Gas in liquid Solution

Solute Solvent

Factors affecting Solubility of gas in liquid :-

(1) Nature of gas & Solvent :-

H_2, N_2, O_2, He, Ne — e.t.c. are less Soluble in water.

SO_2, HCl, NH_3 are more soluble in water

(2) Temperature (T) :-

$$gas + solvent \rightleftharpoons solution + X\ kj$$

(exothermic)

T ↑ ← Solubility of gas ↓

T ↓ → Solubility of gas ↑

(3) Pressure :-

Solubility of gas ↑ with increases pressure.

Henry's law :-

It can be stated at Constant temp the solubility of gas in liquid is directly proportional to the partial pressure of the present above the surface of liquid or solution.

OR

mole fraction of the gas in solution is directly proportional to partial pressure of the gas in solution

OR

The partial pressure of the gas in vapour phase in directly proportional to the molefraction of the gas (X) in solution.

$p \propto x$

$\boxed{p = K_H x}$

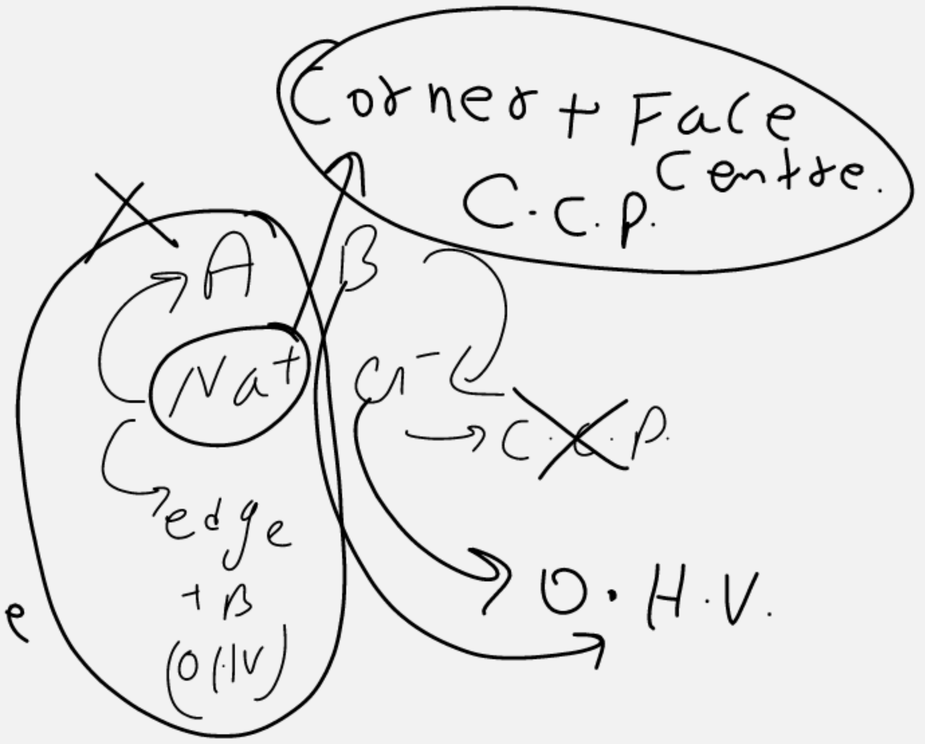
K_H = Henry's Constant.

- it is not a universal Constant
- it depends nature of gas and T.
- K_H increases with increase in T

10. In a solid 'AB' having NaCl structure, 'A' atoms occupy the corners of the cubic unit cell. If all the face-centred atoms along one of the axes are removed, then the resultant stoichiometry of the solid is

(a) AB_2 (b) A_2B

(c) A_4B_3 (d) A_3B_4.



A → Corner + Face centre

→ $8 \times \frac{1}{8} + 6 \times 1/2$ (6 → 4)

