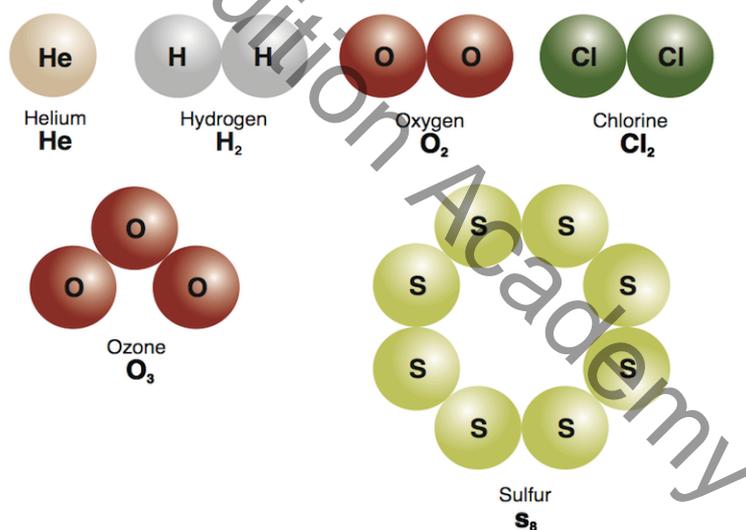


Element, Compounds and Mixture

1- Elements

- **Definition:** Elements are made up of atoms, and each element only has **one type** of atom. For example, oxygen is only made up of oxygen atoms.
- **Arrangement of Element in the periodic table.** There are about 100 different elements, which are arranged in the periodic table based on their properties.
- **Arrangement by atomic number.** All elements are arranged in the periodic table in ascending order of **atomic number**. Different element has different proton numbers.
- Most are metals, a few are metalloids (also known as semi-metals), and the rest are non-metals.



2- Chemical symbols

- Atoms of each element are represented by their own chemical symbol. A chemical symbol:
 - consists of one or two letters
 - always starts with a capital letter, with any other letter in lower case

C2: Atomic structure

And Periodic table

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- For example the symbol O represents an atom of oxygen, and Na represents an atom of sodium. You must write the chemical symbol of sodium as Na, not as NA, na or nA.

First Twenty Elements				
1 H Hydrogen	2 He Helium	3 Li Lithium	4 Be Beryllium	5 B Boron
6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon
11 Na Sodium	12 Mg Magnesium	13 Al Aluminium	14 Si Silicon	15 P Phosphorus
16 S Sulfur	17 Cl Chlorine	18 Ar Argon	19 K Potassium	20 Ca Calcium

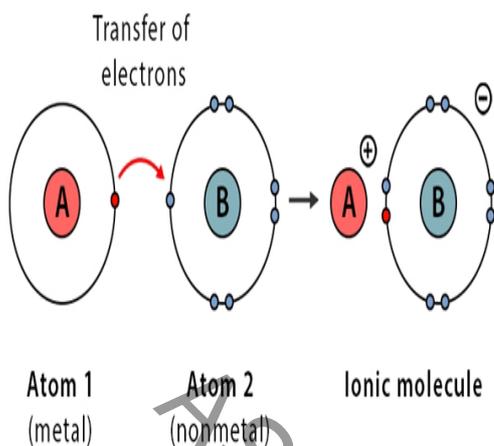
First 20 Elements 

3-Compounds

- **Definition of compound:** A **compound** is a substance that contains two or more elements chemically combined together. The elements in each compound are present in fixed proportions – for example in carbon dioxide (CO₂) for every gram of carbon there is 2g of oxygen.
- **The formation of compounds:** Making a compound involves **making** bonds between atoms. Sometimes you also need to **break** bonds in the reactants. usually results in a change in energy which can be detected. So either energy is required for the formation or energy is made during the formation.
- **Transferring of electrons to make compounds:** **Electrons** can either be shared, lost or gained to form chemical bonds.

