Chemical Bonding

SET Self Evaluation Test - 3

1. Nature of the bond formed between two elements depends on the
(a) Oxidation potential (b) Electronegativity
(c) Ionization potential (d) Electron affinity

2. Two elements X and Y have following electronic configurations $X = 1s^2, 2s^2\,2p^6, 3s^2 3p^6, 4s^2$ and $Y = 1s^2, 2s^2\,2p^6, 3s^2 3p^5$. The expected compound formed by combination of X and Y is **[BHU 1990]**
(a) XY_2 (b) X_5Y_2
(c) X_2Y_5 (d) XY_5

3. Electricity do not pass through ionic compounds
(a) In solution (b) In solid state
(c) In melted state (d) None of these

4. From the following which compound on heating readily sublimes
(a) $NaCl$ (b) $MgCl_2$
(c) $BaCl_2$ (d) $AlCl_3$

5. Which one in the following contains ionic as well as covalent bond **[IIT 1979; CPMT 1983; DPMT 1983]**
(a) CH_4 (b) H_2
(c) KCN (d) KCl

6. The solution of sugar in water contains **[NCERT 1972; MP PET 2000]**
(a) Free atoms
(b) Free molecules
(c) Free ions
(d) Free atoms and free molecules

7. In which of the following reactions, there is no change in the valency **[NCERT 1974; CPMT 1971, 78]**
(a) $4KClO_3 \rightarrow 3KClO_4 + KCl$
(b) $SO_2 + 2H_2S \rightarrow 2H_2O + 3S$
(c) $BaO_2 + H_2SO_4 \rightarrow BaSO_4 + H_2O_2$
(d) $2BaO + O_2 \rightarrow 2BaO_2$

8. The octet rule is not followed in **[BHU 1981]**
(a) F_2 (b) NaF
(c) CaF_2 (d) BF_3

9. Sodium chloride is an ionic compound whereas hydrogen chloride is a gas because **[KCET 2002]**
(a) Sodium is reactive
(b) Covalent bond is weaker than ionic bond
(c) Hydrogen chloride is a gas
(d) Covalent bond is stronger than ionic bond

10. Which one of the following molecules has a coordinate bond **[CPMT 1988, 94]**
(a) NH_4Cl (b) $AlCl_3$
(c) $NaCl$ (d) Cl_2

11. Co-ordinate bond is absent in **[RPMT 2002]**
(a) $BH_4^{\ominus}$ (b) CO_3^{-2}
(c) H_3O^+ (d) $NH_4^{\oplus}$

12. The dipole moment of chlorobenzene is 1.73 D. The dipole moment of p-dichlorobenzene is expected to be **[CPMT 1991]**
(a) 3.46 D (b) 0.00 D
(c) 1.73 D (d) 1.00 D

13. Polarization of electrons in acrolein may be written as **[IIT 1988]**
(a) $\overset{\delta^-}{C}H_2 = CH - \overset{\delta^+}{C}H = O$ (b) $\overset{\delta^-}{C}H_2 = CH - CH = \overset{\delta^+}{O}$
(c) $\overset{\delta^-}{C}H_2 = \overset{\delta^+}{C}H - CH = O$ (d) $\overset{\delta^+}{C}H_2 = CH - CH = \overset{\delta^-}{O}$

14. The order of dipole moments of the following molecules is **[Roorkee 2000]**
(a) $CHCl_3 > CH_2Cl_2 > CH_3Cl > CCl_4$
(b) $CH_2Cl_2 > CH_3Cl > CHCl_3 > CCl_4$
(c) $CH_3Cl > CH_2Cl_2 > CHCl_3 > CCl_4$
(d) $CH_2Cl_2 > CHCl_3 > CH_3Cl > CCl_4$

15. The electronegativity of C, H, O, N and S are 2.5, 2.1, 3.5, 3.0 and 2.5 respectively. Which of the following bond is most polar
(a) $O-H$ (b) $S-H$
(c) $N-H$ (d) $C-H$

16. Which of the following bond has the most polar character **[DPMT 1982; CBSE PMT 1992; CPMT 1999]**
(a) $C-O$ (b) $C-Br$
(c) $C-S$ (d) $C-F$

