



Al-Mustaqbal University College

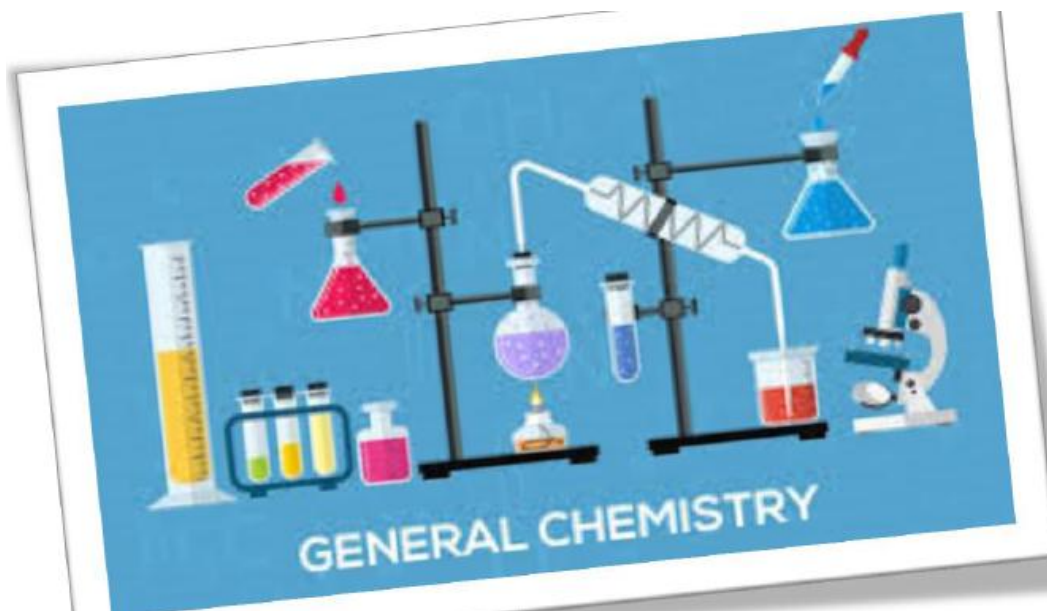


Anesthesia Techniques Department

First Class

General Chemistry

First Lecture



مدرس المادة

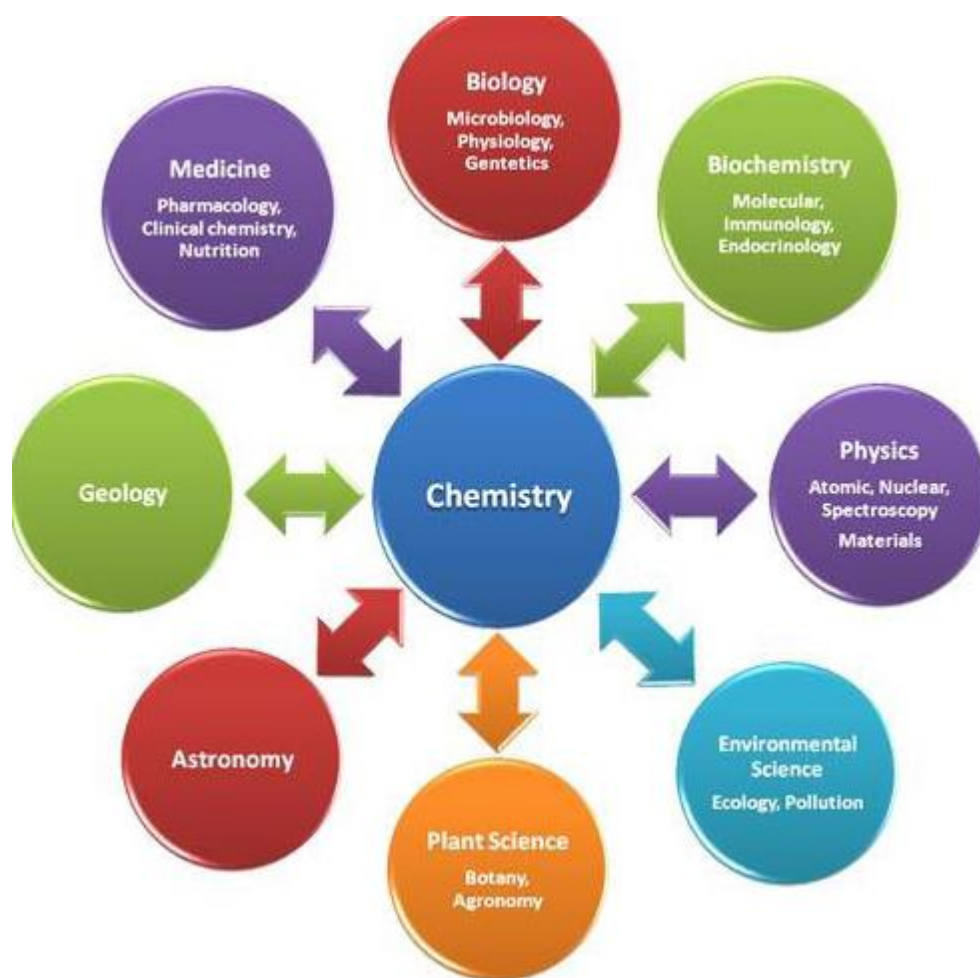
م.م زينب محسن نجم

What is Chemistry?

