CHEMICAL BONDING

COVALENT BOND

1. The strength of bonds by 2s - 2s, 2p - 2p and 2p -2s overlapping has the order :-

(1) s – s > p – p > s – p (2) s – s > p – s > p – p

(3) p – p > s – p > s – s (4) p – p > s – s > p – s

2. Which is not characteristic of π-bond:-

(1) π - bond is formed when a sigma bond already formed

(2) π - bond are formed from hybrid orbitals

(3) π - bond may be formed by the overlapping of p-orbitals

(4) π-bond results from lateral overlap of atomic orbitals

3. Which compound of xenon is not possible

(1) XeF_2 (2) XeF_4 (3) XeF_5 (4) XeF_6

4. Similarity of fluorine and oxygen may not be attributed to-

(1) Their atomic and ionic radii are closely similar

(2) The atom of both elements attain an octet of electrons in their valence shell

(3) Both of them are highly electronegative elements

(4) Both form stable pπ – pπ multiple bonds with themselves

HYBRIDISATION

5. Among the following species identify the isostructural pairs:-

NF_3, NO_3^-, BF_3, H_3O^+, HN_3

(1) [NF_3, NO_3^-] and [BF_3, H_3O^+]

(2) [NF_3, HN_3] and [NO_3^-, BF_3]

(3) [NF_3, H_3O^+] and [NO_3^-, BF_3]

(4) [NF_3, H_3O^+] and [HN_3, BF_3]

6. Which of the set of species have same hybridisation state but different shapes:-

(1) NO_2^+, NO_2 , NO_2^- (2) ClO_4^-, SF_4, XeF_4

(3) NH_4^+, H_3O^+, OF_2 (4) SO_4^{-2}, PO_4^{-3}, ClO_4^-

7. Which of the following elements can not exhibit sp^3d hybridisation state:-

(a) C (b) P (c) Cl (d) B

Correct answer is:-

(1) a, c (2) a, d (3) b, c (4) b, d

8. Which of the following set is not correct:–

(1) SO_3, O_3, NH_4^+ all have coordinate bonds

(2) H_2O, NO_2, ClO_2^-, all are 'V' shape molecules

(3) I_3^-, ICl_2^-, NO_2^+ ; all are linear molecules

(4) SF_4, SiF_4, XeF_4 are tetrahedral in shape

9. The shape of XeO_2F_2 will be :-

(1) Square planar

(2) Tetrahedral

(3) Pentagonal bipyramidal

(4) See saw

10. A σ bonded molecule MX_3 is T–shaped. The number of non–bonding pairs of electrons is

(1) 0

(2) 2

(3) 1

(4) Can be predicted if atomic number of M is known

11. The structure and hybridization of $Si(CH_3)_4$ is :

(1) bent, sp (2) trigonal, sp^2

(3) octahedral, sp^3d (4) tetrahedral, sp^3

12. When the hybridization state of carbon atom changes from sp^3, sp^2 and sp, the angle between the hybridized orbitals.

(1) decrease considerably

(2) increase progressively

(3) decrease gradually

(4) all of these

13. Molecular shapes of SF_4, CF_4 and XeF_4 are :-

(1) The same, with 2, 0 and 1 lone pairs of electrons respectively

(2) The same, with 1,1 and 1 lone pairs of electrons respectively

(3) Different, with 0,1 and 2 lone pairs of electrons respectively

(4) Different, with 1,0 and 2 lone pairs of electrons respectively

14. Select the correct matching :

List I	**List II**
A : XeF_4	1. Pyramidal
B : XeF_6	2. T-shape
C : XeO_3	3. Distorted octahedral
D : $XeOF_2$	4. Square planar

