CHEMICAL BONDING

IONIC BOND

- **Properties of ionic comopounds**
- Hard & Brittle with High Boiling and Melting Points.
- Soluble in Polar Solvents (Hydration>Lattice)
- Conductivity : Aqueous > Fused > Solid State
- Solubility ∝ Dieletric constant ∝ 1/Polarisation ∝ Diff. in size of cations and anions

Ionic Charac. ∝ Lattice enthalpy ∝ $^{1}/_{\text{I. E (Cat.)}}$ ∝ Electron affinity (Anion) ∝ Charge Magnitude

Formulas to calculate Hybridisation

SN = 1/2 [V + M - C+ A] C = Cationic charge A = Anionic charge	SN= Steric number V= Valence e (central atom) M = Monovalent side atoms
SN = sigma bond + LP	SN = Steric number LP = Lone pairs

- **Repulsions** : Lone Pair - Lone Pair (LP-LP) > Lone Pair - Bond Pair (LP-BP) > Bond Pair - Bond Pair (BP-BP)
- **Strength of Orbital overlap**
  - σ bond : s-s > s-p> p-p
  - π bond : $2p\pi$-$2p\pi$ > $2p\pi$-$3p\pi$ > $3p\pi$-$3p\pi$

Mol.	Geometry	Shape	S.N.	Hyb
AB_2	Linear	Linear	2	sp
AB_3	Triagnol Planar	Triagnol Planar	3	sp^2
AB_2L	Triagnol Planar	Bent	3	
AB_4	Tetrahedral	Tetrahedral	4	sp^3
AB_3L	Tetrahedral	Pyramidal	4	
AB_2L_2	Tetrahedral	Bent	4	
AB_4	Square planar	Square planar	4	dsp^2
AB_5	T.B.P.	T.B.P.	5	sp^3d
AB_4L	TBP	See Saw	5	
AB_3L_2	TBP	T-Shape	5	
AB_2L_3	TBP	Linear	5	
AB_6	Octahedral	Octahedral	6	sp^3d^2
AB_5L	Octahedral	Square Pyramidal	6	
AB_4L_2	Octahedral	Square Planar	6	
AB_7	P.B.P	P.B.P	7	sp^3d^3
AB_6L	P.B.P	Distorted Oct.	7	
AB_5L_2	P.B.P	Pentagonal Planar	7	

Only Eı

HOMONUECLEAR M.O.T

$\sigma1s < \sigma^*1s < \sigma2s < \sigma^*2s < \pi2p_x = \pi2p_y < \sigma2p_z < \pi^*2p_x = \pi^*2p_y < \sigma^*2p_z$

$n\ e^- \leqq 14$

$\sigma1s < \sigma^*1s < \sigma2s < \sigma^*2s < \sigma2p_z < \pi2p_x = \pi2p_y < \pi^*2p_x = \pi^*2p_y < \sigma^*2p_z$

$n\ e^- > 14$

Species	Total e^-	Bond order	Unpaired e^-	Mag. Char.
Be_2, Li_2^{2-}, B_2^{2+}	8	0	0	Dia
B_2^+, Be_2^-	9	0.5	1	Para
B_2, Be_2^{2-} , C_2^{2+}	10	1	2	Para
C_2^+ , B_2^-	11	1.5	1	Para
B_2^{2-}, C_2, N_2^{2+}, BN, CN^+	12	2	0	Dia
C_2^- N_2^+, CN	13	2.5	1	Para
N_2, O_2^{2+}, C_2^{2-}, CO, NO^+, CN^-	14	3	0	Dia
N_2^-, O_2^+, NO	15	2.5	1	Para
N_2^{-2}, O_2, NO^-, F_2^{2+}	16	2	2	Para
O_2^-, F_2^+	17	1.5	1	Para
O_2^{-2}, F_2, Ne_2^{2+}	18	1	0	Dia
F_2^-, Ne_2^+	19	0.5	1	Para
F_2^{-2}, Ne_2	20	0	0	

Bond order = 1/2 (Nb - Na)

- If B.O. = 0, Molecule doesn't exist
- Bond order ∝ Bond Strength ∝ Bond Stability ∝ 1/Bond length
- **Bond order in resonating strucrtures**

$$= \frac{\text{Total number of bonds between atoms}}{\text{Total number of resonating structures}}$$

- CO_3^{2-} = 1.33 ; O_3 = 1.5 SO_4^{2-} = 1.5

Bridged Compounds

B_2H_6	Al_2Cl_6	Al_2I_6	$Al_2(CH_3)_6$
3c-2e⁻	3c-4e⁻	3c-4e⁻	3c-2e⁻

Hydrogen Bonding

- Hydrogen Connected to E.N. element forming non bonding interaction.
- Strength : HF > H_2O > NH_3 (depends on E.N.)