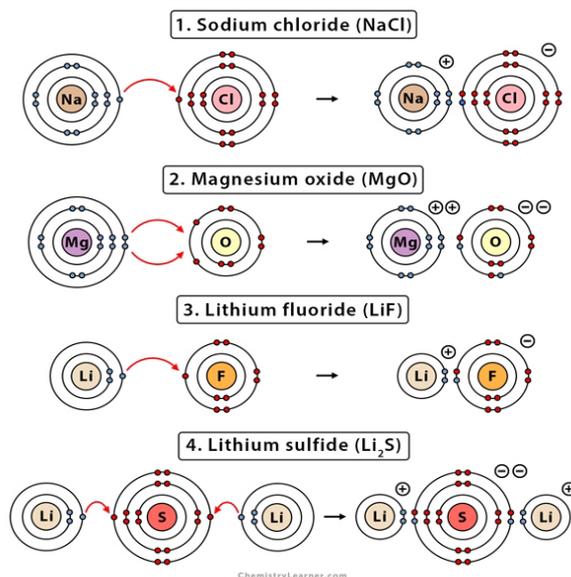
a) **Ionic Bonding:** A compound which is formed from metal and non metals. Metal loses Electrons and Non- metal gains Electrons and form ionic bonding between them.

Ionic Bond



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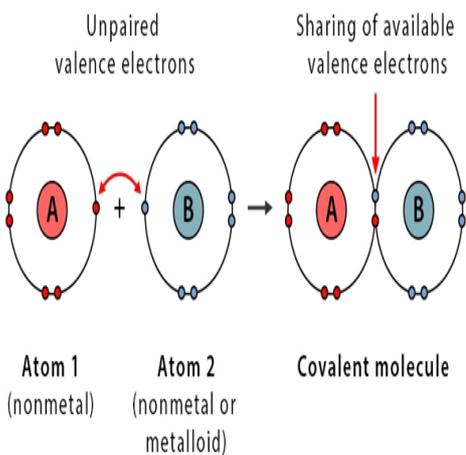
Ionic Bond Examples



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b) Covalent bonding: A compound which is formed from non-metals. Each atom shares electrons with an other. This sharing type of bonding is called Covalent bonding

Covalent Bond

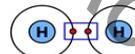


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Types of Covalent Bond

Based on the number of shared electron pairs

Single Bond



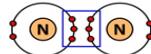
Hydrogen (H₂)

Double Bond



Carbon dioxide (CO₂)

Triple Bond

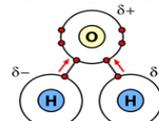


Nitrogen (N₂)

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Based on the polarity and coordination of the atoms

Polar Bond



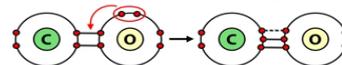
Water (H₂O)

Nonpolar Bond



Fluorine (F₂)

