NEET CHEMICAL BONDING AND MOLECULAR STRUCTURE

1. In the structure of ClF_3, the number of lone pair of electrons on central atom 'Cl' is **[2018]**
1) One 2) Two 3) Three 4) Four

2. Which of the following molecules represents the order of hybridisation *sp*2, *sp*2, *sp*, *sp* from left to right atoms? **[2018]**
1) $HC \equiv C - C \equiv CH$ 2) $CH_2 = CH - C \equiv CH$ 3) $CH_3 - CH = CH - CH_3$ 4) $CH_2 = CH - CH = CH_2$

3. Consider the following species : **[2018]**
CN^+, CN^-, NO and CN Which one of these will have the highest bond order?
1) NO 2) CN^- 3) CN 4) CN^+

4. The species, having bond angles of 120° is : **[2017]**
1) ClF_3 2) NCl_3 3) BCl_3 4) PH_3

5. Which of the following pairs of species have the same bond order ? **[2017]**
1) O_2, NO^+ 2) CN^-, CO 3) N_2, O_2^- 4) CO, NO

6. Consider the molecules CH_4, NH_3 and H_2O. Which of the given statements is false? **[2016]**
1) The H–C–H bond angle in CH_4, the H–N–H bond angle in NH_3, and the H–O–H bond angle in H_2O are all greater than 90°
2) The H–O–H bond angle in H_2O is larger than the H– C–H bond angle in CH_4.
3) The H–O–H bond angle in H_2O is smaller than the H–N–H bond angle in NH_3.
4) The H–C–H bond angle in CH_4 is larger than the H–N–H bond angle in NH_3.

7. Predict the correct order among the following :- **[2016]**
1) lone pair- lone pair > lone pair - bond pair > bond pair - bond pair
2) lone pair - lone pair > bond pair - bond pair > lone pair - bond pair
3) bond pair - bond pair > lone pair - bond pair > lone pair - lone pair
4) lone pair - bond pair > bond pair - bond pair > lone pair - lone pair

8. Decreasing order of stability of O_2, O_2^-, O_2^+ and O_2^{2-} is : **[2015]**
1) $O_2^+ > O_2 > O_2^- > O_2^{2-}$ 2) $O_2^{2-} > O_2^- > O_2 > O_2^+$
3) $O_2 > O_2^+ > O_2^{2-} > O_2^-$ 4) $O_2^- > O_2^{2-} > O_2^+ > O_2$

9. The correct bond order in the following species is: **[2015]**
1) $O_2^{2+} < O_2^- < O_2^+$ 2) $O_2^+ < O_2^- < O_2^{2+}$ 3) $O_2^- < O_2^+ < O_2^{2+}$ 4) $O_2^{2+} < O_2^+ < O_2^-$

10. Which of the following pairs of ions are isoelectronic and isostructural? **[2015]**
1) ClO_3^-, CO_3^{2-} 2) SO_3^{2-}, NO_3^- 3) ClO_3^-, SO_3^{2-} 4) CO_3^{2-}, SO_3^{2-}

11. Maximum bond angle at nitrogen is present in which of the following? **[2015]**
1) NO_2^- 2) NO_2^+ 3) NO_3^- 4) NO_2

12. Which of the following species contains equal number of σ and π – bonds **[2015]**
1) XeO_4 2) $(CN)_2$ 3) $CH_2(CN)_2$ 4) HCO_3^-

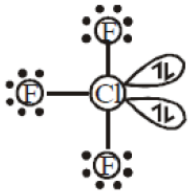
13. Which of the following molecules has the maximum dipole moment? **[2014]**
1) CO_2 2) CH_4 3) NH_3 4) NF_3

14. Which one of the following species has planar triangular shape? **[2014]**
1) N_3^- 2) NO_3^- 3) NO_2^- 4) CO_2

15. The number of sigma (s) and pi (p) bonds in pent- 2-en-4-yne is :- (2019)
(1) 10 σ bonds and 3 π bonds (2) 8 σ bonds and 5 π bonds
(3) 11 σ bonds and 2 π bonds (4) 13 σ bonds and no π bond

ANSWERS

1. 2) The structure of ClF_3 is



The number of lone pair of electrons on central Cl is 2.

