

## VSEPR Theory, Valence Bond Theory, Characteristic of Covalent Compounds

### 1. Which of the following is not correct?

1. A sigma bond is weaker than pi bond.
2. A sigma bond is stronger than pi bond.
3. A double bond is stronger than a single bond.
4. A triple bond is stronger than a double bond.

### 2. pi bond is formed by the overlapping of

1. p - p orbitals along their axis
2. s - p orbitals along the axis of p - orbital
3. p - p orbitals perpendicular to their axis
4. s - s orbitals

### 3. Which one of the following is an incorrect statement?

1. A pi bond is formed when a sigma already exists.
2. A pi bond may be formed by the overlapping of 'p' or 'd' orbitals.
3. A pi bond is formed by the overlapping of hybrid orbitals.
4. A pi bond is formed by the lateral overlapping of atomic orbitals.

### 4. Molecule which contains only sigma bonds in it is

1. Pentene
2. Pentane
3. Pentadiene
4. Pentyne

### 5. Strongest bond is formed by the, axial overlapping of

- 1) 2s and 2p-orbitals
- 2) 2p- and 2p-orbitals
- 3) 2s and 2s-orbitals
- 4) All of these

6. s - p overlapping is present in

1. Br<sub>2</sub>                      2. H<sub>2</sub>                      3. O<sub>2</sub>                      4. HF

7. The type of overlap present in the bonds of hydrogen sulphide molecule is

- 1) s-p                      2) s-s                      3) p-p                      4)  $sp^3-s$

8. According, to V.B. theory, the bonds in methane are formed due to the overlapping

- 1)  $1\sigma s-s, 3\sigma s-p$                       2)  $1\sigma s-p, 3\sigma s-s$   
3)  $2\sigma s-s, 2\sigma s-p$                       4)  $4\sigma sp^3-s$

9. Which of the following has homoatomic overlap?

- 1) H - Cl                      2) Li-Cl                      3) C- Cl                      4) Cl-Cl

10. The orbital overlapping is maximum in

1. Cl<sub>2</sub>                      2. HI                      3. HCl                      4. HBr

11. The number of sigma and Pi bonds in a molecule of cyanogen (  $N \equiv C - C \equiv N$  ) are

1. 4, 3                      2. 3, 4                      3. 5, 2                      4. 3, 5

12. Which of the following molecule does not have a linear arrangement of atoms?

1. H<sub>2</sub>O                      2. C<sub>2</sub>H<sub>2</sub>                      3. BeH<sub>2</sub>                      4. CO<sub>2</sub>

13. CO<sub>2</sub> is not iso-structural with

1. HgCl<sub>2</sub>                      2. SnCl<sub>2</sub>                      3. C<sub>2</sub>H<sub>2</sub>                      4. ZnCl<sub>2</sub>

14. Shape of phosphorus pentachloride molecule is

1. Octahedron                      2. Square pyramid                      3. Trigonal bipyramid                      4. Pyramid

15. Which of the following has distorted tetrahedron shape?

1.  $\text{SiF}_4$       2.  $\text{CCl}_4$       3.  $\text{H}_2\text{O}$       4.  $\text{CHCl}_3$

16. Which of the following is not a pyramidal species?

1.  $\text{NH}_3$       2.  $\text{H}_3\text{O}^+$       3.  $\text{PH}_3$       4.  $\text{NH}_4^+$

17. Of the following species, the one having planar structure is

1.  $\text{NH}_4^+$       2.  $\text{BF}_4^-$       3.  $\text{XeF}_4$       4.  $\text{CCl}_4$

18. The geometry of  $\text{ClO}_3^-$  ion according to Valence Shell Electron Pair Repulsion (VSEPR) theory will be

- 1) Planar triangular      2) Pyramidal      3) Tetrahedral      4) Square planar

19. In  $\text{OF}_2$  number of bond pairs and lone pairs of electrons are respectively

- 1) 2, 6      2) 2, 8      3) 2, 10      4) 2, 9

20. In  $\text{BF}_3$  molecule, number of bond pairs and lone pairs of electrons on Boron atom are

- 1) 2, 2      2) 3, 1      3) 1, 3      4) 3, 0

21. The orientation of electron pairs and the shape of molecule are different in

- 1)  $\text{BeF}_2$       2)  $\text{SnCl}_2$       3)  $\text{CCl}_4$       4)  $\text{CCl}_4$

22. Maximum number of planar atoms in  $\text{SF}_6$  molecule

- 1) 5      2) 4      3) 6      4) 7

23. A molecule which cannot exist theoretically is

- 1)  $\text{SF}_2$       2)  $\text{OF}_2$       3)  $\text{OF}_4$       4)  $\text{O}_2\text{F}_2$

**24. In a nitrogen molecule, the two atoms of nitrogen are bounded by**

1. One sigma bond and two pi bond
2. One sigma bond and one pi bond
3. Two sigma bonds and one pi bond
4. Three sigma bonds

**25. According to valence bond theory the predicted bond angle for H<sub>2</sub>O**

1. 90°
2. 109°28'
3. 107°18'
4. 104°28'

**26. Which is not the characteristic of Pi-bond?**

1. pi bond is formed after a sigma bond in same direction.
2. pi bonds are formed by hybrid orbitals.
3. pi bond is weaker than sigma bond.
4. pi bond is formed lateral overlap of P or d orbitals only.

