

2014

(5th Semester)

CHEMISTRY

SIXTH PAPER (CHEM-352)

(Inorganic Chemistry—II)

Full Marks : 55

Time : 2 hours

(PART : B—DESCRIPTIVE)

(Marks : 35)

*The figures in the margin indicate full marks
for the questions*

1. (a) Describe crystal structures of Rutile (TiO_2) and Zinc blende (ZnS). 2+2=4
- (b) Describe the calculation of lattice enthalpy of ionic solids using Born-Haber cycle. 3

OR

2. (a) Discuss briefly the characteristic features of colour centres and Frenkel defects with suitable examples. 2+2=4

(2)

(b) Describe the band structure in *n*-type and *p*-type semiconductors using suitable diagrams. 3

3. (a) Using the molecular orbital (MO) diagrams, predict the magnetic properties of oxygen (O_2) and nitric oxide (NO). $2\frac{1}{2}+3=5\frac{1}{2}$

(b) Calculate bond order of O_2 and NO. $1\frac{1}{2}$

OR

4. (a) Draw the molecular orbital diagram of carbon monoxide (CO) and calculate its bond order. $3\frac{1}{2}$

(b) Describe the characteristic features of various weak non-bonding interaction. $3\frac{1}{2}$

5. (a) Write a short note on the reactions of pseudohalogen, cyanogen (NCCN). Using the Hard Soft Acid Base (HSAB) principle, describe the multiple binding modes of the pseudohalide, NCS^- (thiocyanate). $3+2=5$

(b) Illustrate the structure and bonding of any two interhalogen compounds. 2

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(Continued)

OR

6. (a) Describe the preparation and properties of hydrides of nitrogen and phosphorus. $2\frac{1}{2}+2=4\frac{1}{2}$

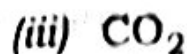
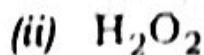
(b) Discuss briefly the isolation and purification of noble gases by the fractionation of liquid air. $2\frac{1}{2}$

7. (a) Define subgroup, class and order of a group. 3

(b) Describe briefly the solvation property of a basic and an acidic non-aqueous solvent. $2+2=4$

OR

8. (a) Deduce the symmetry elements and the symmetry point group of the following molecules : 6



(b) When a small piece of sodium (Na) or potassium (K) is dissolved in liquid ammonia (NH_3), a characteristic blue coloured solution results. Explain. 1

9. (a) Draw the diagram and explain how the d -orbital energy levels split when transition metal ion is placed in the centre of a tetrahedral field. 3
- (b) The electrode potentials of transition metals are very high, but they are not good reducing agents. Explain why. 2
- (c) Compounds of transition metals are generally coloured. How would you explain this behaviour? 2

OR

10. (a) What is the difference between an inner orbital complex and an outer orbital complex? Discuss with one example each. 3
- (b) What is crystal field theory? How does this theory account for the fact that $[\text{CoF}_6]^{3-}$ is paramagnetic but $[\text{Co}(\text{NH}_3)_6]^{3+}$ is diamagnetic though both are octahedral? 1+3=4

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CHEMISTRY

SIXTH PAPER (CHEM-352)

(Inorganic Chemistry—II)

(PART : A—OBJECTIVE)

(Marks : 20)

The figures in the margin indicate full marks for the questions

SECTION—I

(Marks : 5)

Put a Tick (✓) mark against the correct answer in the brackets provided for it :

1×5=5

1. Aluminium hydroxide is a/an

(a) Arrhenius acid ()

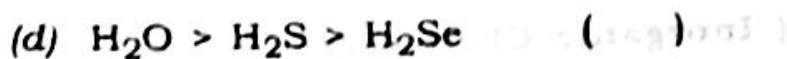
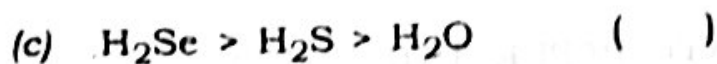
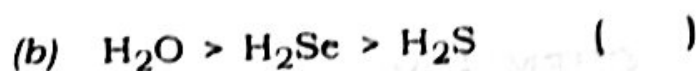
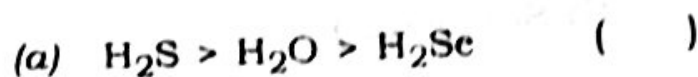
(b) Bronsted-Lowry acid ()

(c) Lewis acid ()

(d) Aqua acid ()

(2)

2. For the following binary hydrogen compounds, their acidity is of the order



3. Which of the following statements is right?

(a) O_2 is more soluble in water than organic solvents ()

(b) O_2 is more soluble in seawater than water ()

(c) O_2 is equally soluble in seawater and water ()

(d) O_2 is more soluble in organic solvents than water ()

4. Induced dipole-induced dipole interaction is called as

- (a) London dispersion ()
- (b) Stacking interaction ()
- (c) H-bonding interaction ()
- (d) van der Waals interaction ()

5. Coordination geometry of $[\text{Zn}(\text{NH}_3)_4]^{2+}$ is

- (a) square planar ()
- (b) distorted tetragonal ()
- (c) tetrahedral ()
- (d) distorted rhombohedral ()

(4)

SECTION—II

(Marks : 15)

Answer the following questions : 3×5=15

1. Write the redox and precipitation reactions of liquid ammonia.

(5)

2. What is meant by brown ring test?

(6)

3. Copper sulphate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) is blue coloured solid, while anhydrous copper sulphate (CuSO_4) is a colour solid. Explain.

(7)

4. What is the basis of HSAB (Hard Soft Acid Base) concept? What are the chemical consequences of hardness of an ion?

5. What are the factors affecting the magnitude of lattice energy?
