

FREEDOM INTERNATIONAL SCHOOL
CHEMISTRY WORKSHEET

CLASS-XI CHEMICAL BONDING AND MOLECULAR STRUCTURE

1. Among the following mixtures, dipole-dipole as the major interaction, is present in
(a) acetonitrile and acetone (b) benzene and ethanol
(c) KCl and water (d) benzene and carbon tetrachloride
2. Which of the following types of hybridisation leads to three dimensional geometry of bonds around the carbon atom?
(a) sp (b) sp^2 (c) sp^3 (d) None of these
3. The maximum number of hydrogen bonds that a molecule of water can have is
(a) 4 (b) 2 (c) 3 (d) 1
4. The number of types of bonds between two carbon atoms in calcium carbide is
(a) Two sigma, two pi (b) One sigma, two pi
(c) One sigma, one pi (d) Two sigma, one pi
5. Based on lattice enthalpy and other considerations which one the following alkali metal chlorides is expected to have the higher melting point?
(a) NaCl (b) KCl (c) RbCl (d) LiCl
6. Dipole-induced dipole interactions are present in which of the following pairs?
(a) H_2O and alcohol (b) HCl and He atoms
(c) Cl_2 and CCl_4 (d) SiF_4 and He atoms
7. The charge/size ratio of a cation determines its polarizing power. Which one of the following sequences represents the increasing order of the polarizing power of the cationic species, K^+ , Ca^{++} , Mg^{2+} , Be^{2+} ?
(a) $K^+ < Ca^{2+} < Mg^{2+} < Be^{2+}$ (b) $Mg^{2+} < Be^{2+} < K^+ < Ca^{2+}$
(c) $Be^{2+} < K^+ < Ca^{2+} < Mg^{2+}$ (d) $Ca^{2+} < Mg^{2+} < Be^{2+} < K^+$
8. The species having pyramidal shape is
(a) SO_3 (b) OSF_2 (c) SiO_3^{2-} (d) BrF_3
9. The structure of IF_7 is
(a) Pentagonal bipyramid (b) Square pyramid
(c) Trigonal bipyramid (d) Octahedral

10. Which of the following is a linear molecule?

- (a) ClO_2 (b) CO_2 (c) NO_2 (d) SO_2

11. Which of these pairs of species have the same order of bond?

- (a) O_2^- , CN^- (b) CN^- , NO^+ (c) CO , NO (d) N^+ , CN^+

12. Isostructural species are those which have the same shape and hybridisation. Among the given species identify the isostructural pairs.

- (a) NF_3 and BF_3 (b) BF_4^- and NH_4^+
(c) BCl_3 and BrCl_3 (d) NH_3 and NO_3^-

13. Polarity in a molecule and hence the dipole moment depends primarily on electronegativity of the constituent atoms and shape of a molecule. Which of the following has the highest dipole moment?

- (a) CO_2 (b) H_2O (c) HI (d) SO_2

14. The types of hybrid orbitals of nitrogen in NO_2^+ , NO_3^- and NH_4^+ respectively are expected to be

- (a) sp , sp^3 and sp^2 (b) sp , sp^2 and sp^3
(c) sp^2 , sp and sp^3 (d) sp^2 , sp^3 and sp

15. Hydrogen bonds are formed in many compounds e.g., H_2O , HF , NH_3 . The boiling point of such compounds depends to a large extent on the strength of hydrogen bond and the number of hydrogen bonds. The correct decreasing order of the boiling points of above compounds is :

- (a) $\text{HF} > \text{H}_2\text{O} > \text{NH}_3$ (b) $\text{H}_2\text{O} > \text{HF} > \text{NH}_3$
(c) $\text{NH}_3 > \text{HF} > \text{H}_2\text{O}$ (d) $\text{NH}_3 > \text{H}_2\text{O} > \text{HF}$

16. In PO_4^{3-} ion the formal charge on the oxygen atom of P–O bond is

- (a) + 1 (b) – 1 (c) – 0.75 (d) + 0.75

17. In NO_3^- ion, the number of bond pairs and lone pairs of electrons on nitrogen atom are

- (a) 2, 2 (b) 4, 0 (c) 1, 3 (d) 3, 1

18. Which of the following species has tetrahedral geometry?

- (a) NH_2^- (b) BH_4^- (c) CO_3^{2-} (d) H_3O^+

19.. Which molecule/ion out of the following does not contain unpaired electrons?