Is a branch of sciences that studies the composition, structure, properties and reactivity of matter.

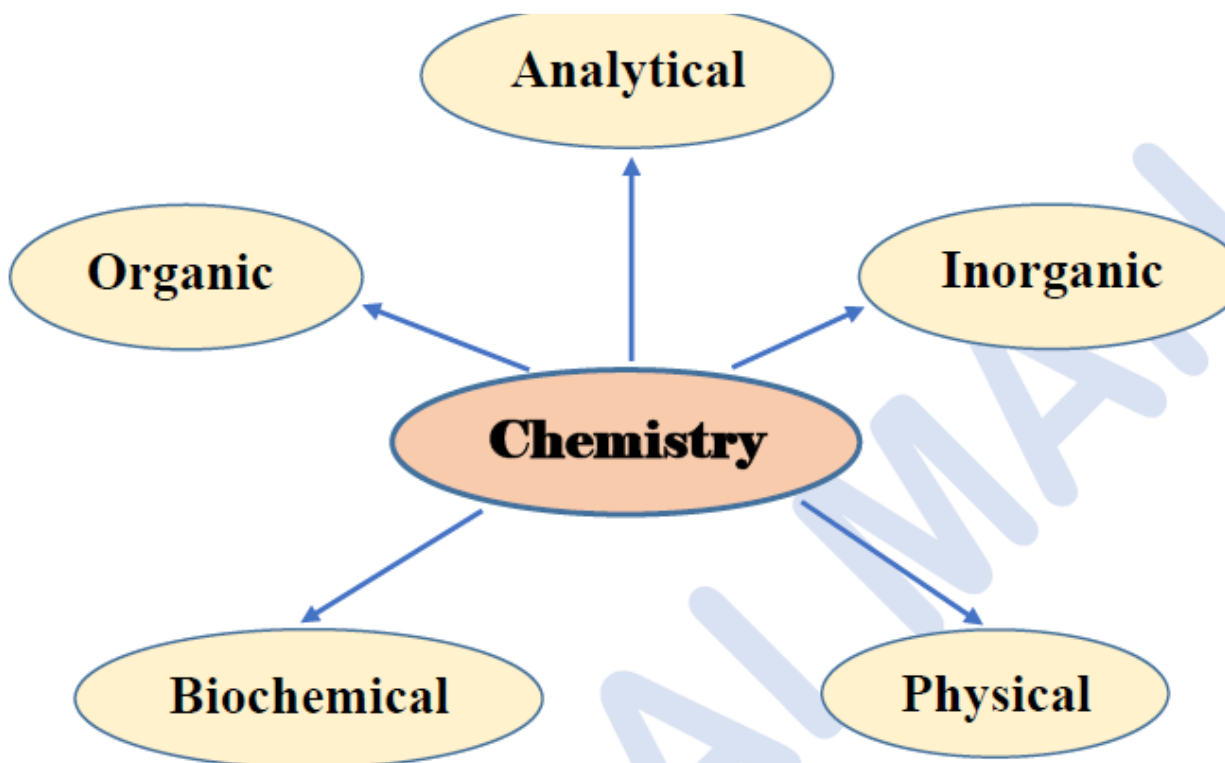
Why we are study chemistry?

Because of **chemistry** is a part of everything in our lives, and it is the science that help us to describe and explain our world. And chemistry is central to understanding a wide range of scientific disciplines.



What are the fields of chemistry?

Chemistry can be divided into major *five* fields:



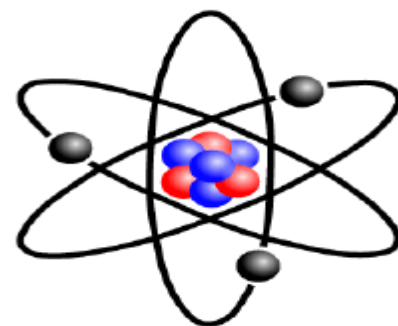
- ❖ **Analytical chemistry:** uses qualitative and quantitative analysis to identify and measure the physical and chemical properties of substances.
- ❖ **Organic chemistry:** studies compounds that contain "carbon".
- ❖ **Inorganic chemistry:** studies materials that do not have carbon as part of their structure.
- ❖ **Biochemistry:** chemistry of living things (from bacteria to human).

- ❖ **Physical chemistry:** Study behavior of and changes of matter as well as the energy changes.

Atom

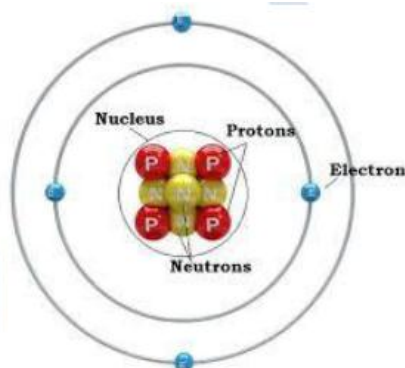
What is an atom?

Atoms are the basic units of matter and the defining structure of elements.



Atoms are made of three basic subatomic particles:

1. The **protons** have a **positive** electric charge.
2. The **electrons** have a **negative** electric charge.
3. The **neutrons** have **no electric** charge.



Protons and *neutrons* are **heavier** than electrons and found in the center of the atoms, which is called *nucleus*.