A → 4

B → O.H.V → $1 + 12 \times 1/4 = 4$

$+ 1/2 = 3/2$

AB

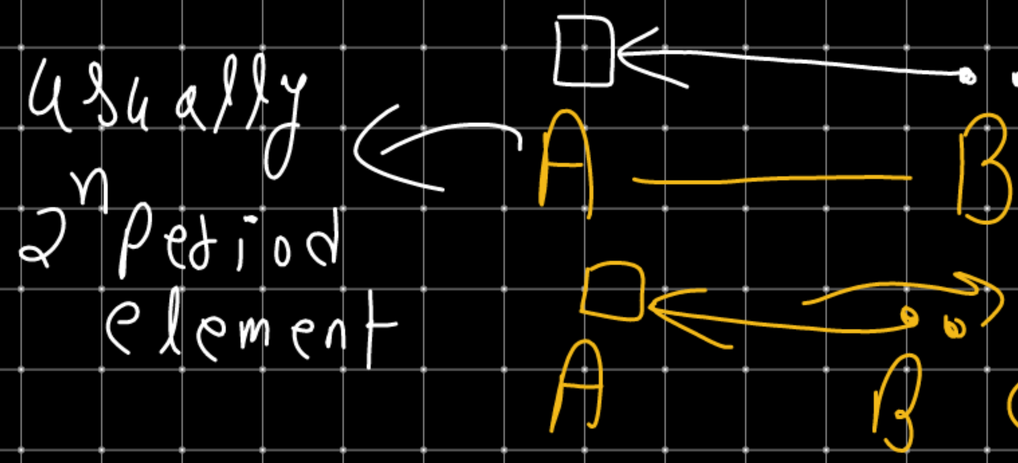
if Face centred atom removed along one axis.

A → $8 * 1/8 + 4 \times 1/2 = 3$, B → 4 ⇒ A_3B_4

Chemical Bonding

Back bonding :-

(1) Out of two bonded atoms one atom have Vacant orbital and other is having L.P. (lone pair)



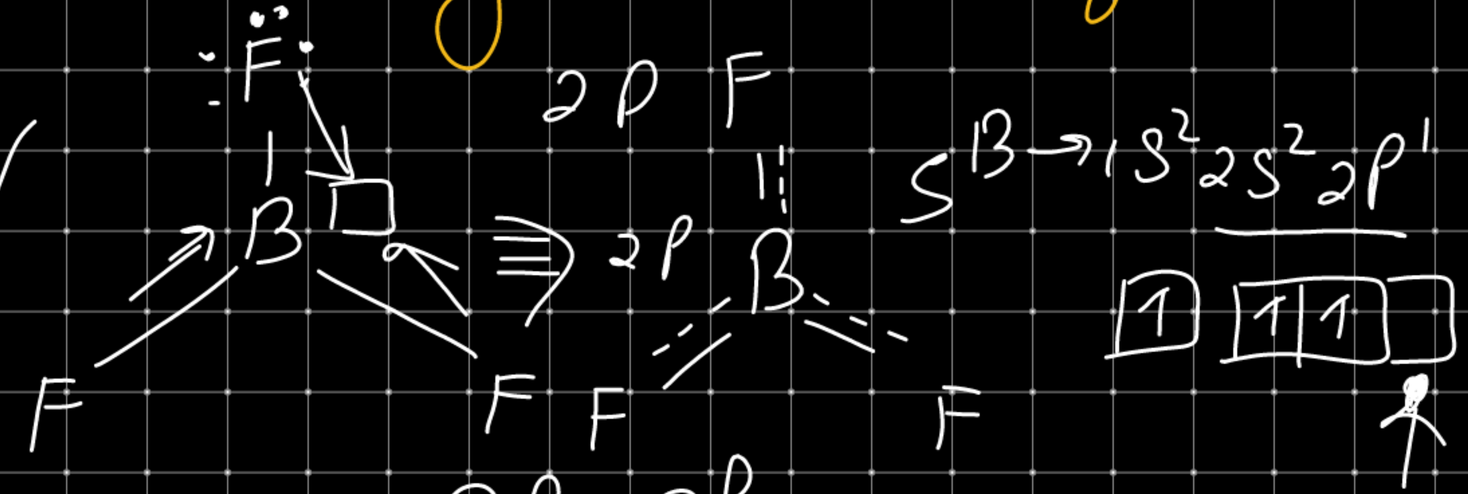
(2) Back Bonding increases bond strength and decreases bond length.

(3) Extent of back bonding is much larger if orbitals involve in bonding have similar size, for strength of back bonding atleast one of two bonded atoms should be 2^{nd} period.

ex: Identify back bonding in following.