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

15. The dipole moment of NH_3 is:-

(1) Less than dipole moment of NCl_3

(2) Higher than dipole moment of NCl_3

(3) Equal to the diple moment of NCl_3

(4) None of these

16. Which set of molecules is polar :-

(1) XeF_4, IF_7, SO_3 (2) PCl_5, C_6H_6, SF_6

(3) $SnCl_2$, SO_2, NO_2 (4) CO_2, CS_2, C_2H_6

17. Species having zero dipole moment :-

(1) XeF_4

(2) 1,2,4 trichloro benzene

(3) SF_4

(4) CH_2Cl_2

18. PCl_5 is non polar because :-

(1) P – Cl bond is non-polar

(2) Its dipole moment is zero

(3) P – Cl bond is polar

(4) P & Cl have equal electronegativity

19. The correct order of dipole moment is :

(1) $CH_4 < NF_3 < NH_3 < H_2O$

(2) $NF_3 < CH_4 < NH_3 < H_2O$

(3) $NH_3 < NF_3 < CH_4 < H_2O$

(4) $H_2O < NH_3 < NF_3 < CH_4$

20. Which of the following has the highest value of dipole moment :

(1) HCl (2) HF (3) HI (4) HBr

MOLECULAR ORBITAL THEORY

21. The ion that is isoelectronic with CO and having same bond order is :-

(1) CN^- (2) O_2^+ (3) O_2^- (4) N_2^+

22. Which of the following is paramagnetic:-

(1) O_2^- (2) CN^- (3) CO (4) NO^+

23. The no. of antibonding electron pair in O_2^- is

(1) 4 (2) 3 (3) 8 (4) 10

24. Which of the following ion has not bond order of 2.5 ?

(1) O_2^- (2) O_2^+ (3) N_2^+ (4) N_2^-

25. In a homonuclear molecule which of the following set of orbitals are degenerate ?

(1) σ_{2s} and σ_{1s} (2) π_{2p_x} and π_{2p_y}

(3) π_{2p_x} and σ_{2p_z} (4) σ_{2p_z} and $\pi^*_{2p_x}$

COORDINATE BOND

26. In Co-ordinate bond, the acceptor atoms must essentially contain in its valency shell an orbital:-

(1) With paired electron

(2) With single electron

(3) With no electron

(4) With three electron

27. The bonds present in N_2O_5 are :–

(1) Only ionic

(2) Covalent & coordinate

(3) Only covalent

(4) Covalent & ionic

28. Which of the following has no coordinate bond ?

(1) PH_3 (2) $P_2H_6^{+2}$ (3) $P_2H_5^{\oplus}$ (4) PH_4^+

WEAK FORCES

29. In dry ice the bond present between two molecules is

(1) Ionic bond (2) Covalent bond

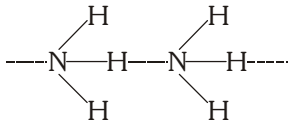
(3) Hydrogen bond (4) Vander Waal

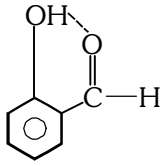
30. Intermolecular hydrogen bonds are not present in:-

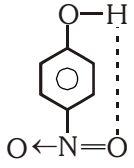
(1) CH_3CH_2OH (2) CH_3COOH

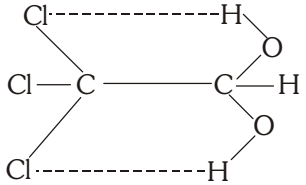
(3) $C_2H_5NH_2$ (4) CH_3OCH_3

31. In which of the following molecule, the shown hydrogen bond is not possible:-

(1) 

(2) 

(3) 

(4) 