Nucleus: small, dense center of atom and contains almost all the mass of the atom and contains protons and neutrons.

Electrons are very **lightweight** and **exist** in a cloud orbiting the nucleus.

Protons and neutrons have approximately the *same mass* and different with electrons where one proton weighs more than electron by **1800** times.

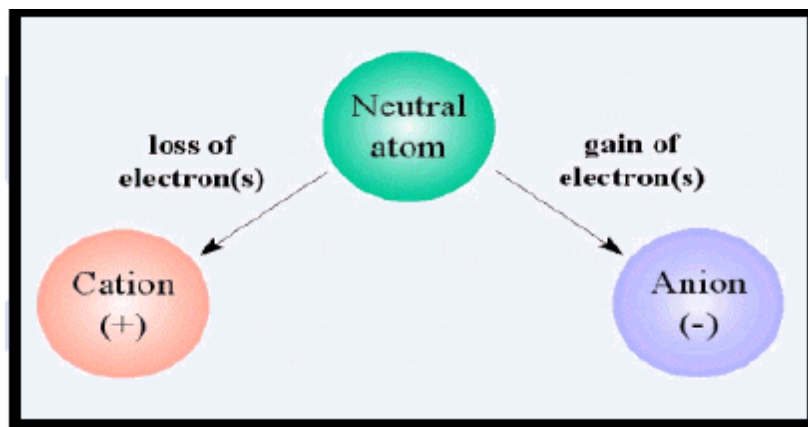
Atoms always have **an equal number** of *protons* and *electrons*, and the number of *protons* and *neutrons* is usually **the same** in the nucleus as well.

If the number of protons and electrons are equal, that atom is electrically **neutral**.

If the atom has **more** protons than electrons, it will have a *positive* charge,

While if the electrons number more than protons the atom has a **negative** charge.

The atom in this case is called an **ion**.



Positive charge \longrightarrow **Cation.**

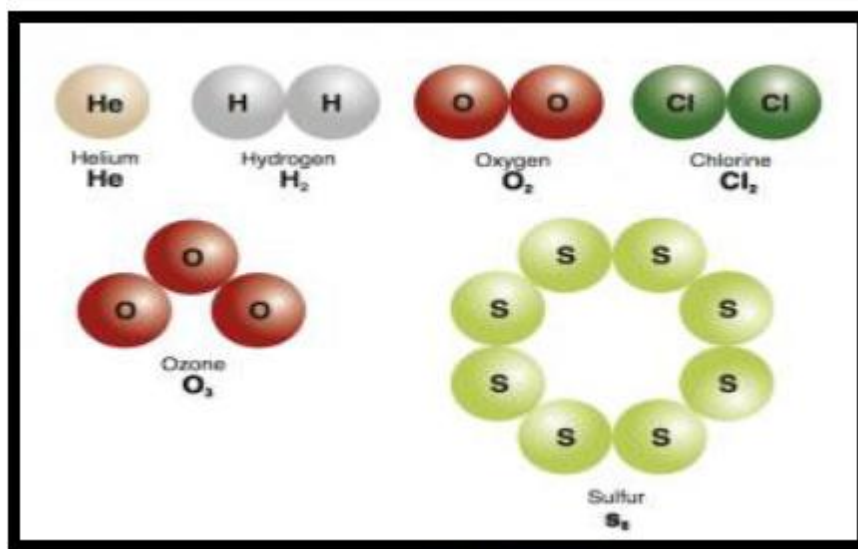
Negative charge \longrightarrow **Anion**

Atoms can attach to another one or more by **chemical bonds** to form **chemical compounds** such as **molecules**.

Elements

Composed of **one** type of **atom**.

Element: is a pure substance that cannot be changed into a simpler form of matter by any chemical reaction.



Each element is assigned by one or two letter chemical symbol – for example: **H**, **Na**, **Zn** etc.

PERIODIC TABLE OF THE ELEMENTS
http://www.kj-soft.com/periodic/

GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	H																		He
2	Li	Be											B	C	N	O	F	Ne	
3	Na	Mg											Al	Si	P	S	Cl	Ar	
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
6	Cs	Ba	La-Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
7	Fr	Ra	Ac-Lr	Rf	Db	Sg	Bh	Hs	Mt	Uun	Uub	Uuq							

Legend:
 Metal: Blue box, Alkali metal: Yellow box, Alkaline earth metal: Orange box, Lanthanides: Green box, Actinides: Red box, Semimetal: Light blue box, Nonmetal: Green box, Metalloid: Yellow box, Halogens element: Purple box, Noble gas: Light green box.
 STANDARD STATE (25°C, 101 kPa): No - gas, Fe - solid, Li - liquid, Tl - solid, Uuq - unknown.

LANTHANIDES: La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu.
ACTINIDES: Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No, Lr.

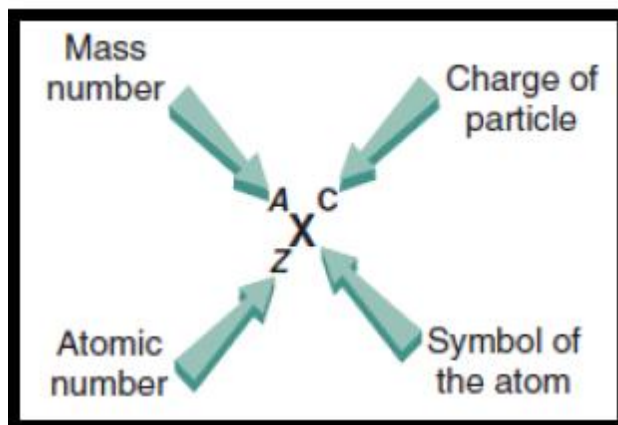
© 2007 by John Wiley & Sons, Inc. All rights reserved. Periodic table of elements.