Consequences

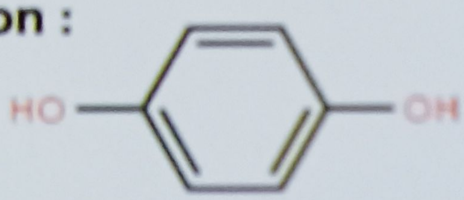
- NH_3 & H_2O have highest M.P. and B.P. in their gps.
- Lower alcohols and NH_3 are soluble in water
- Viscosity increases with H-Bonding
- Volatility of compounds decreases
- H-Bond Ice > Water > Impure water
- Compounds with Intramolecular H-Bonding have sharp melting points. e.g. Ortho nitrophenol

Dipole Moment

- $NF_3 < NH_3$; $H_2O > F_2O$
- Trans $C_2H_2Cl_2$ < Cis $C_2H_2Cl_2$
- Trans N_2F_2 < Cis N_2F_2
- $CH_3Cl > CH_2Cl_2 > CHCl_3 > CCl_4$

- **μ = 0 for non polar & symmetric molecules** e.g. $BeCl_2$, CH_4, SbF_5, Trans $C_2H_2Cl_2$

Exception :



Hydroquinone

Lone pair not involved in resonance

OCTET RULE

Stable arrangement of atoms when surrounded by 8 e^- (owned or by sharing)

Incomplete or Hypovalent	$AlCl_3$, BF_3, BeF_2
Expanded or Hypervalent	PF_5, SF_6, H_4SO_4, IF_7
Odd e^- molecules	O_2^-, NO, ClO_2

Octet rule doesn't tell about energy of molecules

Oxide type

Acidic - CO_2, B_2O_3, N_2O_5, SO_2, Cl_2O_7, CrO_3, I_2O_5, Mn_2O_7

Basic - Li_2O, Na_2O, CaO, BaO, Na_2O_2, KO_2

Neutral - CO, N_2O, NO, H_2O

Amphoteric ZnO, BeO, Al_2O_3, Ga_2O_3, SnO

Elements forming amphoteric oxides	
As^{+3}, Fe^{+3}, V^{+3}, Cr^{+3}, Be, Zn, Al, Ga, Ge, Sn, Sb, Pb, Bi, Po	
Trend	**Reason**
$HF > H_2O > NH_3 > CH_4$	A.C ↑ as EN ↑
$HI > HBr > HCl > HF$	A.C ↑ as size ↑
$H_2Te > H_2Se > H_2S > H_2O$	A.C ↑ as size ↑
$SO_3 > SeO_3 > TeO_3$	A.C ↑ as EN ↑
$H_2SO_4 > H_2SeO_4 > H_2TeO_4$	A.C ↑ as EN ↑
$HNO_3 > H_2CO_3 > H_3BO_3$	A.C ↑ as EN ↑ , O.N ↑
$H_3PO_4 > H_3AsO_4 > H_3SbO_4$	A.C ↑ as EN ↑
$HOF > HOCl > HOBr > HOI$	A.C ↑ as EN ↑
$HClO_4 > HBrO_4 > HIO_4$	A.C ↑ as EN ↑
$N_2O_5 > P_2O_5 > As_2O_5$	A.C ↑ as EN ↑
$HClO_4 > HClO_3 > HClO_2 > HClO$	A.C ↑ as ON ↑
$P_4O_{10} > SiO_2 > Al_2O_3$	A.C ↑ as EN ↑ , ON ↑
$Mn_2O_7 > MnO_2 > MnO$	A.C ↑ as ON ↑
$Rb_2O > K_2O > Na_2O > Li_2O$	B.C ↑ as Size ↑
$BaO > SrO > CaO > MgO$	B.C ↑ as Size ↑
$Ca(OH)_2 > Mg(OH)_2 > Be(OH)_2$	B.C ↑ as Size ↑
$RbOH > KOH > NaOH > LiOH$	B.C ↑ as Size ↑