

Chemistry

is a branch of **physical science** that studies the composition, structure, properties and change of **matter**.

Chemistry is chiefly concerned with **atoms** and **molecules** and their interactions and transformations, for example, the properties of the **chemical bonds** formed between atoms to create **chemical compounds**.

Chemistry is sometimes called *the central science* because it bridges other **natural sciences** like **physics**, **geology** and **biology**.

Introduction of chemistry sciences

Definition :- Chemistry is the study of matter and energy and the interactions between them.

Chemistry is the study of the properties of materials and the changes that materials undergo .

or Chemistry is the study of the properties and behavior of matter.

Chemistry tends to focus on the properties of substances and the interactions between different types of matter, particularly reactions that involve electrons.

Matter : – anything that has mass and occupies space is called matter.

Classification of Matter

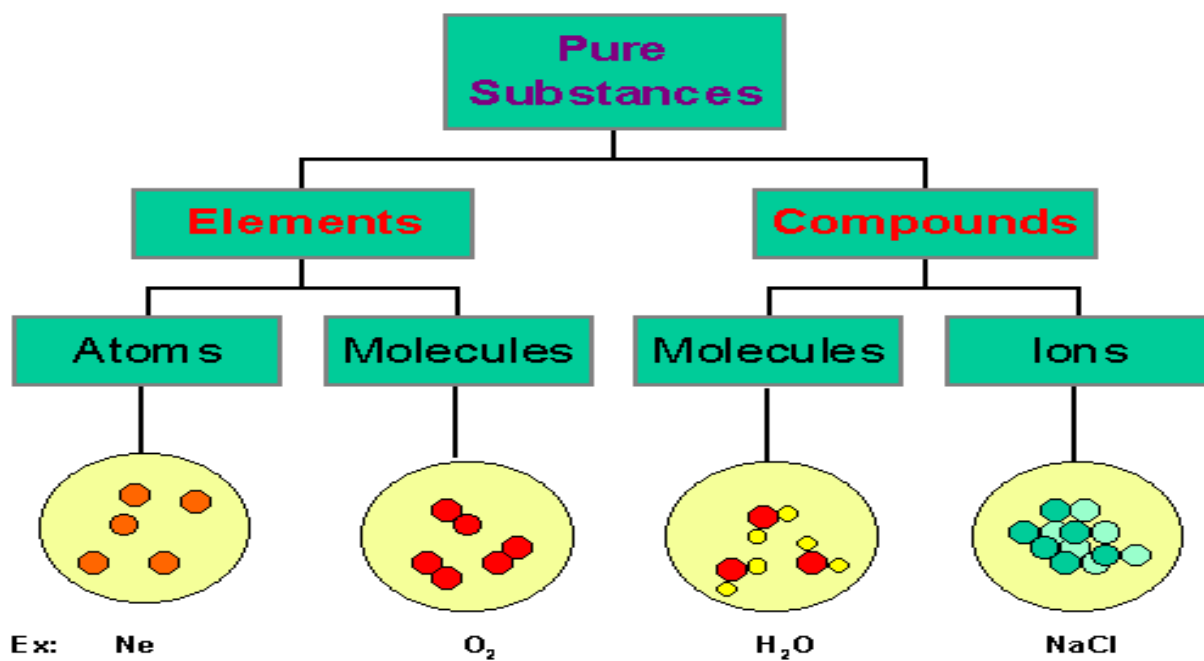
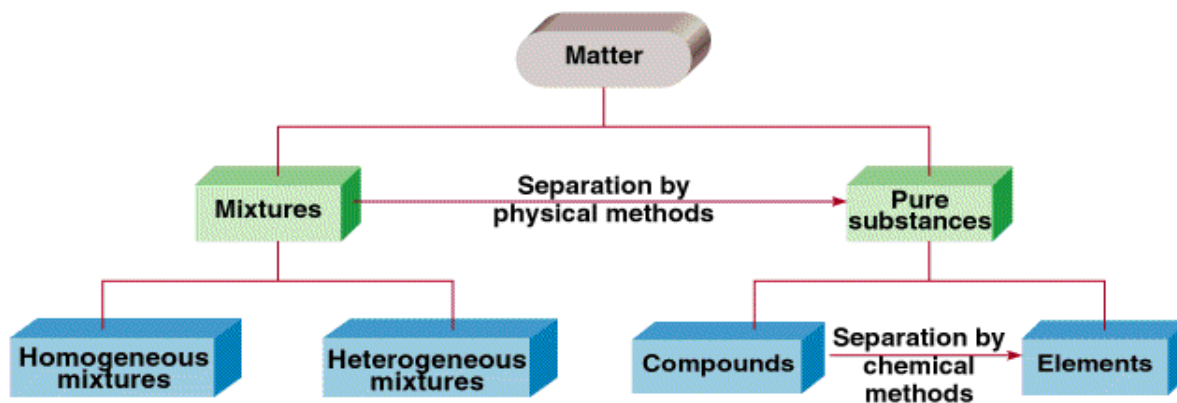
Matter classified according to its physical state to (gas , liquid , solid) and according to its composition as (elements , compound , or Mixtures)