Each element is identified by two numbers

Atomic number and Atomic weight (mass number).

Atomic number (Z): is the number of protons in the nucleus of the atom

$$Z = \#P = \#E$$

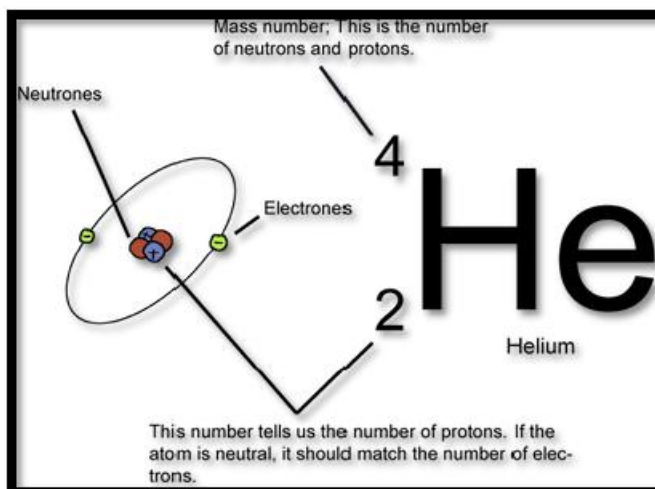
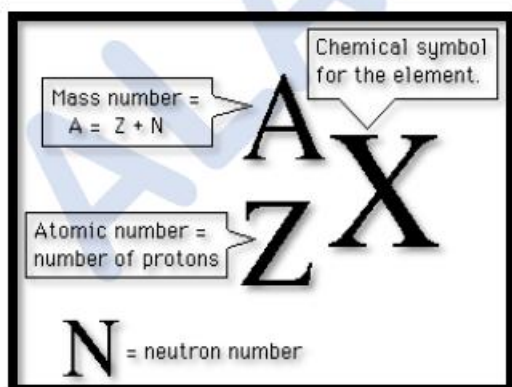


The number of protons (atomic number) determine the identity of an element.

Note: Adding a **proton** to an atom makes a **new** element.

Mass number: is the sum of protons and neutrons in the nucleus.

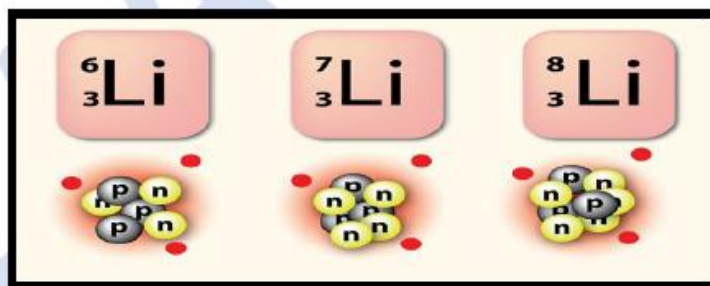
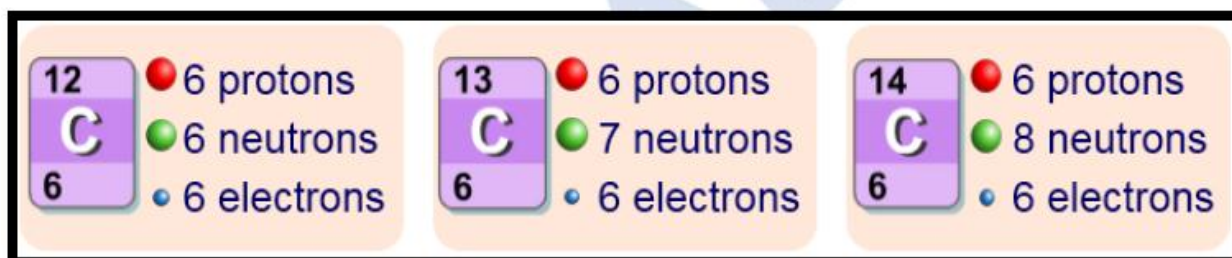
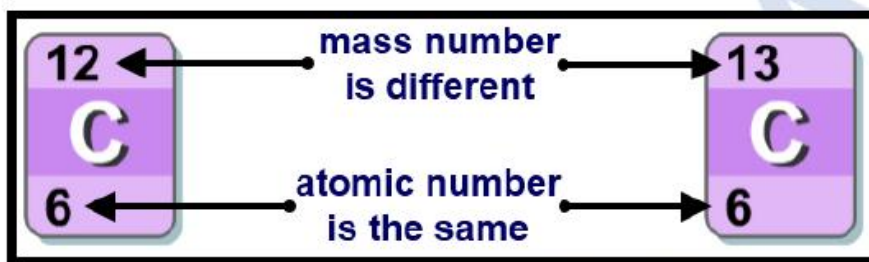
$$A = \#P + \#N$$



Isotopes

What are isotopes?

