SAFAL EDUCATION ACADEMY
STANDARD – XI
CHEMISTRY
[Paper – 6]

TIME : 1.0 Hr   MARKS : 60
NAME : _____   Marks Obtained : _____

Section – 1 (Some basic concept of Chemistry) [23]

Q – 1 Solve the following [4]

1. What will be the molality of the solution containing 18.25 g of HCl gas in 500 g of water?
   (i) 0.1 m (ii) 1M (iii) 0.5 m (iv)1 m

2. If the concentration of glucose ($C_6H_{12}O_6$) in blood is 0.9 g/L, what will be the molarity of a glucose in blood?
   (i) 5M (iii)0.005 M (iv) 0.5 M

3. One mole of oxygen gas at STP is equal to .....
   (i) 6.022×10^{23} molecules of oxygen,   (ii) 6.022×10^{23} atoms of oxygen
   (iii) 16 g of oxygen,   (iv) 32 g of oxygen

4. 16 g of oxygen has same number of molecule. as in:
   (1) 16 g of CO, (ii) 28 g of N2, (iii) 14g of N2, (iv) 1.0 g of H2

Q – 2 Solve the following [19]

1. An organometallic compound on analysis was found to contain, C = 64.4%, H= 5.5% and Fe = 29.9%. Determine its empirical formula. (At. mas of Fe = 56)

2. In sulphur estimation of 0.157 g of an organic compound gave 0.4813 g of barium sulphate. What is the percentage of sulphur in the compound? [At. mass of (a) Barium = 137u (b) Sulphur = 32u (c) Oxygen = 16 u]

3. Calculate the molarity of NaOH in the solution prepared by dissolving its 4g in enough water to form 250 mL of the solution.

4. Q.1. A solution contains 25% water, 25% ethanol and 50% acetic acid by mass. Calculate the mole fraction of each component.

5. A dry gas measuring 280 ml at 305 K and 750 mm of Hg, weighs 0.344 g. Calculate the molecular weight of the gas.

6. In Victor Meyer's experiment, 0.6 g of a volatile substance displaced 112 ml of air at S.T.P. Find the molecular mass of the substance.

7. 4 g of NaOH are dissolved in 200 cm3 of water Find the molarity of the solution.

Section – 2 (Chemical Bonding) [37]

Q – 1 Answer the following [15]

1. What do you understand by lattice energy?

2. The elements of which groups prefer to form cations?

3. How many covalent bonds are present in a molecule of ethylene?

4. Which of the following elements does not show variable covalency? Al, F, S, Cl

5. What is the maximum covalency of sulphur?

6. How many singlet linkages are present in the Sugden's structure of SF6?

7. Among AgCl and AgI, which is more covalent?

8. What type of orbitals can overlap to form a covalent bond?

9. What happens to the potential energy of the system when two atoms form a covalent bond?

10. Is hybridization between the orbitals of two atoms possible?

11. What type of bond is formed when two ρ-orbitals overlap axially?

12. What is a kernel and how is it formed?

13. Why does He_2 not exist?

14. Out of σ and π-bonds, which bond is stronger and why?

15. Arrange the following molecular species in increasing order of stability (giving bond orders) :
    O_2, O_2^+, O_2^-, O_2^{2-}

Q – 2 Answer the following [22]

1. Discuss the factors which govern the formation of a covalent bond

2. What is variable covalency? Give some examples.

3. What are Sidgwick's views regarding the failure of the octet rule?

4. What are Fajan's rules?

5. Define dipole moment. How is it related to the molecular structure?

6. What is lattice energy and how is it related to the stability of anionic compound?

7. Why do covalent compounds exhibit stereoisomerism?

8. On the basis of VSEPR theory explain why BeCl2 molecule is linear whereas H2O is angular.

9. What are the main points of difference between atomic and molecular orbitals?

10. Explain on the basis of molecular orbital diagram why O_2 should be paramagnetic.

11. On the basis of VSEPR theory explain why $BeCl_2$ molecule is linear whereas H_2O is angular.

ANSWERS

Section – 1 (Some basic concept of Chemistry) [23]

Q – 1 Solve the following [4]

1. What will be the molality of the solution containing 18.25 g of HCl gas in 500 g of water?
    (i) 0.1 m (ii) 1M (iii) 0.5 m (iv)<u>1 m</u>

2. If the concentration of glucose ($C_6H_{12}O_6$) in blood is 0.9 g/L, what will be the molarity of a glucose in blood?
    (i) 5M (iii)<u>0.005 M</u> (iv) 0.5 M

3. One mole of oxygen gas at STP is equal to .....
    (i) <u>6.022×10^{23} molecules of oxygen</u>, (ii) 6.022×10^{23} atoms of oxygen (iii) 16 g of oxygen, (iv) <u>32 g of oxygen</u>

4. 16 g of oxygen has same number of molecule. as in:
    (1) 16 g of CO, (2) 28 g of N2, (iii) <u>14g of N2</u>, (iv) <u>1.0 g of H2</u>

Q – 2 Solve the following [19]

