
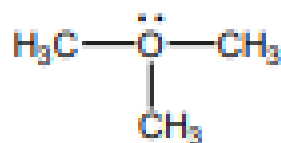
	INDIAN SCHOOL AL WADI AL KABIR	
Class: XI	Department: SCIENCE 2022 – 23 SUBJECT: CHEMISTRY	Date of submission: 30.10.2022
Worksheet No: 04 WITH ANSWERS	Chapter: CHEMICAL BONDING AND MOLECULAR STRUCTURE	Note: A4 FILE FORMAT
NAME OF THE STUDENT	CLASS & SEC:	ROLL NO.

Questions 1 – 4 are paragraph-based questions.

The attractive force which holds various constituents (atoms, ions, etc.) together in different chemical species is called a chemical bond. Kossel and Lewis were the first to provide some logical explanation of valence which was based on the inertness of noble gases. Lewis postulated that atoms achieve the stable octet when they are linked by chemical bonds. In the formation of a molecule, only the outer shell electrons take part in chemical combination and they are known as valence electrons. The inner shell electrons are well protected and are generally not involved in the combination process. G.N. Lewis introduced simple notations to represent valence electrons in an atom. These notations are called Lewis symbols.

- ... in 1916 developed an important theory of chemical combination between atoms known as electronic theory of chemical bonding.
 - Kössel
 - Lewis
 - Both a) & b)
 - Sidgwick
- In the formation of a molecule, only the outer shell electrons take part in chemical combination and they are known as ...
 - Kernel
 - valence electrons
 - Primary electrons
 - Secondary electrons
- In the CH_4 molecule there are ... valence electrons available for bonding.
 - 4
 - 6
 - 8
 - 10

4. The type of bond between atoms in a molecule of CO_2 is
- Ionic bond
 - Metallic bond
 - Hydrogen bond
 - covalent bond.
5. sp^3d^2 hybridization is present in SF_6 , find its geometry
- octahedral geometry
 - square planar geometry
 - tetragonal geometry
 - tetrahedral geometry
6. Find the molecule with the maximum dipole moment
- CH_4
 - NH_3
 - CO_2
 - NF_3
7. Find the pair with sp^2 hybridisation of the central molecule
- NH_3 and NO_2^-
 - BF_3 and CH_4
 - BF_3 and NO_2^-
 - NH_2^- and H_2O
8. What is the formal charge on oxygen in the following structure?



- +1
 - 2
 - 1
 - 0
9. The correct decreasing order of boiling points of the following compounds is
- $\text{HF} > \text{H}_2\text{O} > \text{NH}_3$
 - $\text{H}_2\text{O} > \text{HF} > \text{NH}_3$
 - $\text{NH}_3 > \text{HF} > \text{H}_2\text{O}$
 - $\text{NH}_3 > \text{H}_2\text{O} > \text{HF}$

Assertion Reason type

10. **Assertion (A):** Though the central atom of both NH_3 and H_2O molecules are sp^3 hybridised, yet $\text{H}-\text{N}-\text{H}$ bond angle is greater than that of $\text{H}-\text{O}-\text{H}$.

Reason (R): This is because nitrogen atom has one lone pair and oxygen atom has two lone pairs.

- A and R both are correct, and R is the correct explanation of A.
- A and R both are correct, but R is not the correct explanation of A.

- c. A is true but R is false.
- d. A and R both are false.

11. **Assertion (A):** ClF_3 has a bent T shape.

Reason (R): It has two lone pairs arranged at 180° .

- a. A and R both are correct, and R is the correct explanation of A.
- b. A and R both are correct, but R is not the correct explanation of A.
- c. A is true but R is false.
- d. A and R both are false.

2 Marks

12. What is the total number of σ and π bonds in the following molecules?

- a. C_2H_6
- b. C_2H_4
- c. HCOOH
- d. CH_3COOH

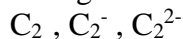
13. Account for the following

- a. The bond dissociation enthalpies of O-H bonds in H_2O are not the same.
- b. The double bond in C_2 molecule consists of π bonds.