**27. How many sigma and pi bonds are present in tetra cyanoethylene?**

1. Nine and nine
2. Five and nine
3. Nine and seven
4. Eight and eight

**28. For compounds**

- A) Tetracyanoethene
- B) Carbon dioxide
- C) Benzene
- D) 1, 3-Butadiene

**Ratio of sigma and pi -bonds is in order**

- 1) A=B<C<D
- 2) A=B<D<C
- 3) A=B=C=D
- 4) C<D<A<B

**29. The strength of bonds by 2s-2s, 2p-2p, 2s-2p, 1s-1s overlap has the order**

1. 1s-1s > 2p-2p > 2s-2p > 2s-2s
2. 2p-2p > 2s-2p > 2s-2s > 1s-1s
3. 2s-2s > 1s-1s > 2s-2p > 2p-2p
4. 2s-2p > 2s-2s > 2p-2p > 1s-1s

**30. Which of the following has  $p\pi - d\pi$  bonding?**

- 1)  $NO_3^-$
- 2)  $SO_3^{2-}$
- 3)  $BO_3^{3-}$
- 4)  $CO_3^{2-}$

**31. The shape of molecule  $AB_3E$  (B=bond pair, E=lone pair) is**

- 1) Tetrahedral      2) Pyramidal      3) Angular      4) T-shape

**32. The effect of repulsion between the two lone pairs of electrons present on oxygen in water molecule is**

1. No Change in H – O – H bond angle      2. Decrease in H – O – H bond angle  
3. Increase in H – O – H bond angle      4. All atoms will be in one plane.

**33.  $BCl_3$  molecule is planar while  $NCl_3$  molecule is pyramidal because**

1. Does not have lone pair on B but has one on N.  
2. B-Cl bond is more polar than N-Cl bond  
3. N atom is smaller than B  
4. N-Cl bond is more covalent than B-Cl bond

**34. Assertion (A): Geometry of  $ICl_3$  is tetrahedral.**

**Reason (R): Its shape is T-shape, due to the presence of three bond pairs and two lone pairs.**

1. Both 'A' and 'R' are true and 'R' is the correct explanation to 'A'.  
2. Both 'A' and 'R' are true but 'R' is not the correct explanation to 'A'.  
3. 'A' is true but 'R' is false.  
4. 'A' is false but 'R' is true.

**35. Triple bond is not present in**

1. Cyanogen      2. Propyne      3. Nitrous Oxide      4. Nitrogen dioxide

**36 Valence bond theory of Pauling and Slater accounts for the following characteristic of covalent bond**

1. Directional nature      2. Ionic nature      3. Stability      4. Bond length

**37 Shape of molecule is decided by**

1. Sigma bonds only
2. pi bonds only
3. Both and bonds
4. Neither nor bonds

**38. In Ethyne molecule the type of bonds between two carbon atoms are**

1. One Sigma and two pi
2. One Sigma and one pi
3. Two Sigma and one pi
4. Two Sigma and no pi

**39 The number of bonds formed by the overlap of 's' and 'p' orbitals in Methane is**

1. 4
2. 3
3. 2
4. 1

**40. The type of overlapping in Br - F bond in Br F<sub>3</sub> molecule is**

1. s - p
2. s - s
3. p - p
4. p - p

**41. Which of the following has pyramidal geometry?**

1. BF<sub>3</sub>
2. SO<sub>3</sub>
3. NCl<sub>3</sub>
4. CO<sub>3</sub><sup>-2</sup>

**42. A molecule having 3 bonds pairs and 2 lone pairs will have**

1. T-shape geometry
2. Trigonal Planar Geometry
3. Linear Geometry
4. Square pyramidal geometry

**43. The shape of formaldehyde molecule as per the VSEPR theory is**

1. Linear
2. Planar Triangle
3. Pyramid
4. Tetrahedron

**44. Assertion (A): (CH<sub>3</sub>)<sub>3</sub>N geometry is pyramidal but in case of, it is planar.**

**Reason (R): The maximum covalency of 'Si' is 'Six' but that of 'C' is four.**

1. Both 'A' and 'R' are true and 'R' is the correct explanation to 'A'.
2. Both 'A' and 'R' are true but 'R' is not the correct explanation to 'A'.
3. 'A' is true but 'R' is false.
4. 'A' is false but 'R' is true.

45. List - 1

- A) OF<sub>2</sub>
- B) [NiCN<sub>4</sub>]<sup>—2</sup>
- C) I<sub>3</sub><sup>—</sup>
- D) XeF<sub>4</sub>

List - 2

- 1) Tetrahedral, bond angle 109°28<sup>1</sup>
- 2) Linear, bond angle 180°
- 3) Square planar, bond angle 90°
- 4) Angular, bond angle 102°

The correct match is

	A	B	C	D		A	B	C	D
1)	4	3	2	3	2)	3	3	2	4
3)	4	2	3	3	4)	1	2	2	3

KEY

- 1) 1      2) 3      3) 3      4) 2      5) 2      6) 4      7) 1      8) 1      9) 4      10) 1
- 11) 2      12) 1      13) 2      14) 3      15) 4      16) 4      17) 3      18) 2      19) 2      20) 4
- 21) 2      22) 1      23) 3      24) 1      25) 1      26) 2      27) 1      28) 1      29) 1      30) 2
- 31) 2      32) 2      33) 1      34) 4      35) 4      36) 1      37) 1      38) 1      39) 2      40) 3
- 41) 3      42) 1      43) 2      44) 2      45) 1