Atoms that have the same number of protons and different number of neutrons, (atoms with same atomic number and different atomic weight). For example:



The isotopes of an element are virtually identical in their chemical reactions. Why?

This is because they all have the same number of protons and the same number of electrons.

The uncharged neutrons make little difference to chemical properties, but do affect physical properties such as melting point and density.

Note: the isotope is usually unstable and decomposes spontaneously

Radioactive isotopes (natural or artificially created) isotopes of a chemical elements having an unstable nucleus that decay emitting, alpha, beta and gamma rays until stability is reached.

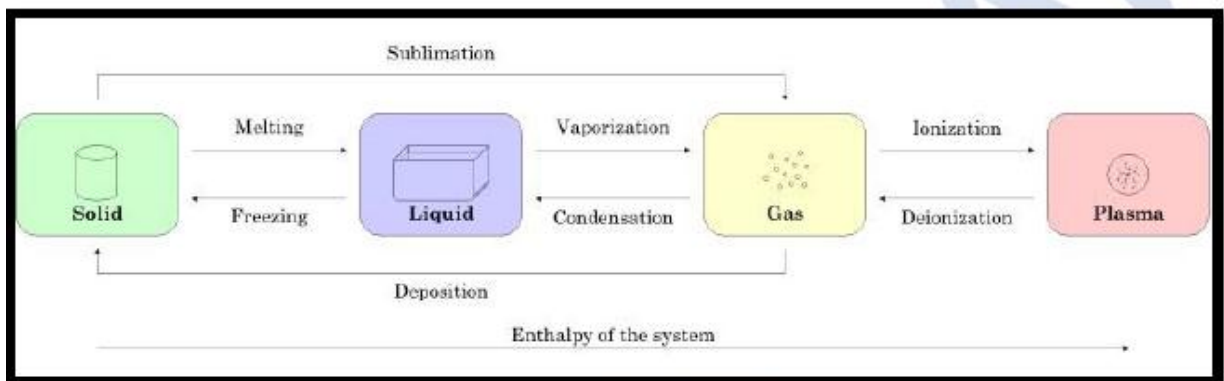
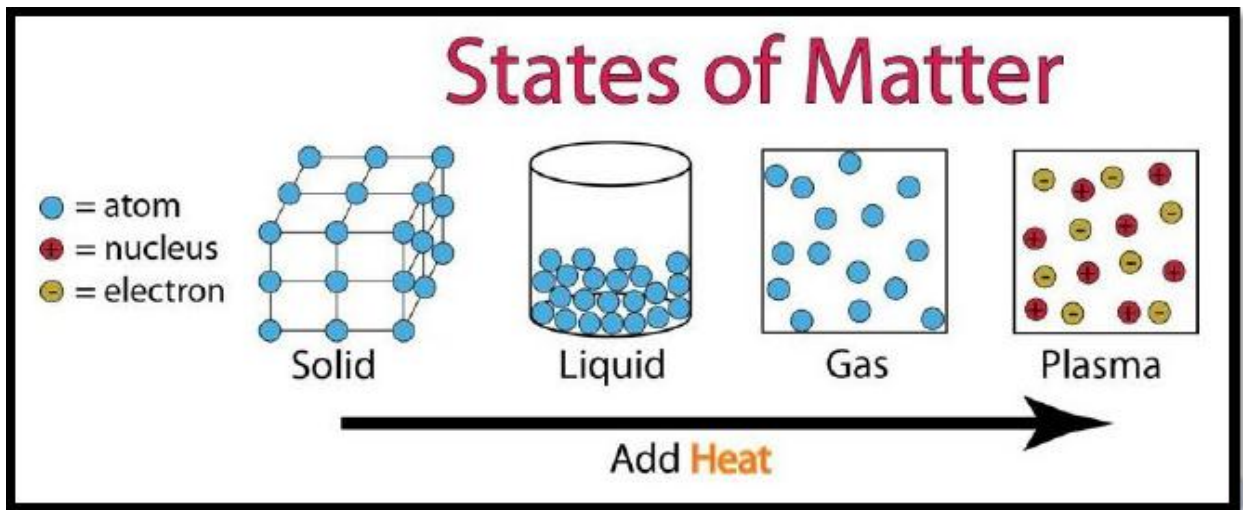
Matter

Is anything that it can take place, or it is anything that has mass and volume.