2) $\overset{sp^2}{CH_2}=\overset{sp^2}{CH}-\overset{sp}{C}\equiv\overset{sp}{CH}$

3. 2)NO : $(\sigma 1s)^2(\sigma^*1s)^2(\sigma 2s)^2(\sigma^*2s)^2(\sigma 2p_z)^2\ \ (\pi 2p_x)^2=(\pi 2p_y)^2(\pi^*2p_x)^1=(\pi^*2p_y)^0$

$$B.O=\frac{10-5}{2}=2.5$$

CN^- : $(\sigma 1s)^2(\sigma^*1s)^2(\sigma 2s)^2(\sigma^*2s)^2$

$$(\pi 2p_x)^2=(\pi 2p_y)^2(\sigma 2p_z)^2$$

$$B.O.=\frac{10-4}{2}=3$$

CN : $(\sigma 1s)^2(\sigma^*1s)^2(\sigma 2s)^2(\sigma^*2s)^2$

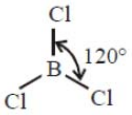
$$(\pi 2p_x)^2=(\pi 2p_y)^2(\sigma 2p_z)^1$$

$$B.O.=\frac{9-4}{2}=2.5$$

CN^+ : $(\sigma 1s)^2(\sigma^*1s)^2(\sigma 2s)^2(\sigma^*2s)^2(\pi 2p_x)^2=(\pi 2p_y)^2$

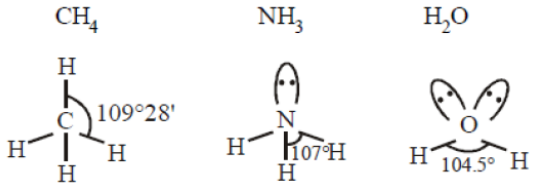
$$B.O.=\frac{8-4}{2}=2$$

4. 3) BCl_3 is trigonal planar and hence the bond angle is 120°.



5. 2) CN^- and CO have same no. of electrons and have same bond order equal to 3.

6. 2)



Tetrahedral; Trigonal pyramidal; Bent

. **Note:** The geometry of H2O should have been tetrahedral if there are all bond pairs. But due to presence of two lone pairs the shape is distorted tetrahedral. Hence bond angle reduced to 104.5° from 109.5°.

7. **1)** According to VSEPR theory order of repulsion in between lp – lp, lp – bp and bp – bp is as under lp – lp > lp – bp > bp – bp

8. **1)** According to molecular orbital theory as bond order decreases stability of the molecule decreases

Bond order $= \frac{1}{2}(N_b - N_a)$

Bond order for $O_2^+ = \frac{1}{2}(10-5) = 2.5$

Bond order for $O_2 = \frac{1}{2}(10-6) = 2$

Bond order for $O_2^- = \frac{1}{2}(10-7) = 1.5$

Bond order for $O_2^{2-} = \frac{1}{2}(10-8) = 1.0$

hence the correct order is

$O_2^+ > O_2 > O_2^- > O_2^{2-}$

9. 3) O_2^+ ion - Total number of electrons (16 – 1) = 15. Electronic configuration

$\sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \sigma 2p_x^2$

$< \pi 2p_y^2 = \pi 2p_z^2 < \pi^* 2p_y^1$

Bond order $= \frac{N_b - N_a}{2} = \frac{10-5}{2} = \frac{5}{2} = 2\frac{1}{2}$

O_2^- (Super oxide ion): Total number of electrons

$(16+1) = 17$. Electronic configuration

$\sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \sigma 2p_x^2$

$< \pi 2p_y^2 = \pi 2p_z^2 < \pi^* 2p_y^2 = \pi^* 2p_z^1$

Bond order

$= \frac{(N_b - N_a)}{2} = \frac{10-7}{2} = \frac{3}{2} = 1\frac{1}{2}$

O_2^{+2} ion: Total number of electrons $= (16-2) = 14$

Electronic configuration

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

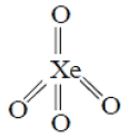
Bond order $= \frac{(N_b - N_a)}{2} = \frac{10-4}{2} = \frac{6}{2} = 3$

So bond order: $O_2^- < O_2^+ < O_2^{2+}$

10. 3) ClO_3^- and SO_3^{-2} both have same number of electrons (42) and central atom in each being *sp*3 hybridised.
Both are having one lone pair on central atom hence they are pyramidal.

11. 2) NO_2^+ has *sp* hybridisation so it is linear with bond angle = 180°.

12. 1)

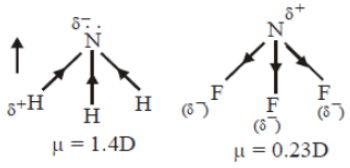


Number of σ bonds = 4

Number of π bonds = 4

13. 3)

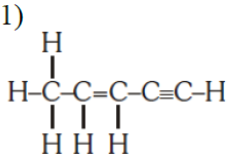
Dipole moment of $NH_3 > NF_3$



(F is more electronegative than N)

14. 2) $NO_3^- = \frac{1}{2}(5+0+1-0) = \frac{6}{2} = 3 = sp^2$ NO_2^- (nitrite ion) also has sp^2 hybridization and gives a trigonal planner geometry but because there are only two outer atoms, the molecular geometry is bent with $\angle 120^0$ bond angles.

15. 1)



Number of sigma bonds = 10

Number of π-bonds = 3