14. Amongst the following compounds, which do not obey the octet rule and why?

- a. H_2O
- b. PCl_5
- c. H_2SO_4
- d. BeF_2

15. Arrange the following in the increasing order of bond length.



16. Using the concept of hybridization explain the structures of PCl_5 and SF_6 .

17. CO_2 and SO_2 are triatomic molecules. Do they have the same dipole moment? Justify your answer.

18. When a magnet is lowered in liquid oxygen, some O_2 stick to it. No such behaviour is observed with liquid N_2 . Explain.

3 Marks

19. Draw the Lewis dot structures for

- a. H_2SO_4
- b. PCl_3
- c. H_2S

20. Which is more covalent?

- a. NaCl or MgCl_2
- b. NaF or NaI
- c. HgCl_2 or CaCl_2

21. a Label the covalent radius and van der Waals radius (99 and 180 pm respectively) in the diagram of a chlorine molecule.

b. Which species of each group is predicted to have the strongest bond?

- i. O_2 , F_2 , N_2
- ii. H_2 , H_2^- , H_2^+
- iii. N_2 , N_2^+ , N_2^-

5 Marks

22. Complete the table

Molecule	Bond pairs	Lone pairs	Geometry	Shape	Hybridisation
CH ₄					
NH ₃					
SF ₆					
BrF ₅					
H ₂ O					
PF ₅					
BCl ₃					

23. Give reasons for the following statements

- The C-C bond length in ethane is 154 pm whereas in ethylene it is 134 pm.
- H₂O is a liquid whereas H₂S is a gas.
- PCl₅ is a reactive molecule.
- The O-O bond lengths in O₃ are the same.
- BF₃ is a non-polar molecule.

Answer key

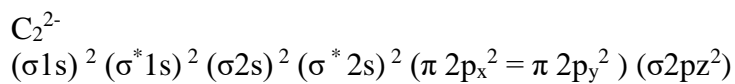
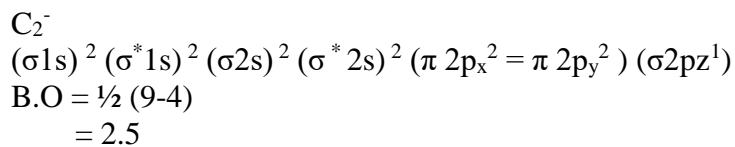
- c
- b
- c
- d
- a
- b
- c
- a
- b
- a
- c

12. a. 7 σ bonds, 0 π bond
b. 5 σ bonds, 1 π bond
c. 4 σ bonds, 1 π bond
d. 7 σ bonds, 1 π bond

13. a. Due to difference in the chemical environment.
b. This is because of the presence of four electrons in two pi molecular orbitals.

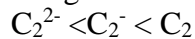
14. b, c, d

15. C₂
 $(\sigma 1s)^2 (\sigma^* 1s)^2 (\sigma 2s)^2 (\sigma^* 2s)^2 (\pi 2p_x)^2 = \pi 2p_y^2$
B.O = $\frac{1}{2} (8-4)$
= 2



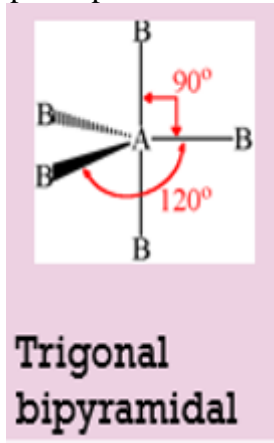
$B.O = \frac{1}{2} (10-4)$
 $= 3$

Increasing bond length



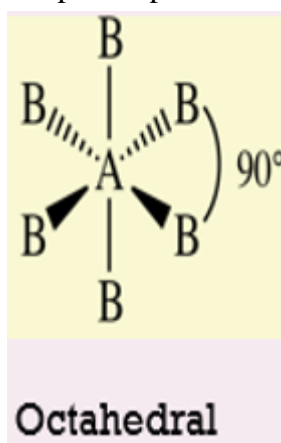
16. PCl_5

sp^3d explanation

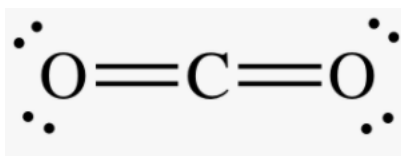


SF_6 .