32. The incorrect order of decreasing boiling points is

(1) $NH_3 > AsH_3 > PH_3$

(2) $H_2O > H_2Se > H_2S$

(3) $Br_2 > Cl_2 > F_2$

(4) $CH_4 > GeH_4 > SiH_4$

33. Acetic acid exists as dimer in benzene due to:-

(1) Condensation reaction

(2) Hydrogen bonding

(3) Presence of carboxyl group

(4) None of the above

34. Maximum no. of hydrogen bonds formed by a water molecule in ice is

(1) 4 (2) 3

(3) 2 (4) 1

35. Density of ice is less than that of water because of

(1) presence hydrogen bonding

(2) crystal modification of ice

(3) open porous structure of ice due to hydrogen bonding

(4) different physical states of these

36. Which of the following compounds show intramolecular hydrogen bonding :

(A) o - nitrophenol

(B) p - nitrophenol

(C) phenol

(D) salicylaldehyde

(1) A & B (2) A & C

(3) A & D (4) B & C

37. The pair of molecules forming strongest hydrogen bonds are :

(1) SiH_4 and SiF_4

(2) $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ and $CHCl_3$

(3) $H-\overset{\overset{O}{\|}}{C}-OH$ and $CH_3-\overset{\overset{O}{\|}}{C}-OH$

(4) H_2O and H_2

IONIC BOND

38. Conditions for ionic bond formation is/are :

(a) Small cation, large anion

(b) Low IP of cation, high electron affinity of anion

(c) Large cation, small anion and less charge

(d) Less lattice enrgy

Correct answer is :

(1) a, d (2) b, c and d

(3) b and c (4) a, b

39. An ionic compound $A^+ B^-$ is most likely to be formed when –

(1) Ionization energy of A is low

(2) Electron affinity of B is high

(3) Electron affinity of B is low

(4) Both (1) and (2)

40. As compared to covalent compounds electrovalent compounds generally possess

(1) High m.p. and high b.p.

(2) Low m.p. and low b.p.

(3) Low m.p. and high b.p.

(4) high m.p. and low b.p.

41. The most stable carbonate is

(1) Li_2CO_3 (2) $BeCO_3$

(3) $CaCO_3$ (4) $BaCO_3$

42. CCl_4 is more covalent than LiCl because :

(1) There is more polarization of Cl in CCl_4

(2) There is more polarization of Cl in LiCl

(3) CCl_4 has more weight

(4) None of above

43. The correct order of decreasing polarisable ions is:

(1) Cl^-, Br^-, I^-, F^- (2) F^-, I^-, Br^-, Cl^-

(3) F^-, Cl^-, Br^-, I^- (4) I^-, Br^-, Cl^-, F^-

44. Ionic conductances of hydrated M^+ ions are in the order –

(1) $Li^+(aq) > Na^+(aq) > K^+(aq) > Rb^+(aq) > Cs^+(aq)$

(2) $Li^+(aq) > Na^+(aq) < K^+(aq) < Rb^+(aq) < Cs^+(aq)$

(3) $Li^+(aq) > Na^+(aq) > K^+(aq) > Rb^+(aq) < Cs^+(aq)$

(4) $Li^+(aq) < Na^+(aq) < K^+(aq) < Rb^+(aq) < Cs^+(aq)$

45. Which of the following halides has the highest melting point –

(1) NaCl (2) KCl

(3) NaBr (4) NaF

SOLUTION

CHEMICAL BONDING

1. Bond strength order

$2s - 2s < 2s - 2p < 2p - 2p$

2. Hybrid orbital does not form π-bond.

3. XeF_5 does not formed

5. NF_3 - Pyramidal H_3O^+ Pyramidal shape

NO_3^- - Trigonal planar HN_3 bent shape

BF_3 - Trigonal planar

6. Option (1) NO_2^+ sp (linear), NO_2 sp^2 (bent), NO_2^- sp^2 (bent)

Option (2) ClO_4^- sp^3 (Td), SF_4 sp^3d (see saw), XeF_2 sp^3d (linear)

Option (3) NH_4^+ sp^3 (Td), H_3O^+ sp^3 (Py), OF_2, sp^3 (bent)

Option (4) SO_4^{2-} sp^3 (Td), PO_4^{3-} sp^3 (Td), ClO_4^- sp^3 (Td)

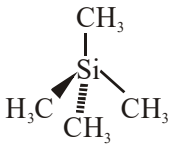
7. C & B does not show sp^3d hybridisation due to non avalibility of 'd' orbital

