rubber is sticky, easily deforms when warm and is brittle when cold. **Vulcanisation** refers to a specific process which involves heating rubber to high temperatures and adding sulphur or other equivalent curatives.

Some Common Uses of Metalloids

Silicon

- It is used for making solar cells, microchips and transistors.
- It is used for manufacturing polymers, also called silicones.
- It is used for manufacturing ferro-silicon, a special form of steel and silicon carbide. It is one of the hardest substances known.
- It is a very important component of cement and glass.

Do you know?

A **solar cell** or **photovoltaic cell** is a device that converts light into electric energy.

Germanium

- Germanium is commonly used as a semiconductor.
- It is used as a transistor in many electronic applications when mixed with arsenic, gallium, etc.
- It is used to form alloys and as a phosphor in fluorescent lamps.

Noble gases

- Noble gases are very non-reactive gases and are therefore used to provide the inert environment.
- **Helium:** for filling weather observation balloons
- **Argon:** For filling electric bulbs

The metals that are not acted upon by mild acids and alkalis, and occur in nature in the free state are called **noble metals**. Thus, they are resistant to corrosion and oxidation. These metals are very precious.

They include –

- Silver
- Gold
- Platinum
- They also include ruthenium, rhodium, palladium, osmium and iridium.

Do you know?

In India, pure gold is denoted as 24 carats. The gold that is generally used for making ornaments is 22 parts of pure gold alloyed with 2 parts of either silver or copper. This mixture is known as 22 carat gold.

Let us study the uses of noble metals.

Uses of silver

Silver is a shiny, heavy metal, and the best conductor of electricity.

- It is used for making silver ornaments and expensive utensils such as glasses, mugs, etc.
- It is used for making coins.
- Salts of silver like silver chloride are used for making photographic films.
- Silver foils are used for decorating sweets.
- Silver is also used for making mirrors using a process called sputtering.

Uses of gold

Gold is bright yellow and a highly malleable and ductile metal.

- Gold is used as the index of wealth. The countries which have more gold reserve are considered to be wealthy.
- It is used for making ornaments.N
- It is used for making high-value coins and medals.
- It is used for covering the mainframe of artificial satellites.

Uses of platinum

Platinum is silvery white, a highly malleable and ductile metal**.**

- It is used for making ornaments and watches.
- It is used as a catalyst in the manufacture of sulphuric acid and nitric acid.
- It is used in platinum catalytic converters.
- It is also used in chemical laboratories.