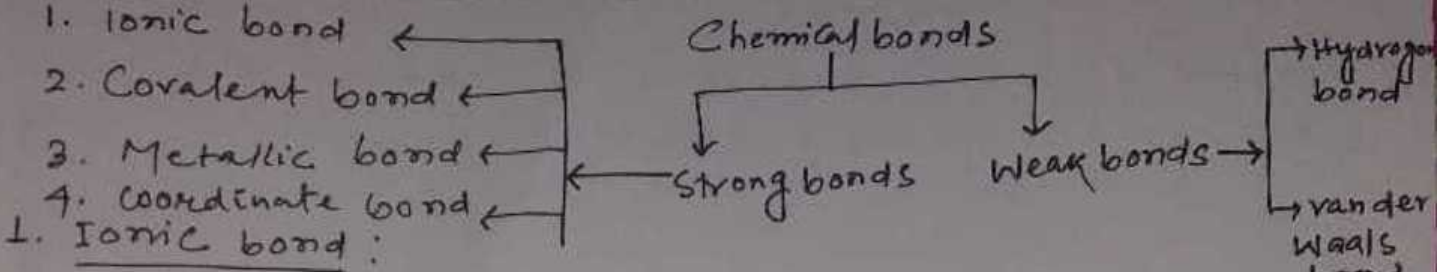
Chemical Bonding - 1

Ionic bond:

* **Chemical bond**: A chemical bond is the force holding two atoms group of atoms forming an aggregate of ions or molecular species such that there occurs a lowering of energy.

* **Classification of Chemical Bond**:



1. **Ionic bond**:

Ionic bonds are electrostatic forces that bind together oppositely charged ions formed by the transfer of electron from a metal atom to a nonmetal atom.

e.g; $Na^{\circ} \longrightarrow Na^{+} + e$

$Cl^{\circ} + e \longrightarrow Cl^{-}$

$Na^{+} + Cl^{-} \longrightarrow NaCl$

Characteristics of ionic Compounds:

i) They are generally crystalline in nature. The constituent ions are arranged in a regular way in their crystal lattices.

ii) They possess high melting and boiling points as they are held by strong electrostatic forces of attraction.

iii) They are hard and brittle in nature.

iv) In solid state they do not conduct electricity. In molten state or in solution they conducts electricity due to the presence of free ions in aqueous state.

v) They are soluble in polar solvents but insoluble in non-polar solvents.

vi) The electrovalent bonds are non-rigid and non-directional.

vii) They do not show Configurational Isomerism (geometrical & optical).

viii) They show isomorphism (similar no. of valence electrons)
ix) They show variable valency.

⊛ Factors affecting the formation of ionic bond:

i) Ionisation Energy (IE):

Smaller the value of IE, greater is the tendency of the ato to form cation. e.g; alkali & alkali earth metals.

ii) Electron Affinity (EA):

High EA of a non-metal favours the formation of an anion e.g; This is generally in cases where octet is incomplet

F — 7 e⁻
O — 6 e⁻
N — 5 e⁻

iii) Lattice Energy:

The amount of energy released when free ions join together to form one mole of a crystal is called Lattice Energy. The higher the magnitude of the lattice energy, the greater is the tendency of the formation of an ionic bond.

$$M^+(g) + X^-(g) \longrightarrow \underset{\text{Lattice}}{MX(s)}$$

$$\Delta H = -U$$

Born Lande Equation for calculating the lattice energy:

The lattice energy can not be determined experimentally but it is usually calculated by the following equation is known as Born Lande Equation.

$$\text{Lattice Energy } (U) = \frac{-N \cdot A \cdot Z^+e \cdot Z^-e}{r_0}\left(1 - \frac{1}{n}\right)$$

Where, N = Avogadro Number.
A = Madelung Constant Which is dependent on the geometry of the crystal lattice but is independent of ionic radii and charge.
Z^+e and Z^-e = Charge on cation and anion respectively.

r_0 = Equilibrium distance between the nuclei of two oppositely charged ions in the lattice.

n = Born exponent.

Q. Calculate the Lattice Energy of NaCl using the following data; Madelung Constant (A) = 1.748,
Equilibrium interionic distance = 2.79 Å,
Born exponent, $n = 8$