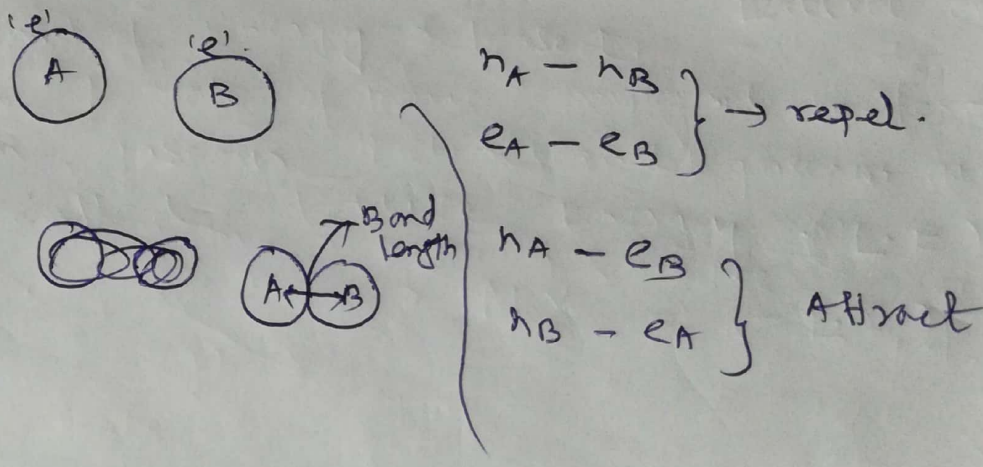
Type of Chemical Bonding

- Interatomic
  - Strong bond
    - a) Ionic bond (Na⁺Cl⁻)
    - b) Covalent bond (CH_4)
    - c) Co-ordinate (NH_4^+)
    - iv) Metalic bond (Fe, Ni, Cu).
  - (200 - 400 KJ/mole)
- Intermolecular
  - i) vander Waals force
  - ii) Hydrogen bond
    - Inter
    - Intra.
  - 20 - 40 KJ/mole.
  - weak bond.

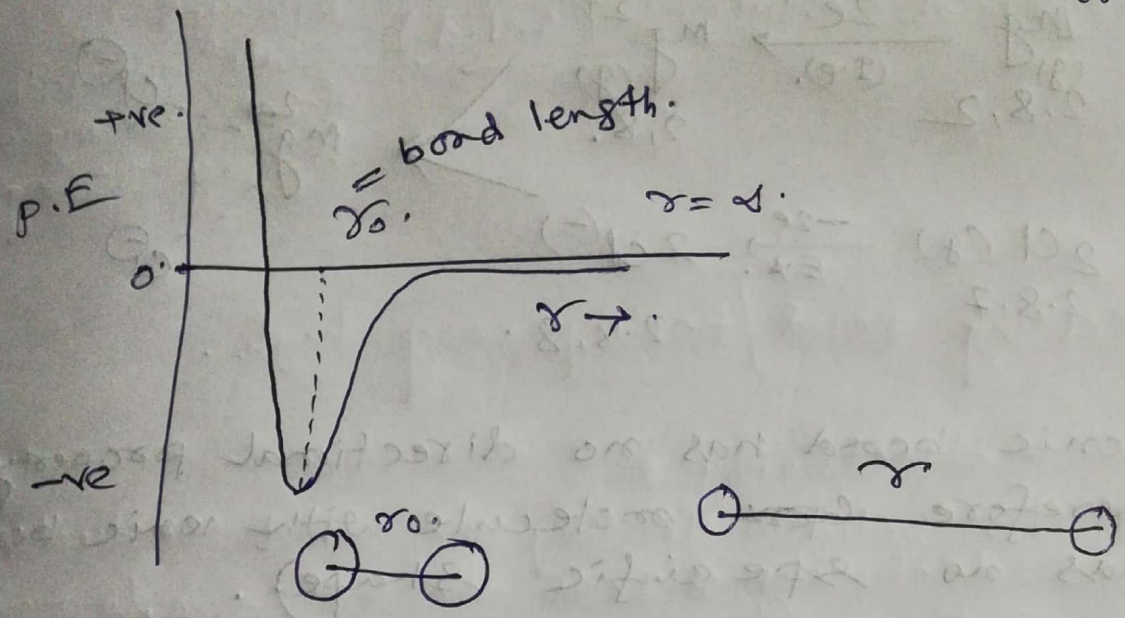
Cause of Chemical bond.

1) To achieve octet rule [8's es rule]
   ⇓
   Nobel gas configaration.
   Ne, Ar, Kr, (Xn) $[ns^2np^6]$ valence shell e⁻ configaration.
   ⇓
   Exception.
   Many compound of Xn are known.

** 2) To lower potential energy to get stability.



Potential energy Vs r (distance between two nucleus of atom)



Main reason of Bond formation is lowering of potential energy and gets stability.

Ionic bond / electrovalent Bond.

Requirement — Metal atom + Non metal atom.

↓

Complete transfer of electron ($\bar{e}$).

Example.

$Na \xrightarrow[(I.P)]{-e} Na^{\oplus}$ (cation)

2.8.1 → 2.8 (octet)

$Cl + e \xrightarrow{(E.A)} Cl^{\ominus}$ (anion)

2,8,7 → 2,8,8 (octet)

$Na^{+} \cdots Cl^{-}$

↓

force of attraction

electrostatic force.

