

CHEMICAL BONDS

ELEMENTS & COMPOUNDS

- Why do elements react to form compounds ?
- What are the forces that hold atoms together in molecules ?
and ions in ionic compounds ?

Elements, Atoms, Molecules & Compounds

- **Elements** → Substances that can't be broken down any further.
- **Atom** → The smallest unit of an element.
- **Molecule** → Two or more atoms joined together chemically.
- **Compound** → Molecule containing at least two different Elements.
 - *Examples of molecules:* Carbon dioxide (CO_2) and methane (CH_4), molecular hydrogen (H_2), molecular oxygen (O_2) and molecular nitrogen (N_2).
 - *Examples of compounds:* Only molecules containing two or more elements, such as carbon dioxide (CO_2) and methane (CH_4).
 - *Q: Explain why all compounds are molecules but not all molecules are compounds.*

Mixtures & Compounds

mixture = **Physical** combination of two or more pure substances.

compound = **Chemical** combination of two or more pure substances in a fixed, definite proportion.

CHEMICAL BONDS

attractive force holding atoms together

Single Bond: involves an electron pair e.g. H₂

Double Bond: involves two electron pairs e.g. O₂

Triple Bond : involves three electron pairs e.g. N₂

Chemical Bonding refers to **the formation of a chemical bond between two or more atoms, molecules, or ions to give rise to a chemical compound.** These chemical bonds are what keep the atoms together in the resulting compound.

The Two Extremes

- **IONIC BOND** results from the transfer of electrons from a metal to a nonmetal.
- **COVALENT BOND** results from the sharing of electrons between the atoms. Usually found between nonmetals.

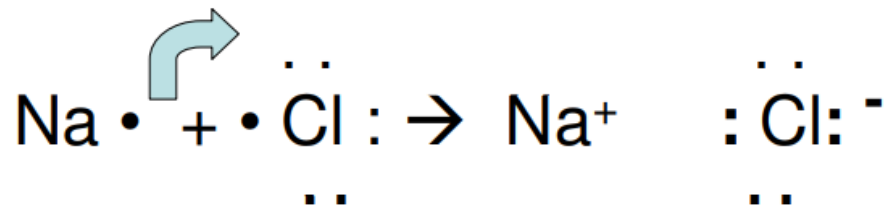
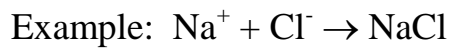
what are the 4 types of chemical bonding?

There are four types of chemical bonds essential for life to exist: **Ionic Bonds, Covalent Bonds, Hydrogen Bonds, and van der Waals interactions.** We need all of these different kinds of bonds to play various roles in biochemical interactions. These bonds vary in their strengths.

1- The Ionic Bond results from the transfer of electrons between two atoms.

Reactions between metals and nonmetals (representative) tend to form ionic bonds

A positively charged ion (**CATION**) is attracted to a negatively charged ion (**ANION**)—attraction between ions is due to their opposite charges



Ion = an atom or group of atoms which have lost or gained one or more electrons, making them negatively or positively charged.

Q: What are positively charged ions (+) called?

Q: What are negatively charged ions (-) called?

Importance of Ions/Electrolytes in the Body:

$\text{K}^+, \text{Na}^+, \text{Cl}^-$

- Carry electrical impulses in the nervous system
- Maintain cellular function with the correct concentrations electrolytes

2- Covalent Bonds

Involves the sharing of a pair of electrons between atoms.

When two atoms have a small difference in their tendencies to lose or gain electrons, we observe electron sharing and covalent bonding.

- Differences in electronegativity can be used to determine if the electrons are shared equally or unequally.
- Often, instead of using a single line to indicate the covalent bond, an arrow is used with the head pointing toward the atom with the greater attraction for the electrons.

One covalent bond = 1 pair of shared electrons

Covalent Compounds can make single (2 electrons), double (4 electrons) or even triple bonds

(6 electrons) depending on the number of electrons they share.