- (a) N_2^+ (b) O_2^{2-} (c) O_2 (d) B_2

20. The bond length does not get affected by_____

- (a) electron affinity (b) bond order (c) hybridisation (d) resonance

21. In the protonation of NH_3 molecule, the following statement is true_____

- (a) shape of NH_3 molecule is changed (b) hydrogen bond is formed
(c) hybridization state of N is changed (d) a covalent bond is formed

22. The shape of sulphate ion is_____

- (a) tetrahedral (b) square planar (c) trigonal bipyramidal (d) hexagonal

23. Which of the following halides has the highest melting point?

- (a) NaF (b) KCl (c) NaBr (d) NaCl

24. CCl_4 is more covalent than LiCl because_____

- (a) There is more polarization of Cl in CCl_4 (b) more polarization of Cl in LiCl
(c) CCl_4 has more weight (d) none of the options

25. As compared to covalent compounds electrovalent compounds generally possess_____

- (a) high m.p. and high b.p. (b) low m.p. and low b.p.
(c) low m.p. and high b.p. (d) high m.p. and low b.p.

26. (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 energy

Conditions for ionic bond formation is / are_____

- (a) a, d (b) b, c and d (c) b and c (d) a, b

27. The force responsible for dissolution of ionic compound in water is_____

- (a) ion - dipole force (b) dipole - dipole forces
(c) ion - ion force (d) hydrogen bond

28. An ionic compound $\text{A}^+ \text{B}^-$ is most likely to be formed when_____

- (a) both (1) and (2) (b) electron affinity of B is high

(c) electron affinity of B is low (d) ionization energy of A is low

29. The pair of elements which on combination are most likely to form an ionic compound_____

(a) K and O (b) Na and Ca (c) O and Cl (d) Al and I.

30. The boiling point of p-nitrophenol is higher than that of o-nitrophenol because_____

(a) NO_2 group at p-position behaves in a different way from that at o-position
(b) intramolecular hydrogen bonding exists in p-nitrophenol
(c) there is intermolecular hydrogen bonding in p-nitrophenol
(d) p-nitrophenol has a higher molecular weight than o-nitrophenol

31. The bond angle in NH_3 is slightly less than that in NH_4^+ . This difference can best be explained on the basis of

(a) difference in hybridisation of N in both species
(b) lone pair–bond pair repulsion in NH_3 but not in NH_4^+
(c) larger size of H in NH_3 compared to NH_4^+
(d) difference in electronegativity of atoms bonded to nitrogen

32. In the molecule XeOF_4 , xenon is the central atom. The number of lone pairs on xenon, the type of hybridisation and the geometry around Xe are respectively:

(a) 2, sp^3d^3 , distorted octahedral (b) 1, sp^3d^2 , square pyramidal
(c) 1, sp^3d^3 , square pyramidal (d) 2, sp^3d^2 , octahedral

33. Which one of the following molecules has the maximum bond order according to MO theory?

(a) C_2^- (b) N_2^+ (c) O_2^{2+} (d) CN^-

34. Which of the following changes lead to a decrease in bond angle in a molecule?

(a) replacement of a bonded atom by a more electronegative one
(b) increase in number of lone pairs on central atom
(c) increase in multiple bonds between central atom and bonded atoms
(d) both (a) and (b)

35. In the compound $[\text{ICl}_4]^-$, the geometry and the hybridisation of central atom are:

(a) square planar, sp_3d_2 (b) see-saw, sp_3d
(c) tetrahedral, sp_3 (d) square pyramidal, sp_3d_2

36. Among the following molecules, which one will have zero dipole moment despite having polar bonds?

(a) XeF_2

- (b) NF_3
- (c) OF_2
- (d) ClF_3

37. In Al_2Cl_6 , each aluminium atom is coordinated to four chlorine atoms.

Which of the following is correct regarding its bonding?