↓

electrovalent bond.

$$F = \frac{K \cdot q_1 q_2}{r^2}$$

$q_1 \Rightarrow$ charge of cation.

$q_2 \Rightarrow$ " of Anion.

Example $MgCl_2$.

$Mg_{(g)}$ (2,8,2) $\xrightarrow[(I.P)]{2e}$ $Mg^{2+}_{(g)}$ (2,8.)

$2Cl_{(g)}$ (2.8.7) $\xrightarrow[E.A]{-2e}$ $2Cl^{(-)}$ (2.8,8.)

Mg^{2+} ... $Cl^{(-)}$ ... $Cl^{(-)}$

(*) (Ionic bond has no directional property therefore molecule with ionic bond has no specific shape).

Energy consideration in Ionic bond.

(1) Metal (M)

$M_{(g)} \xrightarrow{-e} M^{(+)}_{(g)}$ (cation) $\longrightarrow$ (+) energy given or energy absorbed. (I.E)

(2) Non Metal (NM)

$NM + e \longrightarrow NM^{(-)}_{(g)} \longrightarrow$ (−) energy released. (E.A)

(3) Their combination. i.e.

$M + NM$

$M^{\oplus}_{(g)} + NM^{(-)}_{(g)} \longrightarrow M^{\oplus}...(NM)^{-}$ (−) Energy released ⇓ Lattice energy.

(*) Amount of Energy released, when 1 mole of ionic compound is formed from gaseous cations and gaseous anions, is called Lattice Energy (L.E).

$M^{\oplus}_{(g)} + X^{(-)}_{(g)} \longrightarrow M^{+}X^{(-)} + (-L.E)$

Favourable condition of formation of ionic bond.

1) Ionisation energy (I.E) should be lower.
2) Electron-affinity (E.A) should be high.
3) Lattice energy (L.E) should be high.

⇓

(*) Stable ionic compound will formed.

(*) Factors on which ionic character of bond depends.

every bond contains ionic as well as covalent character

(*) Metal character ↑
Non metal character ↑
→ Ionic character ↑

Example (1): NaF > NaCl > NaBr > NaI.

Ionic character decreases →
Covalent character increases →
(Fazan's rule). [will discuss next lecture.]

F > Cl > Br > I.

non metalic character.

(2) LiCl < NaCl < KCl < RbCl.

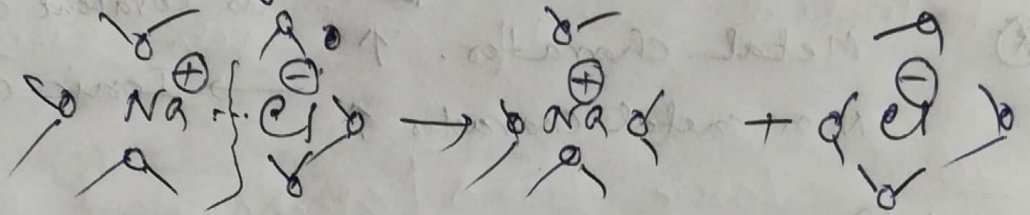
Ionic character increases.
Covalent character decreases.

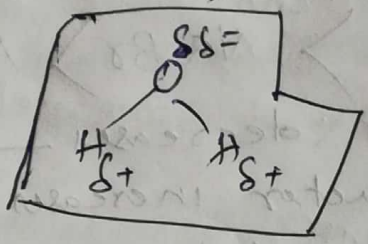
Properties of Ionic Compound:

① Physical State: (Solid) Always in solid state as electrostatic force among molecules is very strong.

② Melting point / Boiling very high.

③ Conductivity
(i) In solid state, they are bad conductor of electricity as Ions are not free to move.
(ii) But in molten or in aqueous medius, they are good conductor.

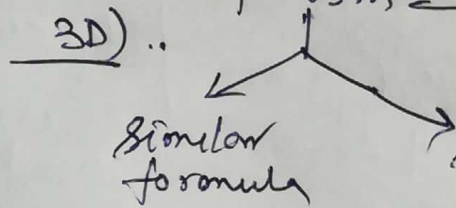




Due to Solvation.

④ Isomerism ⟹ No isomerisation of ionic single molecule But ionic crystal have size and shape. ~~Ionic molecules have no~~ Ionic bond of ionic molecule has no directional property. Therefore, Ionic Compound does not show isomerism.

⑤ Isomorphism → Similar (3D) (lattice) Structure (in 3D)..



NaCl & MgCl. } isomorph
NaF & MgO. }
NaCl & KCl → X

Example

① NaF & MgO.

Size ⇒ Na, Mg almost same.

F, O " "

therefore NaF & MgO shows isomorphism.

② KCl, NaCl.

Size. Na < K, therefore KCl & NaCl are not showing isomorphism.

⑥ Reaction kinetics of ionic compound.

⇓

very fast reaction

$Na^+Cl^- + Ag^+NO_3 \longrightarrow Na^+NO_3 + AgCl\downarrow$

ppt

⑦ Solubility : Ionic compound is highly soluble in water. because of hydration energy or solvation energy.

Next topic ⇒ Lattice Energy, Solvation Energy, Fazan's rule, Born haber cycle.