17. The geometry of H_2S and its dipole moment are **[IIT 1999]**
(a) Angular and non-zero (b) Angular and zero
(c) Linear and non-zero (d) Linear and zero

18. How many σ and π bonds are there in the molecule of tetracyanoethylene

$$\begin{matrix} N\equiv C \\ N\equiv C \end{matrix}\!\!\rangle C=C\langle\!\!\begin{matrix} C\equiv N \\ C\equiv N \end{matrix}$$

[NCERT 1980; MP PMT 1986, 95;Orissa JEE 1997]

(a) Nine σ and nine π (b) Five σ and nine π

(c) Nine σ and seven π (d) Five σ and eight π

19. The shape of H_3O^+ ion is **[EAMCET 1993; CPMT 2001]**

(a) Linear (b) Angular

(c) Trigonal planar (d) Triangular pyramidal

20. The hybridization in sulphur dioxide is **[IIT 1986; DPMT 1990]**

(a) sp (b) sp^3

(c) sp^2 (d) dsp^2

21. The number and type of bonds between two carbon atoms in CaC_2 are

(a) One sigma (σ) and one pi (π) bonds

(b) One sigma (σ) and two pi (π) bonds

(c) One sigma (σ) and one and a half pi (π) bonds

(d) One sigma (σ) bond

22. Which of the following resonating structures of N_2O is the most contributing **[Roorkee Qualifying 1998]**

(a) $N\equiv N-O$ (b) $N-N\equiv O$

(c) $N=N-O$ (d) $N-N=O$

23. The hybridization of atomic orbitals of nitrogen in NO_2^+, NO_3^-, and NH_4^+ are

(a) sp, sp^3 and sp^2 respectively

(b) sp, sp^2 and sp^3 respectively

(c) sp^2, sp and sp^3 respectively

(d) sp^2, sp^3 and sp respectively

24. The molecule having one unpaired electron is **[IIT 1985; MP PMT 1989]**

(a) NO (b) CO

(c) CN^- (d) O_2

25. The geometry of ClO_3^-, according to valence shell electron pair repulsion (VSEPR) theory will be **[KCET 1996; MP PET 1997]**

(a) Planar triangle (b) Pyramidal

(c) Tetrahedral (d) Square planar

26. Which of the following halogens has the highest bond energy **[CPMT 1988]**

(a) F_2 (b) Cl_2

(c) Br_2 (d) I_2

27. What bond order does O_2^{2-} have **[Pb. PMT 2001]**

(a) 3 (b) 2

(c) 1 (d) 1/2

28. In the process, $O_2^+ \rightarrow O_2^{+2} + e$ the electron lost is from **[Orissa JEE 2002]**

(a) Bonding π-orbital (b) Antibonding π-orbital

(c) $2p_z$ orbital (d) $2p_x$ orbital

29. The maximum number of hydrogen bonds formed by a water molecule in ice is **[IIT 1996]**

[MP PET 1993; AFMC 2002;UPSEAT 1999, 2001, 02]

(a) 4 (b) 3

(c) 2 (d) 1

30. Hydrogen bonding is not present in **[AIIMS 1998; MP PET/PMT 1998]**

(a) Glycerine

(b) Water

(c) Hydrogen sulphide

(d) Hydrogen fluoride

31. The bonds in $K_4[Fe(CN)_6]$ are **[IIT Screening 2000]**

(a) All ionic

(b) All covalent

(c) Ionic and covalent

(d) Ionic, covalent and coordinate covalent

32. In which of the following ionic, covalent and coordinate bonds are present

(a) Water

(b) Ammonia

(c) Sodium cyanide

(d) Potassium bromide

Answers and Solutions

(SET -3)

1. (b) If the two elements have similar electronegativities,the bond between them will be covalent, while a large difference in electronegativities leads to an ionic bond.

2. (a) From electronic configuration valencies of X and Y are + 2 and −1 respectively so formula of compound is XY_2.

3. (b) Ionic compounds can't pass electricity in solid state because they don't have mobile ion in solid state.

4. (d) $AlCl_3$ sublimes readily on heating.

5. (c) Structure of KCN is $[K^+(C^-\equiv \ddot{N})]$.

6. (b) Sugar is an organic compound which is covalently bonded so in water it remains as free molecules.