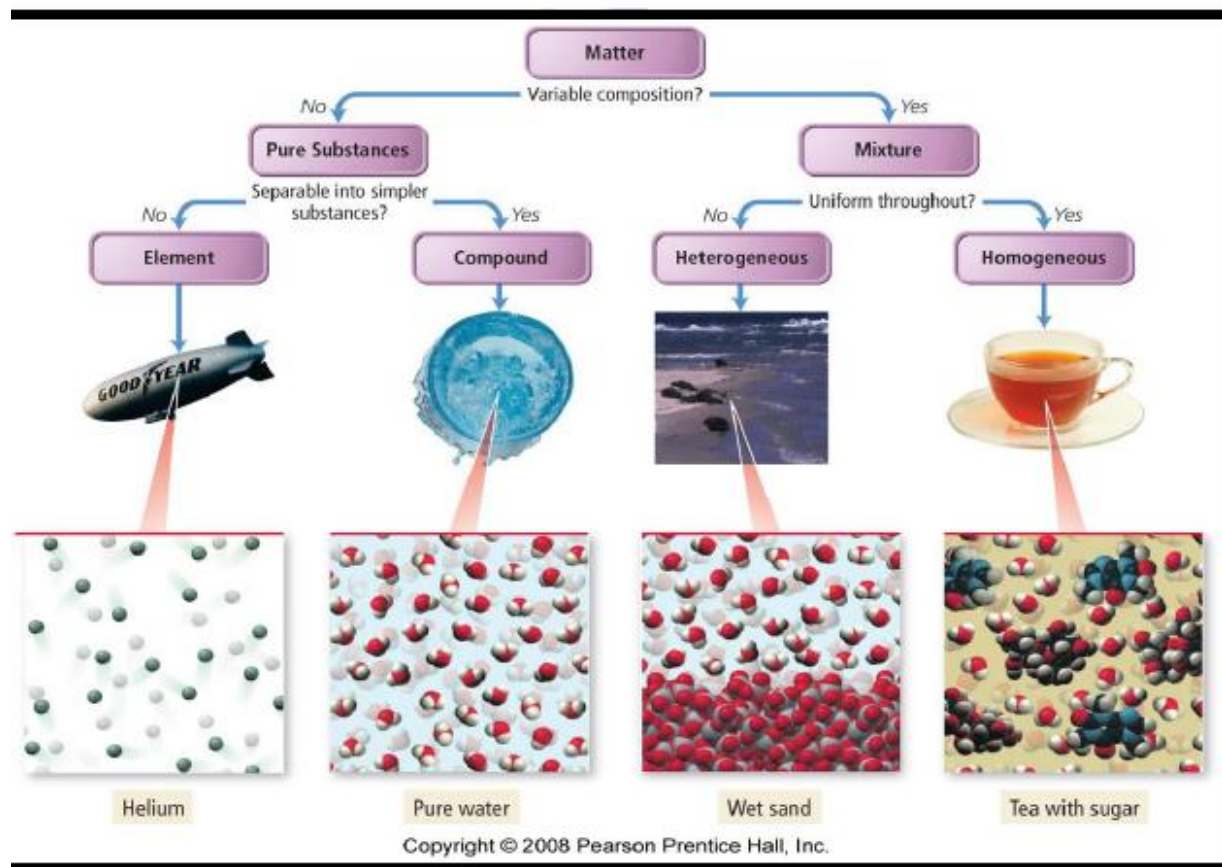
There are four states of matter:

- **Solid:** a state of matter that has a definite shape and volume.

- **Liquid:** a state of matter that has no definite shape but has a definite volume.
- **Gas:** a state of matter that has no definite shape or volume.
- **Plasma:** a state of matter that are gases that have so much energy that electrons of an atom cannot stay in orbitals around one atomic nucleus. The atomic ions and free electrons mix around.



All matter classified to a pure **substance** or a **mixture**



A pure substance: is a substance that has only one component, for example H₂O.

There are different types of a pure substance:

Elements: A substance that cannot be chemically converted into simpler substances. **Hydrogen and oxygen for example are elements.**

Compounds: A substance that contains two or more elements.

The elements hydrogen and oxygen may combine to form the compound water H₂O.

A mixture: is a composed of two or more pure substances in which each substance retains its own identity.

A mixture may be either:

Homogenous mixture: has a uniform composition.

Heterogeneous mixture: has non-uniform composition.

Chemical bonds

A chemical bond is an attraction between atoms.

What are atoms and compounds always trying to achieve?

Atoms form chemical bonds to achieve a full valence shell of electrons. This may be achieved in two ways:

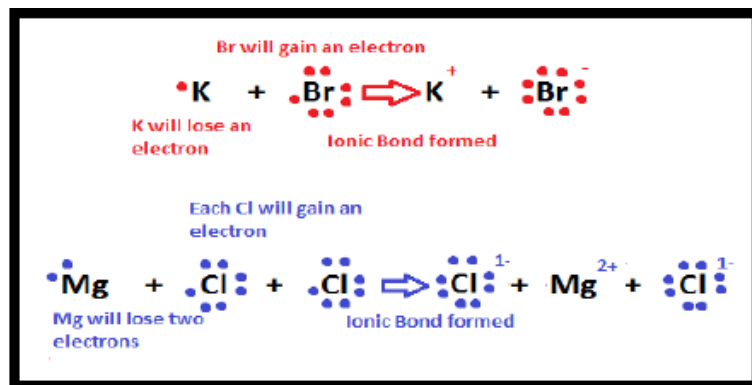
- 1- An exchange** of electrons between metal and non-metal atoms.
- 2- Sharing of** electrons between non-metal atoms.

Ionic Bond

- An ionic bond is the electrostatic attraction between oppositely charged ions.
- Ionic bonds involve electron transfer (one atom loses electrons and another gain them).
- The atom that loses electrons becomes a cation (a positive ion).
- The atom that gains electrons becomes an anion (a negative ion).

- An ionic bond usually occurs between a metal and a nonmetal.