1. An organometallic compound on analysis was found to contain, C = 64.4%, H= 5.5% and Fe = 29.9%. Determine its empirical formula. (At. mas of Fe = 56) (Ans C10H10Fe)

2. In sulphur estimation of 0.157 g of an organic compound gave 0.4813 g of barium sulphate. What is the percentage of sulphur in the compound? [At. mass of (a) Barium = 137u (b) Sulphur = 32u (c) Oxygen = 16 u] (Ans 42.10%)

3. Calculate the molarity of NaOH in the solution prepared by dissolving its 4g in enough water to form 250 mL of the solution. (Ans 0.4M)

4. Q.1. A solution contains 25% water, 25% ethanol and 50% acetic acid by mass. Calculate the mole fraction of each component. (Ans water = 0.503, ethanol = 0.196, acetic acid = 0.301)

5. A dry gas measuring 280 ml at 305 K and 750 mm of Hg, weighs 0.344 g. Calculate the molecular weight of the gas. (Ans 31.2)

6. In Victor Meyer's experiment, 0.6 g of a volatile substance displaced 112 ml of air at S.T.P. Find the molecular mass of the substance. [Ans 120]

7. 4 g of NaOH are dissolved in 200 cm3 of water Find the molarity of the solution. [Ans 0.5]

Section – 2 (Chemical Bonding) [37]

Q – 1 Answer the following [15]

1. What do you understand by lattice energy?

    The amount of energy liberated in condensing the required number of cations and anions to form the lattice of one gram mole of an ionic compound is called the lattice energy of that compound.

2. The elements of which groups prefer to form cations?

    Groups 1 and 2

3. How many covalent bonds are present in a molecule of ethylene?

    Six

4. Which of the following elements does not show variable covalency? Al, F, S, Cl

Al

5. What is the maximum covalency of sulphur?

   Six

6. How many singlet linkages are present in the Sugden's structure of SF6?

   Four

7. Among AgCl and AgI, which is more covalent?

   AgI

8. What type of orbitals can overlap to form a covalent bond?

   Half-filled orbital

9. What happens to the potential energy of the system when two atoms form a covalent bond?

   Potential energy decreases

10. Is hybridization between the orbitals of two atoms possible?

    No

11. What type of bond is formed when two ρ-orbitals overlap axially?

    σ bond

12. What is a kernel and how is it formed?

    When an atom loses one or more of its valence electron, the remaining part of the atom left is called core or kernel.

13. Why does He_2 not exist?

    The bond order for He_2 is zero. Hence, the molecule cannot exist.

14. Out of σ and π-bonds, which bond is stronger and why?

    σ bond, due to a greater overlapping of atomic orbitals.

15. Arrange the following molecular species in increasing order of stability (giving bond orders) : O_2, O_2^+, O_2^-, O_2^{2-}

    $O_2^{2-} < O_2^- < O_2 < O_2^+$ B.O. 1, 3/2, 2, 5/2

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Q – 2 Answer the following [22]

1. Discuss the factors which govern the formation of a covalent bond

   The factors are :

   (i) High value of ionization

   (ii) equal electron gain enthalpy

   (iii) Equal electronegativities

2. What is variable covalency? Give some examples.

   In an excited state, the atom has more probability of sharing its unpaired electron with those of other atoms.

3. What are Sidgwick's views regarding the failure of the octet rule?

   According to sidgwick, it is not always necessary for an atom to achieve an octet. He put forward his views in the form of a concept called concept of maximum covalency. In this, the maximum

covalency of an atom is governed by its position in periodic table. The maximum covalency of an atom can be less than four as well as it can exceed four.

4. What are Fajan's rules?

The Fajan's rules are :

(i) Smaller size of cation and greater the size of anion, greater is the extent of polarization in an ionic compound.

(ii) Larger the charge on cation and anion, greater is the extent of polarization in an ionic compound.

(iii) Higher is the dielectric constant of the medium, lesses is the extent of polarization in an ionic compound.

5. Define dipole moment. How is it related to the molecular structure?

Dipole moment is defined as the product of magnitude of the charge present on either of the two atoms and the distance by which the two atoms are separated in the molecule.

Since the dipole moment is a vector quantity, the net dipole moment of a molecule is the resultant of the dipole moments of all the polar bonds present in it.

6. What is lattice energy and how is it related to the stability of anionic compound?

The amount of energy liberated in condensing the required number of cations and anions to form the lattice of one gram mole of an ionic compound is called the lattice energy of that compound.

The magnitude of lattice energy gives an idea of the inter ionic forces. It depends upon two factors: (i) Smaller the size of ions, greater is the lattice energy, (ii) Higher the charge on the ions, greater is the lattice energy. Lattice energy is regarded as a measure of ease of formation and stability of an ionic compound.

7. Why do covalent compounds exhibit stereoisomerism?

The covalent bonds are rigid and directional. They can orient at specific angles in space. Due to the possibility of different spatial arrangements of covalent bonds in space, a covalent compound may exhibit stereoisomerism.