Mixture:- combination of two or more substances in which each substance retains its own chemical identity.

Homogeneous mixture: - composition of this mixture is consistent throughout. Ex . Solution (Air, gasoline)

Heterogeneous mixture : - composition of this mixture varies throughout the mixture. ex. (rocks + wood)

Classification of Matter



pure substance :- It is also possible for a homogeneous substance to be composed of a single substance

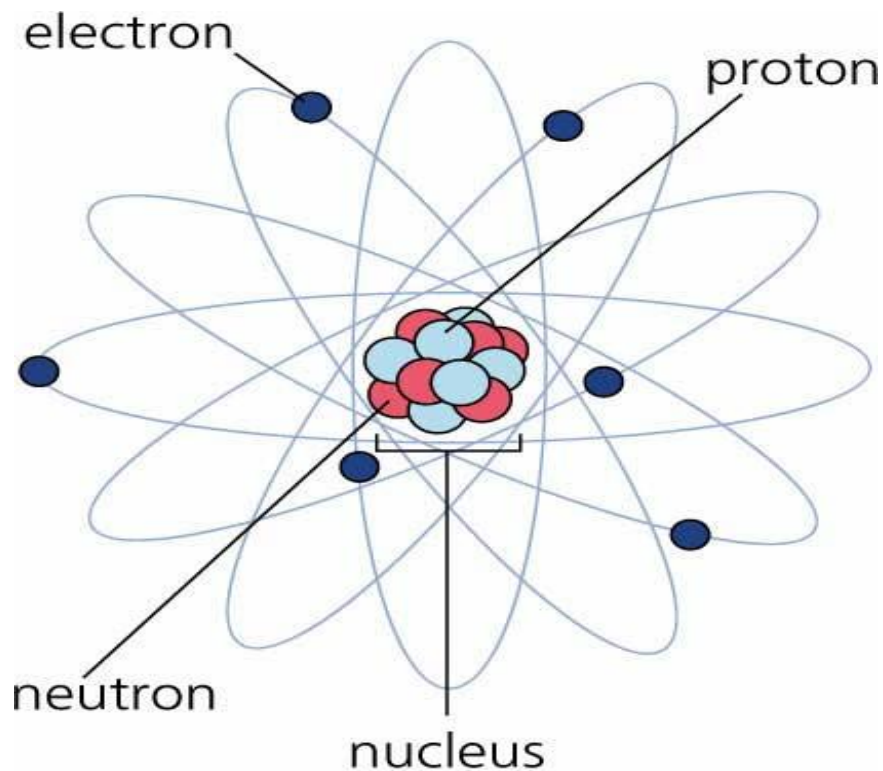
Element – A substance that can not be separated into simpler substances by chemical means.

Atom – the smallest unit of an element.

Atoms

Is the smallest particle of an element that can exist and still have the properties of the element.

The atom is a basic unit of matter that consists of a dense , central nucleus surrounded by a cloud of negatively charged electrons. The atomic nucleus contains a mix of positively charged protons and electrically neutral neutrons The electrons of an atom are bound to the nucleus by the electromagnetic force.



