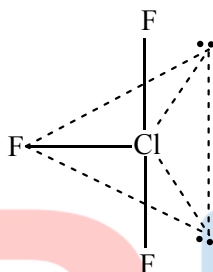


Topic :- Chemical Bonding and Molecular Structure

- 1 (c)
Cl in ClF_3 has sp^3d -hybridization



and possesses two axial Cl—F bonds and one equatorial bond. Two lone pairs are at equatorial position give rise to bent 'T' shape to ClF_3 .

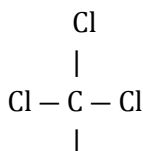
- 3 (c)
 O_2^- has one unpaired electron in its antibonding molecular orbital.
- 4 (d)
 $\text{PCl}_3 < \text{PBr}_3 < \text{PI}_3$, the bond angle order is explained in terms of increasing electronegativity of halogens, whereas, $\text{PF}_3 > \text{PCl}_3$, bond angle order is explained in terms of $p\pi - d\pi$ bonding in PF_3 .

- 5 (c)
 $\mu_{\text{experimental}} = \text{Dipole moment} \times 10^{-18}$
 $\mu_{\text{theoretical}} = \text{Bond length} \times 4.8 \times 10^{-10} \text{ esu} \times \text{cm}$

$$\text{Percentage ionic character} = \frac{\mu_{\text{experimental}}}{\mu_{\text{theoretical}}} \times 100$$

$$= \frac{1.0 \times 10^{-18} \times 100}{1.25 \times 4.8 \times 10^{-10} \times 10^{-8}}$$
$$= 16.66\%$$

- 6 (d)
 CCl_4 does not exhibit dipole moment due to its symmetrical structure.

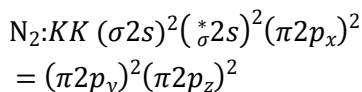


Cl

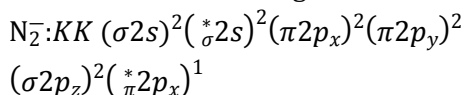
7

(a)

N_2 molecule has 14 electrons. The molecular orbital electronic configuration of the molecule is as



N_2^- ion is formed when N_2 accept an electron hence it has 15 electrons. The molecular orbital electronic configuration of the molecule is as



Hence, this electron goes to antibonding π molecular orbital.

8

(b)

The size of isoelectronic decreases with increase in atomic number.

9

(a)

The bond orders for H_2 , H_2^+ , He_2 and He_2^+ are 1.0, 0.5, 0.0 and 0.5 respectively.

10

(b)

N atom has smallest radius.

11

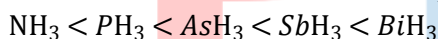
(d)

The order of screening effect for a given shell electrons is $s > p > d > f$.

12

(a)

The stability of hydrides decreases down the gp, i.e., from NH_3 to BiH_3 which can be observed from their bond dissociation enthalpy. The correct order is



Property	NH_3	PH_3	AsH_3	SbH_3	BiH_3
$\Delta_{diss} H^-(E-H)/kJ mol^{-1}$	389	322	297	255	—

13

(a)

SF_4 has sp^3d^2 -hybridization and see-saw geometry.

14

(a)

Due to presence of intermolecular hydrogen bonding in H_2O , its molecules are associated with each other which results unusual high boiling point of water.

15

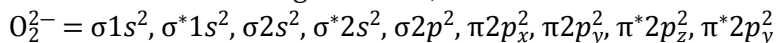
(c)

Larger is anion, more is covalent character.

16

(a)

Molecular orbital configuration of,



17

(a)

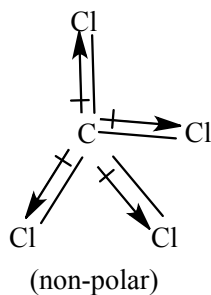
Valencies of X, Y and Z is +2, +2 and -2 respectively so, they will form a compound having of formula XYZ_2 .

18

(a)

The molecule in which the bond dipoles of all the bonds are cancel out by each other, is called non-polar e.g., CCl_4 .

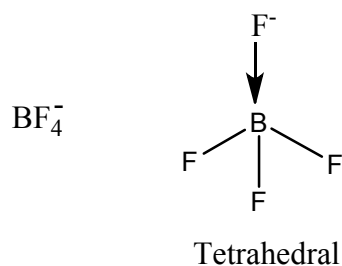
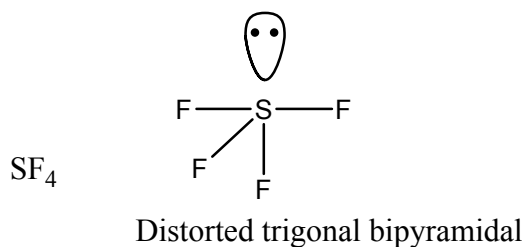
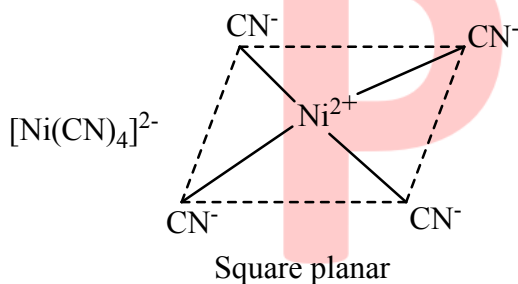
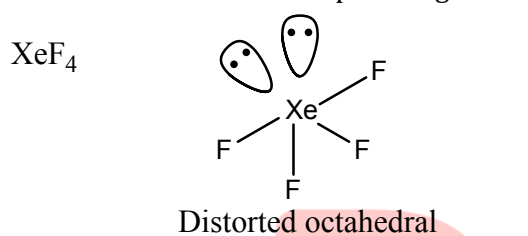
In CCl_4 , there is a large difference between the electronegativities of C and Cl but all the four C – Cl bond dipoles cancel each other, hence it is a non-polar molecule.



19

(c)

Tetrahedral structure is associated with sp^3 hybridised central atom without any lone pair. The structure of all the compounds given are as follows :

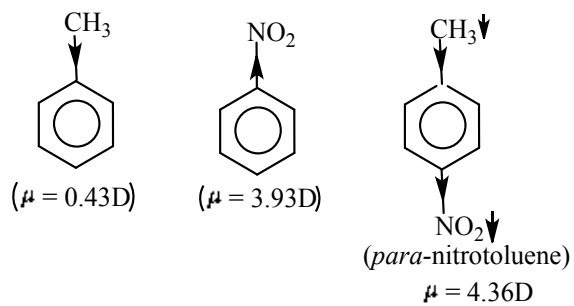


20

(c)

Methyl group has $+I$ effect and $-\text{NO}_2$ group has $-I$ effect. Therefore, in p -nitro toluene the dipole moments of $-\text{CH}_3$ and $-\text{NO}_2$ groups act in the same direction. So, the resultant

dipole moment is additive.
i.e., $3.93+0.43=4.36$ debye



PE

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	c	a	c	d	c	d	a	b	a	b
Q.	11	12	13	14	15	16	17	18	19	20
A.	d	a	a	a	c	a	a	a	c	c

P E