8. On the basis of VSEPR theory explain why $BeCl_2$ molecule is linear whereas H_2O is angular.

In $BeCl_2$, the central Be atom possesses two bond pairs of electrons. These pairs repel each other to the maximum possible extent and get oriented at an angle of 180°. Therefore, $BeCl_2$ molecule acquires a linear shape.

In H_2O, the two lone pairs of electrons present on the central atom strongly repel the O-H bond pairs. Since lone pair-bond pair repulsion is more than the bond paie-bond pair repulsion, the normal angle of $109° 28'$ in a tetrahedral geometry decreases to $104.5°$ and the tetrahedral geometry gets distorted. The resulting geometry is regarded as bent or angular.

9. What are the main points of difference between atomic and molecular orbitals?

	Atomic orbitals		Molecular orbitals
1	In an atomic orbital, the electron cloud is associated with the nucleus	1	In a molecular orbital, the electron cloud is associated with the molecule as a whole and is spread over the whole nuclear system of

	of a single atom. Thus an atomic orbital is monocentric.		combining atoms. A molecular orbit is thus polycentric.
2	They are pure orbitals and obtain by solving Schrodinger wave equation for the given atomic system.	2	They are usually obtain by the combination of atomic orbitaks of the combining atoms.
3	They possess higher energy and are less stable.	3	The bonding molecular orbits possess lesser energy and are more stable.

10. Explain on the basis of molecular orbital diagram why O_2 should be paramagnetic.

Electron Configuration: $(\sigma_{2s})^2 \, (\sigma_{2s}^*)^2 \, (\sigma_{2p})^2 \, (\pi_{2p})^4 \, (\pi_{2p}^*)^2$
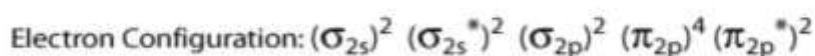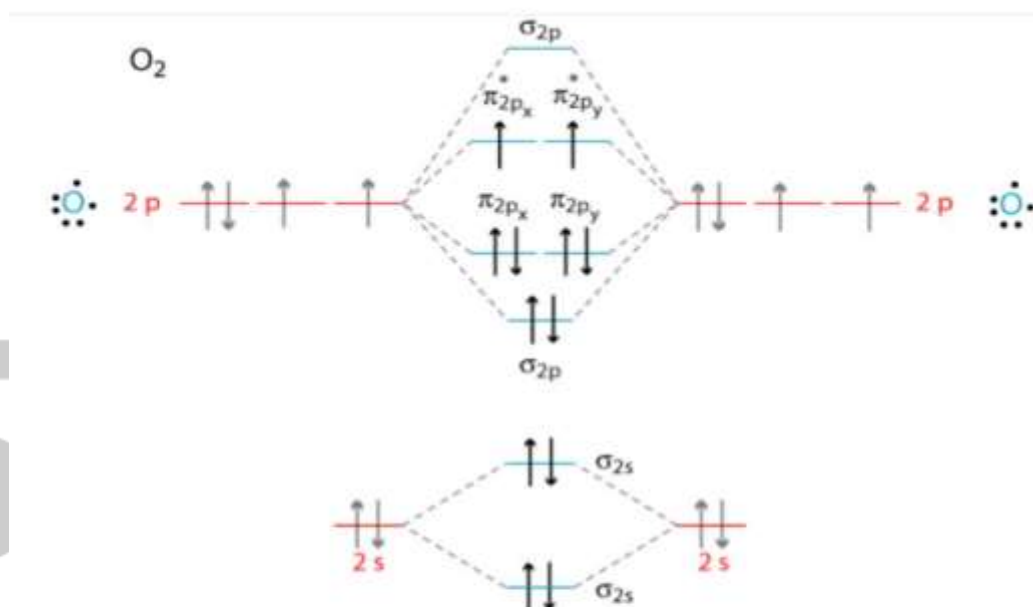
Bond Order $= \frac{1}{2}(2 - 2 + 2 + 4 - 2) = 2$ Double Bond

From the molecular orbital diagram of O_2 shown in Fig., it is clear that the aufbau order of filling of molecular orbitals leaves two unpaired electrons, one each in π^*_{2Px} and π^*_{2py} molecular orbitals. Thus, a O_2 molecule possesses two unpaired electrons even in the ground state. The unpaired electrons impart paramagnetic character to oxygen molecule. Thus, O_2 molecule should be paramagnetic in nature.

11. On the basis of VSEPR theory explain why $BeCl_2$ molecule is linear whereas H_2O is angular.

In $BeCl_2$, the central Be atom possesses two bond pairs of electrons. These pairs repel each other to the maximum possible extent and get oriented at an angle of 180°. Therefore, $BeCl_2$ molecule acquires a linear shape.

In H_2O, the two lone pairs of electrons present on the central atom strongly repel the O-H bond pairs. Since lone pair-bond pair repulsion is more than the bond paie-bond pair repulsion, the normal

angle of 109° 28' in a tetrahedral geometry decreases to 104.5° and the tetrahedral geometry gets distorted. The resulting geometry is regarded as bent or angular.