Sub-Atomic Particles, Properties and Location

Particle	Relative Mass (amu)	Electric Charge	Location
electron	$\frac{1}{1840}$	-1	outside the nucleus
proton	1	+1	nucleus
neutron	1	0	nucleus

Atomic Structure

Atom is composed of three types of subatomic particles which is: - **proton, neutron, and electron.**

These subatomic particles, they are not all the same size. when you compare the masses of it, you find is that electrons have an extremely small mass, compared to either protons or neutrons. on the other hand, the masses of protons and neutrons are fairly similar, although technically, the mass of a neutron is slightly larger than the mass of a proton.

Proton	1.6727×10^{-24}	+1
Neutron	1.6750×10^{-24}	0
Electron	9.110×10^{-28}	-1

Here, charge is given in multiple of 1.602×10^{-19} coulombs.

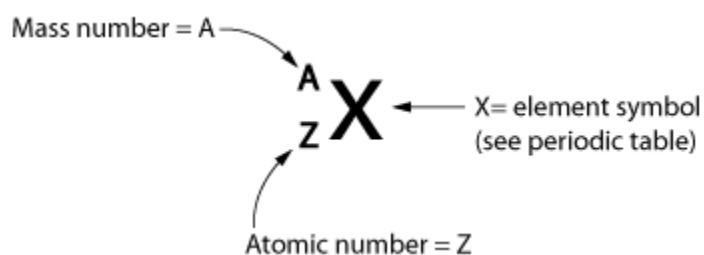
In a neutral atom, the number of positively charged **protons** in the nucleus is equal to the number of orbiting **electrons**.

A group of atoms can remain bound to each other, forming a **Molecule**. An atom containing an equal number of protons and electrons is electrically neutral.

Otherwise it has a positive or negative charge and is an **Ion**.

An atom is classified according to the number of protons and neutrons in its nucleus: the number of protons determines the chemical element, and the number of neutrons determines the **Isotope** of the element.

We use the following symbol to describe the atom:



$A = Z + N$, where N is the number of neutrons.

If you add or subtract a **proton** from the nucleus, you create a new **Element**.

If you add or subtract a **neutron** from the nucleus, you create a new **Isotope** of the same element you started with.

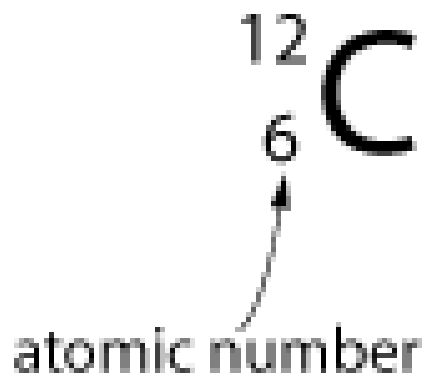
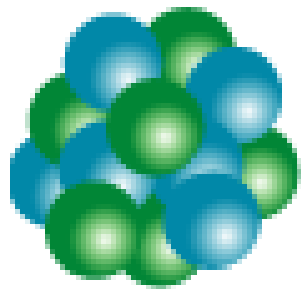
1	Atomic Number
H	Symbol
1.008	Mass Number

2	Atomic Number
He	Symbol
4.003	Mass Number

3	Atomic Number
Li	Symbol
6.940	Mass Number

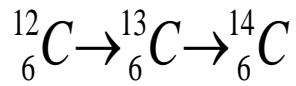
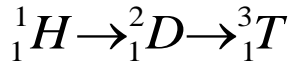
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- The **Atomic Number** of an atom is the number of protons in the nucleus of that atom equal to number of electron.
- The **Mass Number** of an atom is the sum of the number of protons and neutrons.

Mass Number = Number of Protons + Number of Neutrons.



ISOTOPE:

Atoms with the same number of **PROTONS** but a different number of **NEUTRONS** (possesses same chemical properties); **e.g.**,



Some isotopes are stable and some are radioactive .

Q/ Find each of these:

- a) number of protons
- b) number of neutrons
- c) number of electrons
- d) Atomic number
- e) Mass Number

Q/ If an element has 91 protons and 140 neutrons what is the :-

- a) Atomic number
- b) Mass number
- c) number of electrons
- d) complete symbol

Q/ an element has 78 electrons and 117 neutrons what is the :-

- e) Atomic number
- f) Mass number
- g) number of protons
- h) complete symbol