(1) BF_3

B.B.✓

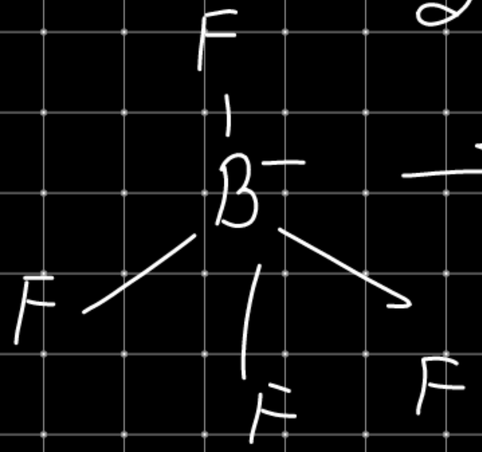


$5^{B} \rightarrow 1s^2 2s^2 2p^1$

$2p_x - 2p_x$

(2) BF_4^-

B.B.X

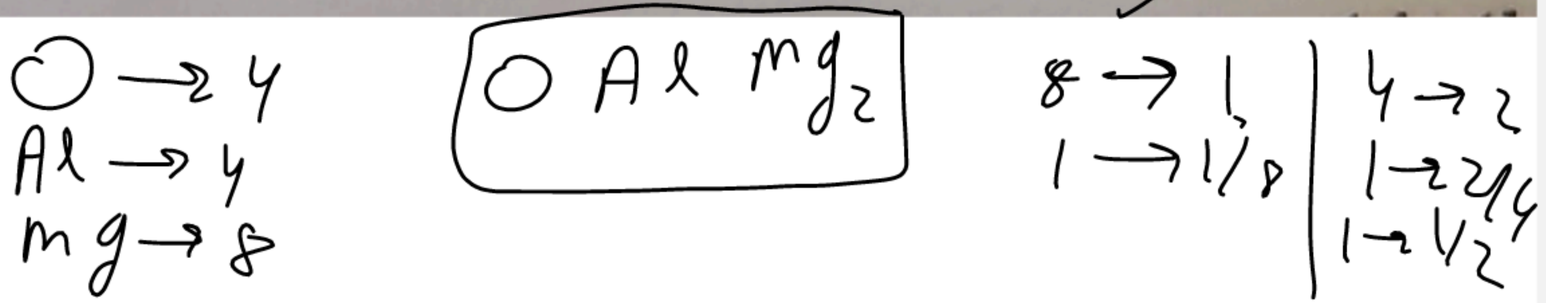


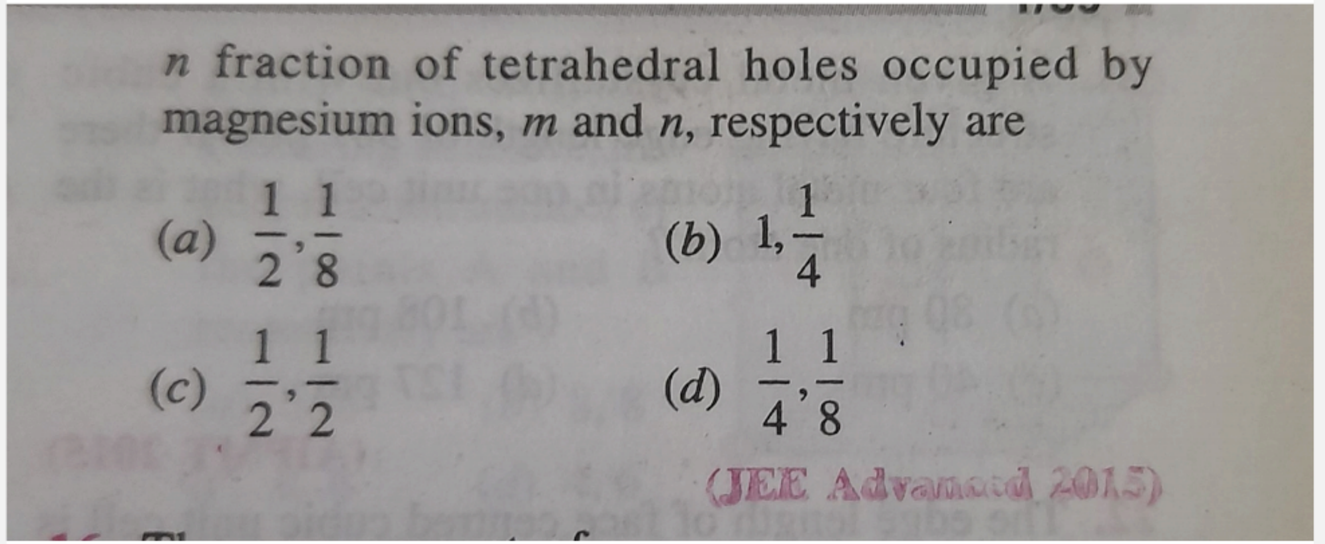
→ octet completed

(c) ABO_2

(AIPMT Mains 2012)

15. If the unit cell of a mineral has a cubic close packed (*ccp*) array of oxygen atoms with *m* fraction of octahedral holes occupied by aluminium ions and





n fraction of tetrahedral holes occupied by magnesium ions, m and n, respectively are

(a) $\frac{1}{2}, \frac{1}{8}$ (b) $1, \frac{1}{4}$

(c) $\frac{1}{2}, \frac{1}{2}$ (d) $\frac{1}{4}, \frac{1}{8}$

(JEE Advanced 2015)

(a)

molecule is neutral.

(charge) = 0

$4 \times (-2) + 4 \times m + 8 \times n = 0 \Rightarrow 12m + 16n = 8$

$(+3)$ $(+2)$

$3m + 4n = 2$ ✓