## **CHAPTER - 04**

## CHEMICAL BONDING AND MOLECULAR STRUCTURE

- 4 SF<sub>4</sub> has an expanded octet around sulphur atom (10 valence electrons)
- Bond order follows the order: CO > CO<sub>2</sub> > CO<sub>3</sub><sup>2</sup>
- 3. 2 Melting point follows the order: LiF > LiCl > LiBr > Lil

5. 1 •Ö-Öl-Ö: Chlorine atom is sp³ hybridised

(Pentagonal planar)

(Trigonal bipyramidal)

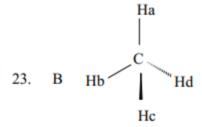
- 7. 2  $SF_4 sp^3d$ ;  $XeF_4 sp^3d^2$ ;  $I_3^- sp^3d$ ;  $XeF_2 sp^3d$ ;  $ICI_4^+ sp^3d$ ;  $SiCI_4 sp^3$ ;  $CIO_4^- sp^3$ ;  $CIO_4^- sp^3$ ;  $CIF_4 sp^3d$
- 8. 2 Bond angle of hydrides decreases down the group due to lack of hybridisation
- 9. 4  $XeO_3$  contains  $d\pi p\pi$  bonds. Bond order of  $XeO_3$  is 2
- 10. 4  $P_x P_x$ ,  $P_y P_y$  overlaps will lead to  $\pi$  bond when z-axis is the internuclear axis
- 11. 2 p-dichlorobenzne has zero dipole moment
- 12. 4 BF<sub>3</sub> has zero dipole moment
- Both CH<sub>4</sub> and CCI<sub>4</sub> have zero dipole moment
- 14. 3  $B_2$  is paramagnetic due to presence of unpaired electrons in  $\pi_{2p}$  orbitals. Highest occupied molecular orbital in  $B_2$  is  $\pi_{2p}$

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- 15. 1 Bond order of O–O bond follows the sequence: O<sub>2</sub> > O<sub>3</sub> > H<sub>2</sub>O<sub>2</sub>. Thus, O–O bond length is in the order: O<sub>2</sub> < O<sub>3</sub> < H<sub>2</sub>O<sub>2</sub>
- 16. 9 **:!**-**!**:-**!**:-**!**:-

Total number of lone pairs = 3 + 3 + 3 = 9

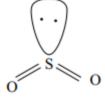
- 17. 3 PCl<sub>2</sub>F<sub>3</sub>, ICl<sub>3</sub> and SF<sub>4</sub> are polar molecules
- 18. 4 BeCl<sub>2</sub>,  $N_3^-$ ,  $N_2O$  and  $NO_2^+$  are linear with no contribution form d-orbitals in hybridisation
- B C C bond length decreases with increase in the number of electronegative fluorine atoms on the carbon (Bent's rule)
- 20. D  $\pi$  electron clouds of  $C_1 C_2$  and  $C_2 C_3$  bonds are mutually perpendicular As per the given information, Cl and H atoms on  $C_1$  lie in a plane perpendicular to the plane of paper whereas F and H atoms on  $C_3$  lie in the plane of paper itself
- C Backbonding affects bondlength bond order and Lewis acidity; the doesnot affect bond angle, geometry and planarily of BF<sub>3</sub> molecule
- A Due to backbonding, O–H bond in (CH<sub>3</sub>)<sub>3</sub>SiOH is more polarised, resulting in the formation of stronger hydrogen bonds

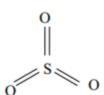


The required planes are

$$H_a - C - H_b$$
,  $H_a - C - H_c$ ,  $H_a - C - H_d$ ,  $H_b - C - H_c$ ,  $H_b - C - H_d$  and  $H_c - C - H_d$ 

24. B





'S'is sp2 hybridised

S is sp2 hybridised

One  $p\pi - p\pi$  bond and

One  $p\pi - p\pi$  bond and two  $p\pi - d\pi$  bonds

one  $p\pi$  -  $d\pi$  bond

- C PCI<sub>8</sub><sup>-</sup> has perfect octahedral geometry
- 26. A, B, C, D

27. A, B, C

- N (Silt3)3 Bond order = 1.33
- 2) NH (SiH3)2 bond angle >120° due to steric repulsion between SiH3 groups N(SiH3)3 - all thi bond angles are 120°
- 3) NH(SiH3)2 backbonding pair is

  Spread only over 2 bonds

  N (SiH3)3 this pair is spread over

  3 bonds.
- 28. A, B, C, D

Bond order of X<sub>2</sub> in the excited state is higher than that in the ground state

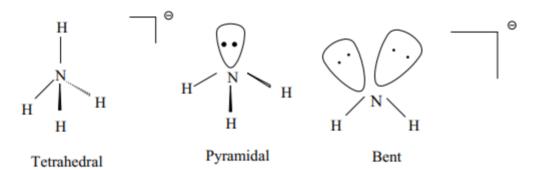
29. ABC D

 $C_2$  is diamagnetic and it contains two  $\pi$ - bonds. If z - axis is intermolecular axis,  $2p_x$  and  $2p_y$  orbitals form  $\pi$ - molecular orbitals which are not symmetrical around the bond axis.

Bonding MOs are lower in energy where as antibonding MOs are higher in energy than the parent AOs

30. A, C, D

## **Brilliant** STUDY CENTRE



$$NH_4NO_3 \equiv NH_4^{\oplus} NO_3^{(-)}$$

N is sp³ hybridised in  $NH_4$  whereas sp² hybridised in  $NO_3$  (-)

Bond energy and bond length of C2 molecule are greater than that of O2 molecule

31. C XeO,F, - Trigonal bipyramidal

ICl<sub>4</sub> - square planar

SF<sub>4</sub> - See - saw shaped (distorted TBP electron pair geometry)

PF<sub>2</sub>Cl<sub>3</sub> - Trigonal bipyramidal

Thus only SF4 doesnot contain 90° bond angle (s)

 32. 3.00 Bond dipole moment due to the three C-Cl bonds at 120° cancel out each other. Now, only one C -Cl bond dipole moment remains making the net dipole moment 1.5D

33. 5.00 
$$^{H}$$
  $_{C} = c = c$ 

Maximum five atoms can be accompdated in the same palne

- 34 2.00 p = 3, q = 5, r = 2, s = 6 and t = 2
- 5.00 PCl<sub>4</sub><sup>+</sup>, ICl<sub>2</sub><sup>+</sup>, SF<sub>2</sub>, AsF<sub>4</sub><sup>+</sup> and SiF<sub>4</sub> have sp<sup>3</sup> hybridisation, thus no involvement of d orbitals in hybridisation
- 36. 6.00 P = 3, Q = 2, R = 1 and S = 0
- 37 D  $\stackrel{\Theta}{\text{CH}_3}$ , NH<sub>3</sub>,  $\stackrel{\Theta}{\text{BF}_4}$ , CH<sub>4</sub> and NH $^{\oplus}_4$  are non planar:

BF<sub>3</sub>,  $CH_3^{\oplus}$ ,  $\dot{C}H_3$  and  $NH_2$  are planar

BF<sub>4</sub>, CH<sub>4</sub> and NH<sub>4</sub> have perfect tetrahedral geometry

38. A PBr<sub>3</sub>Cl<sub>2</sub> and BF<sub>3</sub> are nonpolar whereas HO—OH and PBr<sub>2</sub>Cl<sub>3</sub> are polar