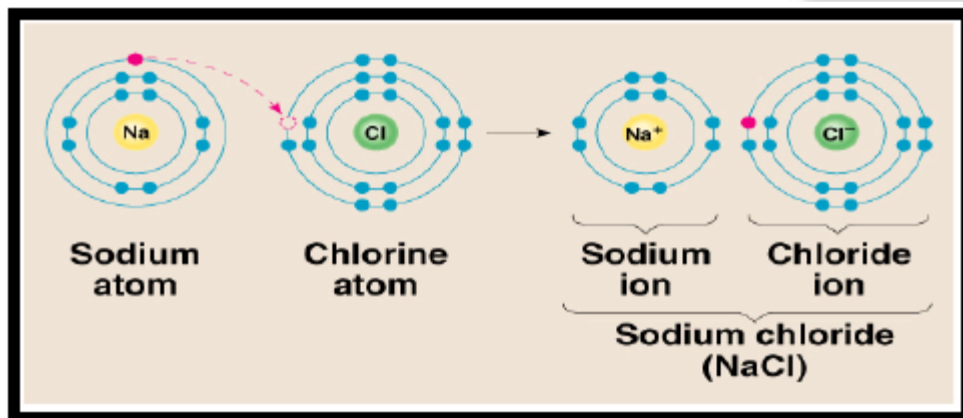
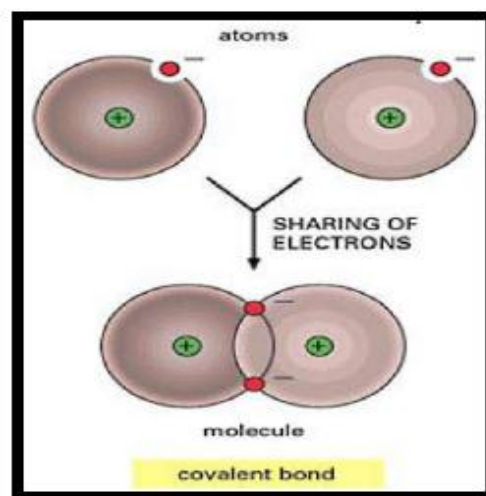
Ionic bonds are found in ionic compounds ex. NaCl, Al₂O₃, KBr, MgCl₂



Covalent Bond

- It is a strong bond formed between two atoms by sharing two valence electrons, one from each atom.

A covalent bond usually occurs between two **non-metals** atoms.

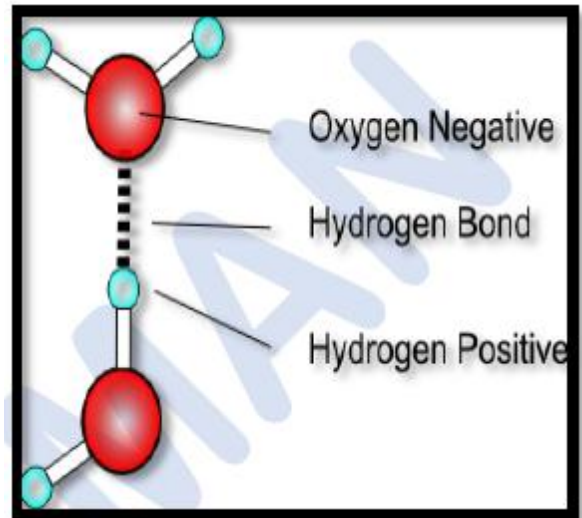
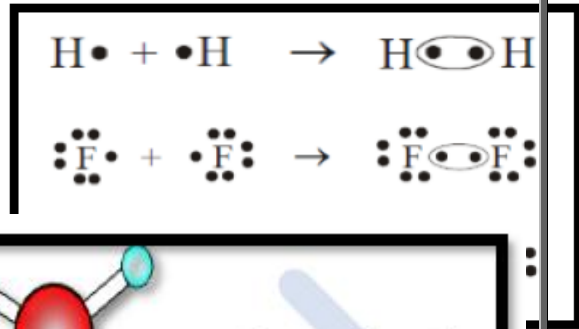


- Covalent bonds are found in molecular elements (ex H_2 , F_2 , Cl_2 , O_3). And molecular compounds

(ex H_2O , CO_2 , C_3H_8 , HF)

Hydrogen bond

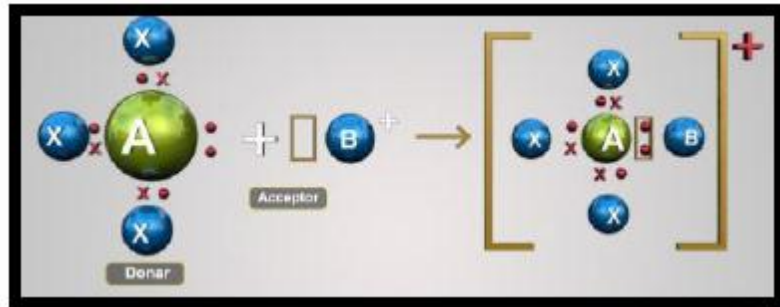
- A chemical bond that hydrogen atom of one molecule is attracted to an electronegative atom, especially **nitrogen (N)**, **oxygen (O)** or **fluorine (F)** atom, usually of another molecule.
- It is a **weak** attraction, where it's **weaker** than **covalent**, **ionic** and **metallic** bonds.