7. (c) In the reaction $\overset{+2}{Ba}O_2 + H_2\overset{+6}{S}O_4 \rightarrow \overset{+2}{Ba}\overset{+6}{S}O_4 + H_2O$ valency is not changing.

8. (d) BF_3 does not have octet, it has only six electrons so it is electron deficient compound.

9. (b) $NaCl$ is a ionic compound because it consists of more elelctronegativity difference compare to HCl.

10. (a) NH_4Cl has a coordinate bond besides covalent and ionic bonds $\left[\begin{array}{c} H \\ | \\ H-N\rightarrow H \\ | \\ H \end{array}\right]^+ Cl^-$

11. (b) $\begin{array}{l} {}^-O \\ | \\ -C=O \end{array}$ has covalent bonds only.

12. (b) Due to symmetry dipole moment of *p*-dichloro benzene is zero.

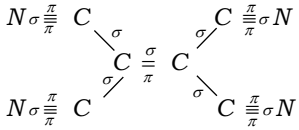
13. (d)

14. (d) CCl_4 has zero dipole moment because of symmetric tetrahedral structure. CH_3Cl has slightly higher dipole moment which is equal to 1.86D. Now CH_3Cl has less electronegativity then CH_2Cl_2. But CH_2Cl_2 has greater dipole moment than $CHCl_3$.

15. (a) More the difference in electronegativity of atoms. Bond between them will be more polar.

16. (d) $C-F$ bond has the most polar character due to difference of their electronegativity.

17. (a) H_2S has angular geometry and have some value of dipole moment.

18. (a) 

9π and 9σ bonds.

19. (d) H_3O^+ has sp^3 hybridization and its shape is triangular pyramidal due to lone pair on oxygen.

20. (c) SO_2 molecule has sp^2 hybridisation.

21. (b) In $\begin{array}{l} C \\ \| \\ Ca \\ \| \\ C \end{array}$ two carbons are joined with 1σ and 2π bonds. ***

22. (a) In N_2O molecule $N\equiv N-O$ structure is most contributed.

23. (b) The shape of NO_2^+, NO_3^- and NH_4^+ are linear trigonal planar and tetrahedral respectively. Thus the hybridization of atomic orbitals of nitrogen in these species are sp, sp^2 and sp^3 respectively.

24. (a) NO has one unpaired electron with Nitrogen.

$$:\dot{N}::\ddot{O}:$$

25. (b) $\begin{array}{l} {}^-O-\ddot{C}l-O \\ \quad\quad | \\ \quad\quad O \end{array}$

26. (b) Bond energy of Cl_2 is highest among all halogen molecule. Bond energies of F_2, Cl_2, Br_2, I_2 are 37, 58, 46 and 36 $Kcal\ mol^{-1}$ respectively.

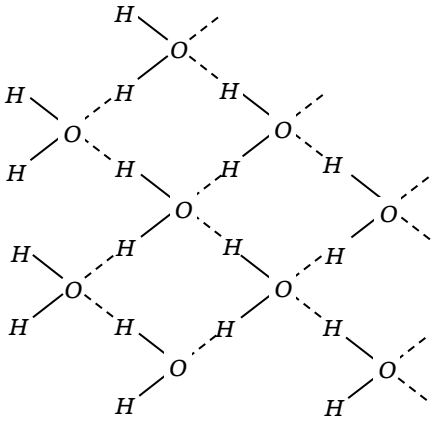
27. (c) O_2^{2-} have bond order one

$$\text{B.O.} = \frac{1}{2}[10-8] = \frac{2}{2} = 1.$$

28. (b) Electron lost from antibonding π orbital.

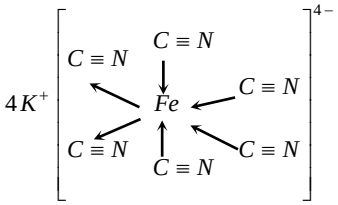
29. (a) In ice each water molecule forms four hydrogen bond through which each water

molecule is tetrahedrally attached with other water molecule.



30. (c) Hydrogen bonding is present in molecules which have *F*, *O*, or *N* atoms.

31. (d) Structure of $K_4[Fe(CN)_6]$ is



32. (c) Sodium cyanide contain ionic, covalent and coordinate bond.