

## Chemical Bonding

## Self Evaluation Test - 3

- Nature of the bond formed between two elements depends on the  
(a) Oxidation potential (b) Electronegativity  
(c) Ionization potential (d) Electron affinity
- 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)  $XY_5$
- Electricity do not pass through ionic compounds  
(a) In solution (b) In solid state  
(c) In melted state (d) None of these
- From the following which compound on heating readily sublimes  
(a)  $NaCl$  (b)  $MgCl_2$   
(c)  $BaCl_2$  (d)  $AlCl_3$
- 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)  $KCl$
- 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
- 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)  $2BaO + O_2 \rightarrow 2BaO_2$
- The octet rule is not followed in [BHU 1981]  
(a)  $F_2$  (b)  $NaF$   
(c)  $CaF_2$  (d)  $BF_3$
- 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
- Which one of the following molecules has a coordinate bond [CPMT 1988, 94]  
(a)  $NH_4Cl$  (b)  $AlCl_3$   
(c)  $NaCl$  (d)  $Cl_2$
- Co-ordinate bond is absent in [RPMT 2002]  
(a)  $BH_4^-$  (b)  $CO_3^{2-}$   
(c)  $H_3O^+$  (d)  $NH_4^+$
- 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
- 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)  $\overset{\delta^+}{C}H_2 = CH - CH = \overset{\delta^-}{O}$
- 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)  $CH_2Cl_2 > CHCl_3 > CH_3Cl > CCl_4$
- 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)  $C-H$
- 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)  $C-F$
- 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

## 150 Chemical Bonding

18. How many  $\sigma$  and  $\pi$  bonds are there in the molecule of tetracyanoethylene
- $$\begin{array}{c} N \equiv C \\ N \equiv C \end{array} \text{C} = \text{C} \begin{array}{c} C \equiv N \\ C \equiv N \end{array}$$
- [NCERT 1980; MP PMT 1986, 95; Orissa JEE 1997]
- (a) Nine  $\sigma$  and nine  $\pi$  (b) Five  $\sigma$  and nine  $\pi$   
 (c) Nine  $\sigma$  and seven  $\pi$  (d) Five  $\sigma$  and eight  $\pi$
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 ( $\sigma$ ) and one pi ( $\pi$ ) bonds  
 (b) One sigma ( $\sigma$ ) and two pi ( $\pi$ ) bonds  
 (c) One sigma ( $\sigma$ ) and one and a half pi ( $\pi$ ) bonds  
 (d) One sigma ( $\sigma$ ) 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  $\pi$ -orbital (b) Antibonding  $\pi$ -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

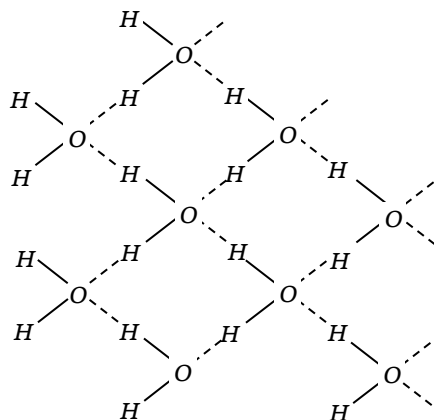
# AS Answers and Solutions

(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  $BaO_2 + H_2SO_4 \rightarrow BaSO_4 + H_2O$  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 an ionic compound because it consists of more electronegativity difference compared 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)  $\begin{array}{c} O^- \\ | \\ ^-O - C = O \end{array}$  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 than  $CH_2Cl_2$ . 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 has some value of dipole moment.
18. (a)  $\begin{array}{c} N \equiv C \quad C \quad C \equiv N \\ \quad \quad \quad \sigma \quad \sigma \\ \quad \quad \quad \pi \quad \pi \\ \quad \quad \quad \sigma \quad \sigma \\ N \equiv C \quad C \quad C \equiv N \\ \quad \quad \quad \sigma \quad \sigma \\ \quad \quad \quad \pi \quad \pi \end{array}$   
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  $\begin{array}{c} C \\ \diagup \quad \diagdown \\ ||| \quad Ca \\ \diagdown \quad \diagup \\ C \end{array}$  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.  
 $\begin{array}{c} \cdot \\ : N :: \ddot{O} : \\ \cdot \end{array}$
25. (b)  $\begin{array}{c} \cdot \\ ^-O - \ddot{Cl} - O \\ \cdot \\ O \end{array}$
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  
 $B.O. = \frac{1}{2}[10 - 8] = \frac{2}{2} = 1$ .
28. (b) Electron lost from antibonding π orbital.
29. (a) In ice each water molecule forms four hydrogen bond through which each water

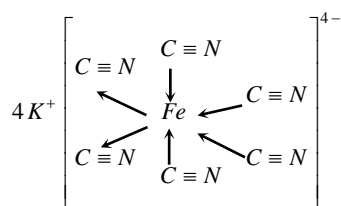
## 152 Chemical Bonding

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.