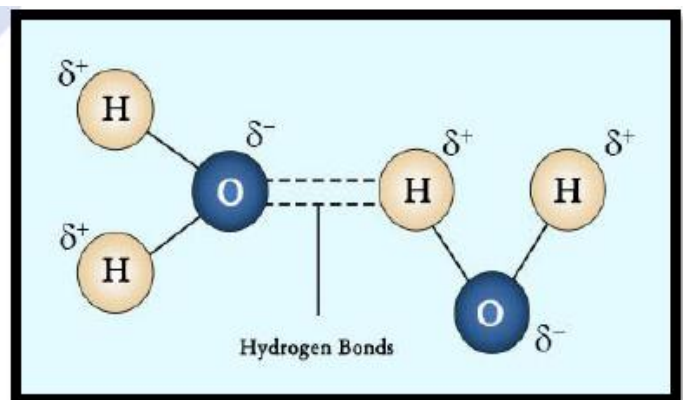
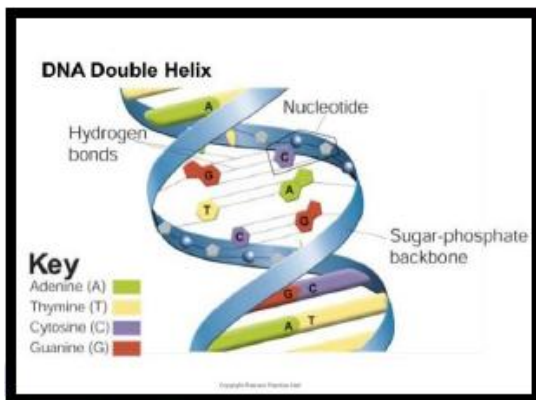
- Is very important, where **this type of bond occurs in both inorganic molecules (such as water) and organic molecules (such as DNA).**

Coordinate bond

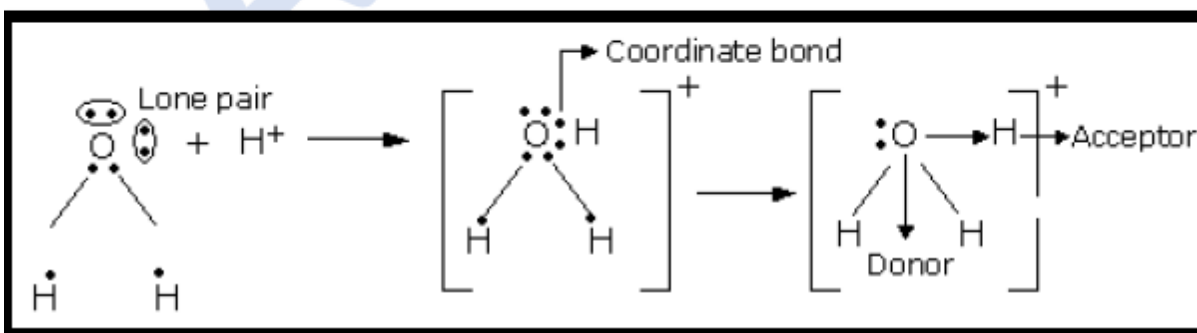
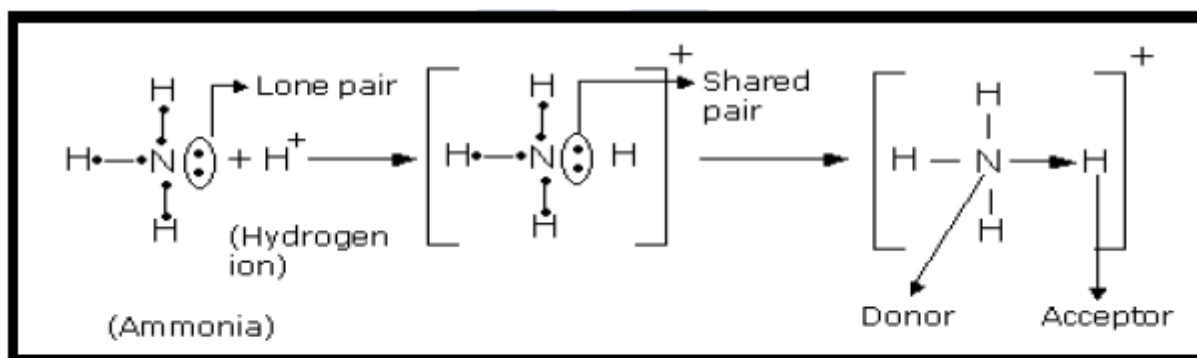
- It's a type of



covalent bond that formed when one atom **donates both of the shared electrons** to the other atom to make the bond.

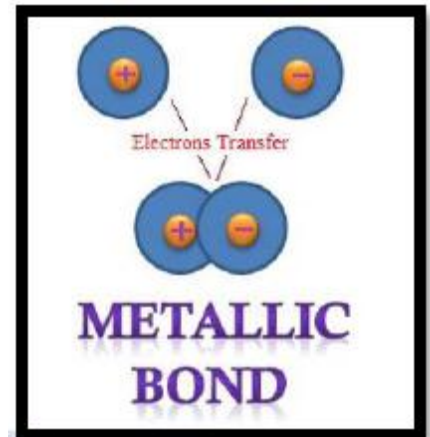


- This is different from a covalent bond because both electrons **come from one atom or molecule** but are **shared as in a typical covalent bond**.



Metallic bond

- Is the type of bonding found in metallic crystals, that formed by the **attraction** between the **metal positive ion** and **delocalized electrons**.



- The free movement of electrons make metals good conductors of heat and electricity

Aluminum more conduct electricity more than magnesium because it has more electrons delocalized.