8. SF_4 is see saw

9. XeO_2F_2 sp^3d see saw

10. T- Shaped species is formed when two lone pair and 3σ bond is formed.

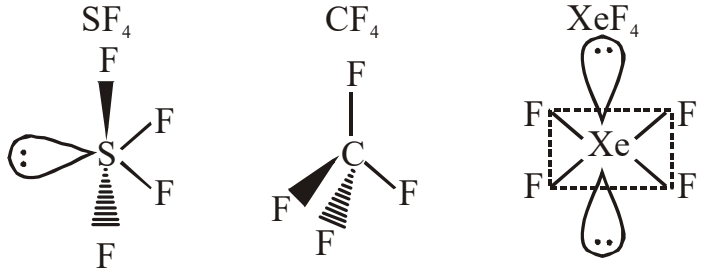
11. $Si(CH_3)_4$ sp^3, Td



12.

Hybridisation	sp^3	sp^2	sp
Bond angle	109°28'	120°	180°

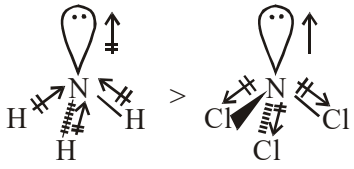
13.



14.

XeF_4	square planar
XeF_6	distorted octahedral
XeO_3	Pyramidal
$XeOF_2$	T-shape

15.



(dipole moment)

16. $SnCl_2$, SO_2, NO_2 are polar and other molecules in options are non-polar.

17. XeF_4 having zero dipole moment

18. In non-polar species the net dipole moment is zero

19. $CH_4 < NF_3 < NH_3 < H_2O$

20. In HX, electronegativity difference increases dipole moment also increases.

21.

	CO	CN^-	O_2^+	O_2^-	N_2^+
Bond order	3	3	2.5	1.5	2.5

22. CN^- , CO, $NO^+ \rightarrow$ No unpaired e^- is present

$\therefore$ Diamagnatic

23. O_2^- , bonding e^- in BMO = 10

e^- in AMO = 7 (3 pair and 1 singe)

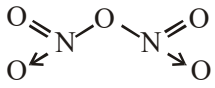
24.

O_2	O_2^-	O_2^+	N_2^+	N_2^-
Bond order	1.5	2.5	2.5	2.5

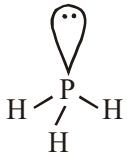
25. π_{2px} and π_{2py} having same energy.

26. In co-ordinate bond formation the acceptor atom must have vacant orbital.

27.



28.

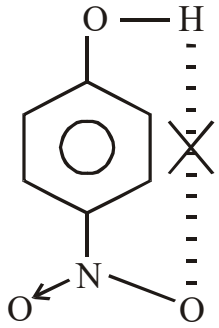


co-ordiante bond is not present.

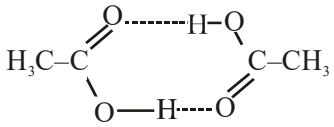
29. dry ice CO_2(solid)

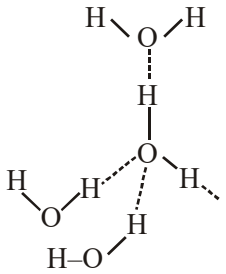
vander waal forces exist between CO_2 molecules

30. CH_3OCH_3 – No hydrogen bonding

31.  Not possible due to greater distance

32. $CH_4 < SiH_4 < GeH_4$

33. 

34.  4-Hydrogen bond / Water molecules.

35. Ice having open cage like structure and having large voids.

36. p-nitrophenol and phenol show intermolecular H-bonding.

37. Hydrogen bond exist between HCOOH & CH_3COOH

38. Condition favour ionic bond formation.

(1) How IP of atom forming cation

(2) High EA of atom forming anion

(3) Greater LE of formed product

(4) Greater cation and small anion

39. See solution of 89

40. Electrovalent compound generally having high mp & bp.

41. Ionic Character ↑ Thermal stability ↑

43. $F^- < Cl^- < Br^- < I^-$ (polarizibility)

44. If the charges are constant then greater the ionic mobility greater will be conductance

45. NaF having greater ionic character among given species ∴ greater m.p.