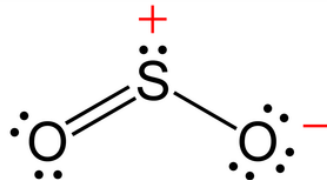
sp^3d^2 explanation



17. CO_2 (linear)



SO_2 (bent)



No, they don't have the same dipole moment.

In CO_2 , the dipoles cancel out and hence have zero dipole moment.

18. O_2 is paramagnetic (due to unpaired electrons). N_2 is diamagnetic (due to paired electrons)

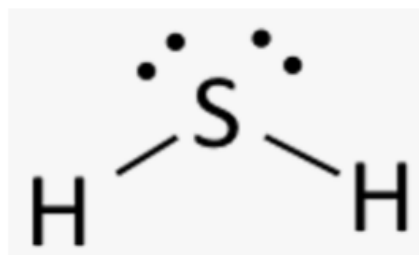
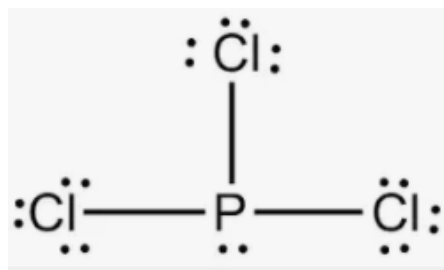
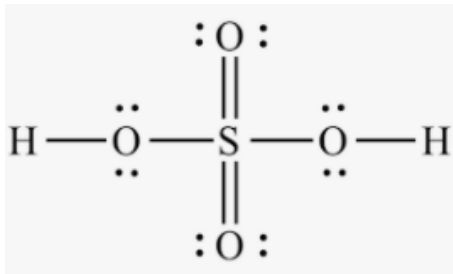
Electronic configurations of N_2 and O_2 .

19..

a. H_2SO_4

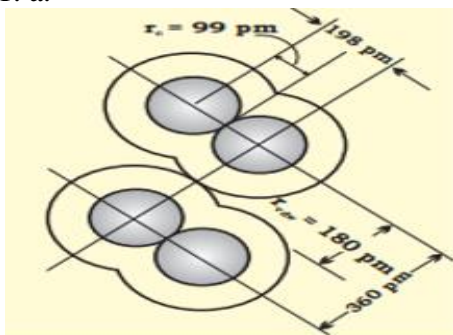
b. PCl_3

c. H_2S



20. a. MgCl_2 , Mg^{2+} - smaller cation, greater charge- greater polarizing power.
 b. NaI - I larger anion, greater polarisability
 c. Hg^{2+} , transition element -greater polarizing power.

21. a.



b.

- i. N_2
- ii. H_2
- iii. N_2

22. Complete the table

Molecule	Bond pairs	Lone pairs	Shape	Hybridisation
CH_4	4	0	Tetrahedral	sp^3
NH_3	3	1	Trigonal pyramid	sp^3
SF_6	6	0	Octahedral	sp^3d^2
BrF_5	5	1	Square pyramid	sp^3d^2
H_2O	2	2	Bent	sp^3
PF_5	5	0	Trigonal bipyramid	sp^3d
BCl_3	3	0	Trigonal planar	sp^2

23.

- a. Ethane is single covalent bonded, sp^3 hybridised.
Ethene is double bonded, sp^2 hybridisation, Thus shorter bond length.
- b. H_2O molecules are associated to each other using strong H bonds. Since associated they are in liquid state. In H_2S there is no H bond.
- c. Axial bonds are longer and weaker than equatorial bonds.
- d. Resonance, partial double bond character
- e. The resultant of 1st and 2nd dipoles cancel out the third dipole.

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