3. Chemical Bonding

- (i) % ionic character

$$= \frac{\textbf{Actual dipole moment}}{\textbf{Calculated dipole moment}} \times 100$$

(ii) Dipole moment is helpful in predicting geometry and polarity of molecule.

Fajan's Rule:

Following factors are helpful in increasing covalent character in ionic compounds

i. Small cation

ii. Big anion

iii. High charge on cation/anion

iv. Cation having pseudo inert gas configuration ($ns^2p^6d^{10}$)

e.g. **Cu^+, Ag^+, Zn^{+2}, Cd^{+2}**

M.O. Theory:

i. Bond order = 1/2 (N_b–N_a)

ii. Higher the bond order, higher is the bond dissociation energy, greater is the stability, shorter is the bond length. on an atom in a Lewis

= [total number of valence electrons in the free atoms] – [total number of non-binding (lone pair) electrons] – $\frac{1}{2}$[total number bonding (shared) electrons]

Relative bond strength :

sp^3d^2 > dsp^2 > sp^3 > sp^2 > sp > p-p (Co-axial) > s-p > s-s > p-p (Co-lateral)

VSEPR theory

i. (LP-LP) repulsion > (LP-BP) > (BP-BP)

ii. NH_3 → Bond angle 106°45' because

(LP-BP) repulsion > (BP-BP) H_2O → 104°27' because (LP-LP) repulsion > (LP-LB) > (BP-BP)

Hybridisation : $H = \frac{V + M - C + A}{2}$

MO Configuration

Case I :

2s–2p mixing occurs (total $e^- \leq 14$)

$\sigma 1s < \sigma^*1s < \sigma 2s < \sigma^*2s < \pi 2p_x = \pi 2p_y < \sigma 2p_z < \pi^*2p_x = \pi^*2p_y < \sigma^*2p_z$

Case II :

2s–2p mixing do not occurs (total e^- > 14 to 20)

$\sigma 1s < \sigma^*1s < \sigma 2s < \sigma^*2s < \sigma 2p_z < \pi 2p_z < \pi 2p_x = \pi 2p_y < \pi^*2p_x = \pi^*2p_y < \sigma^*2p_z$

Application of H-bonding

Physical State (densile nature)	∝ H-bond
Melting point (mp)	∝ H-bond
Boiling point (bp)	∝ H-bond
Viscosity	∝ H-bond
Surface Tension	∝ H-bond
Volatilty	∝ 1/H-bond
Vapour Pressure	∝ 1/H-bond