- (a) Each Al is sp^2 hybridised with a vacant p-orbital.
- (b) Each Al is sp^3 hybridised with coordinate bonds from bridging Cl atoms
- (c) Al uses dsp^2 hybridisation to bond
- (d) Bonding is purely ionic

38. Consider the species: O_2 , O_2^+ , O_2^- , O_2^{2-} . Arrange them in the increasing order of bond length.

- (a) $\text{O}_2^{2-} < \text{O}_2^- < \text{O}_2 < \text{O}_2^+$
- (b) $\text{O}_2^+ < \text{O}_2 < \text{O}_2^- < \text{O}_2^{2-}$
- (c) $\text{O}_2^- < \text{O}_2^{2-} < \text{O}_2^+ < \text{O}_2$
- (d) $\text{O}_2 < \text{O}_2^{2-} < \text{O}_2^- < \text{O}_2^+$

39. Which of the following pairs is *not* isostructural?

- (a) SO_4^{2-} and SiO_4^{4-}
- (b) ClO_4^- and PO_4^{3-}
- (c) XeF_4 and ICl_4^-
- (d) BF_4^- and NH_4^+

40. Which of the following represents the correct order of increasing ionic character of the bonds?

- (a) $\text{H-F} < \text{H-Cl} < \text{H-Br} < \text{H-I}$
- (b) $\text{H-I} < \text{H-Br} < \text{H-Cl} < \text{H-F}$
- (c) $\text{H-Cl} < \text{H-I} < \text{H-F} < \text{H-Br}$
- (d) $\text{H-Br} < \text{H-I} < \text{H-Cl} < \text{H-F}$

Directions: In the given questions, a statement of Assertion (A) is followed by a statement of Reason (R). Of the statements given below mark the correct statements as.

A. Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

C. Assertion (A) is true, but Reason (R) is false.

D. Assertion (A) is false, but Reason (R) is true.

E. Both Assertion (A) and Reason (R) is false.

41. **Assertion (A):** In BeCl_2 (vapour), the molecule is linear.

Reason (R): The central Be atom is sp hybridised.

42. **Assertion (A):** The bond angle in water is less than in ammonia.

Reason (R): Oxygen is more electronegative than nitrogen, leading to greater lone pair-bond pair repulsion in H_2O .

43. **Assertion (A):** BF_3 molecule is planar but NH_3 molecule is pyramidal.

Reason (R): BF_3 has sp^2 hybridisation while NH_3 has sp^3 hybridisation with one lone pair.

44. **Assertion (A):** F_2 has a lower bond dissociation enthalpy than Cl_2 .

Reason (R): F-F bond is weak due to strong repulsion between lone pairs of fluorine atoms.

45. **Assertion (A):** In SF_6 , all S-F bonds are equivalent.

Reason (R): SF_6 has sp^3d^2 hybridisation and octahedral geometry.

46. **Assertion (A):** O_2 molecule is paramagnetic.

Reason (R): Molecular orbital theory shows the presence of two unpaired electrons in O_2 .

47. **Assertion (A):** The bond angle in NF_3 is less than in NH_3 .

Reason (R): Higher electronegativity of fluorine reduces N-F bond pair electron density around nitrogen, increasing lone pair repulsion.

48. **Assertion (A):** Ionic bonds are stronger in compounds with higher lattice enthalpy.

Reason (R): Lattice enthalpy increases with smaller cation and anion size and higher charges.

49. **Assertion (A):** XeF_2 molecule is linear in shape.

Reason (R): Xe atom in XeF_2 undergoes sp^3d hybridisation with 3 lone pairs in equatorial positions.

50. **Assertion (A):** CO has higher bond dissociation energy than O_2 .

Reason (R): CO has triple bond character with strong π -overlap while O_2 has double bond.