Coordinate Bond

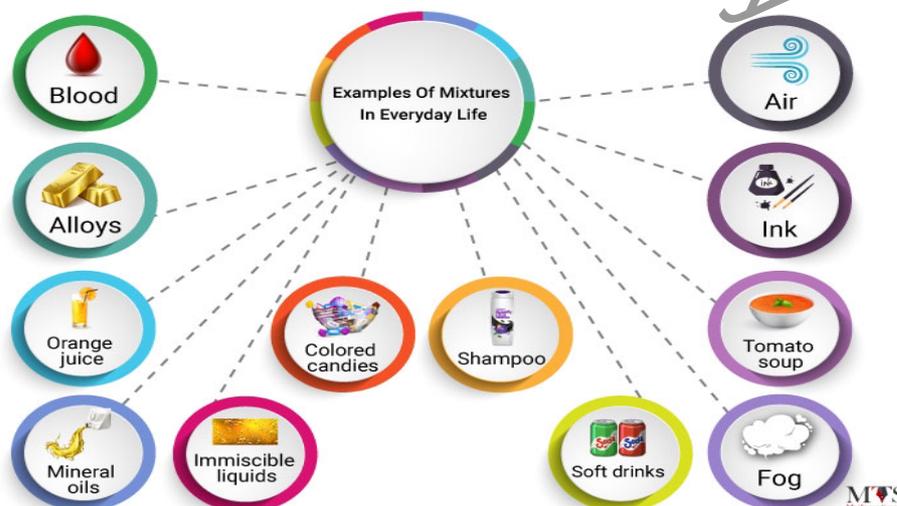
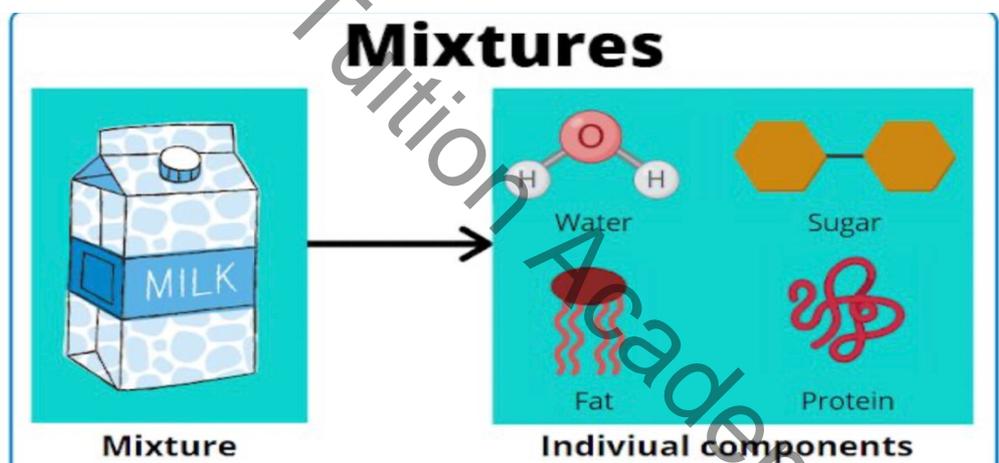


Carbon monoxide (CO)

4- Mixture

Definition : A **mixture** is made from two or more elements or compounds being mixed together, without the formation of any chemical bonds. This diagram represents the differences between elements, compounds and mixtures.

- **The chemical property of each substance in a mixture does not change.** When elements or compounds are mixed together, the chemical properties of the individual substances do not change. This is because there are **no chemical bonds** between substances in a mixture.
- **Mixtures can be separated by physical processes.** Substances in a mixture can be separated using **physical** processes. These processes do not involve any chemical reactions or the formation of new substances.
- **Mixtures come in different states.** You can get a mixture of liquids (e.g. oil), a mixture of solids (e.g. different grains in sand), or a mixture (e.g. water and sand in cement).



C2: Atomic structure

And Periodic table

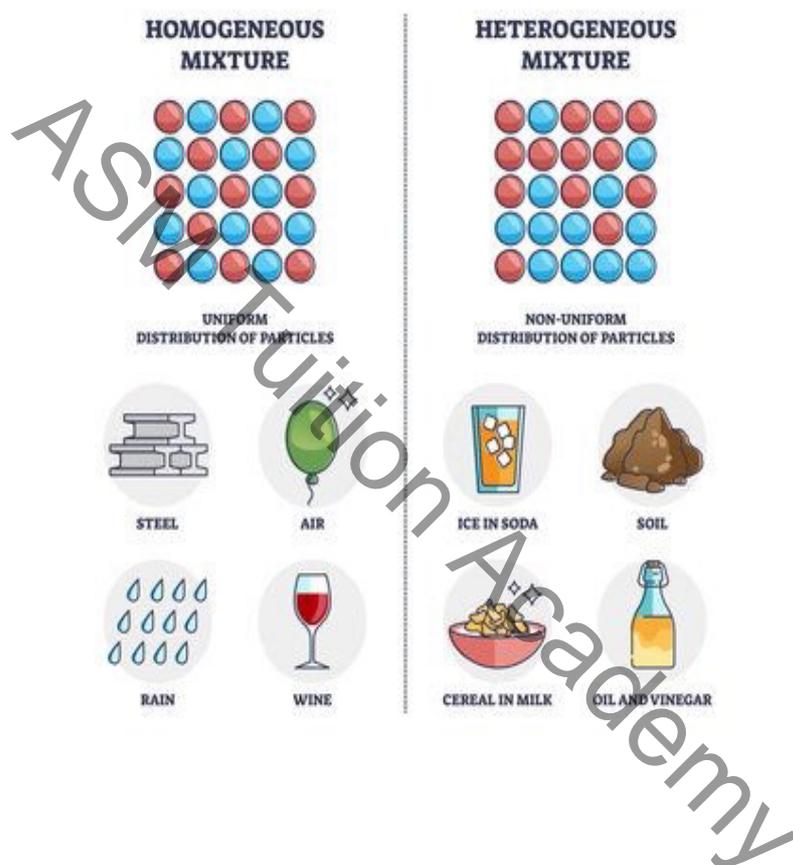
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Types of mixture:

- There are 2 types of mixture

1- Homogeneous mixture : Homogeneous mixtures can be defined as mixtures that possess a uniform composition through all their substances. Or mix completely. For example, sugar and water, salt and water

2- Heterogeneous mixture: Heterogeneous mixtures can be defined as mixtures that do not possess a uniform composition through all their substances. For example sulfur and iron filings



- Here is the difference of homogenous and heterogeneous mixture

HOMOGENEOUS MIXTURES VERSUS HETEROGENEOUS MIXTURES

Homogenous mixtures have a uniform composition throughout the mixture	Heterogenous mixtures have a mixed composition which may vary from point to point
Components are not visible to the naked eye	Components can be seen easily
The whole mixture is in the same phase	Substances can be of two phases and layers may separate
Particle size is often at atomic or molecular level	Heterogenous mixtures have large particle sizes
Components cannot be separated easily	Components can be separated easily

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Comparison between Compound and Mixture

Compounds and Mixtures

	Compound	Mixture
1) Formation	A chemical reaction takes place when a compound is formed, usually there is an energy change (e.g. heat is given off).	No chemical change takes place when a mixture is formed, usually there is little or no energy change.
2) Composition	Has fixed composition by mass. E.g. H ₂ O – 2 units of hydrogen, 1 unit of oxygen	Has variable composition by mass.
3) Melting and Boiling point	Has fixed melting and boiling points.	Has variable melting and boiling points (melt and boil over a range of temperatures)

Compounds and Mixtures

	Compound	Mixture
4) Properties	Has its own physical and chemical properties which are different from its elements – i.e. hydrogen and oxygen are gases at rtp, water is a liquid at rtp.	Does not have its own properties, it has the same properties as its components
5) Separation	The constituents (elements) can only be separated by chemical methods.	The constituents can be separated from one another by physical methods.
6) Arrangement of atoms	 <p>A compound of 2 elements</p>	 <p>A mixture of 2 elements</p>

Comparison between Element, Compound and Mixture

Comparing Elements, Compounds and Mixtures

	Elements	Compounds	Mixtures
% composition by mass	Fixed/constant	Fixed/constant	Variable
Atoms	One type	Two or more different types	Two or more different types
Heating / combustion	Only one product formed or oxidises to one other substance	May have two or more products formed / decomposes	May have two or more products formed
Can be separated by physical means?	No	No	Yes
Appearance	Only one colour	Only one colour	Can be two or more colours

Comparing Elements, Compounds and Mixtures

	Elements	Compounds	Mixtures
Some parts dissolve in water and some parts do not	Not possible	Not possible	Possible
Examples	Metals, Na, Ca, Ar, Ne, H ₂ , Cl ₂ , O ₃ , P ₄ , S ₈	HCl, CO ₂ , H ₂ O, Na ₂ SO ₄	Crude oil (petroleum), alloys (brass, steel, bronze), air, solutions, fractions from crude oil (diesel, petrol, bitumen)
Pure / Impure	Pure	Pure	impure

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