

2015

(5th Semester)

CHEMISTRY

SIXTH PAPER (CHEM-352)

(Inorganic Chemistry—II)

Full Marks : 55

Time : 2½ hours

(PART : B—DESCRIPTIVE)

(Marks : 35)

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

1. (a) Mention the important characteristics of ionic crystals. 3
- (b) The ionic radii of K^+ and Cl^- ions are 1.33 Å and 1.81 Å respectively. Predict the coordination number of K^+ ion and the site occupied by K^+ ion in the KCl crystal. 2
- (c) How is a tetrahedral site formed in a closed-packed structure? 2

G16/135a

(Turn Over)

OR

2. (a) Discuss briefly the characteristic features of Schottky defect in crystals. 3
- (b) Define non-stoichiometric defects. Explain briefly metal deficiency defects. 1+2=3
- (c) What is the effect of temperature on n -type semiconductor? 1
3. (a) What are the essential conditions required for the formation of atomic orbitals to form molecular orbitals? 3
- (b) Give pictorial representation of the molecular orbitals formed by the combination of s and p_x atomic orbitals (assuming x -axis as the molecular axis). 1
- (c) Draw the molecular orbital (MO) energy level diagram of O_2 molecule and explain its magnetic behaviour. 2+1=3

OR

4. (a) Compare the electrical conductance of conductors and insulators in terms of band model. 3

- (b) What do you mean by dipole-induced dipole interactions? 2
- (c) Give reasons why the boiling point of noble gases increases from He to Xe. 2
5. (a) What is meant by inert pair effect? Explain the stability of different oxidation states shown by group 13 elements. 1+2=3
- (b) How will you prepare B_2H_6 ? Briefly explain its structure. 1+2=3
- (c) Write the structure of dinitrogen tetroxide and Caro's acid. $\frac{1}{2} + \frac{1}{2} = 1$

OR

6. (a) What do you mean by pseudohalogens? Provide suitable examples. 3
- (b) Explain the bonding and structure of XeF_4 . 3
- (c) What are clathrates? 1
7. (a) What do you mean by conjugate acid-base pair? Give example. 2
- (b) On the basis of HSAB principle, give reason why AgI_2^- is stable while AgF_2^- does not exist. 1

(c) Explain by giving suitable example the following reactions in liquid ammonia : 2+2=4

- (i) Neutralization reaction
- (ii) Redox reaction in which alkali metals in liquid ammonia act as reducing agents

OR

8. (a) What is meant by amphiprotic solvent? 1

(b) Explain the following terms : 1+1=2

- (i) Axis of symmetry
- (ii) Order of a group

(c) Write the symmetry elements and symmetry point group of the following molecules : 2+2=4

(i) BF_3

(ii) NH_3

9. (a) Mention two points of differences of the first transition series as compared to the second series. 1

(b) Discuss the tendency of transition metals to form complex compounds. 3

(c) Using crystal field stabilization energy, explain that $[\text{Fe}(\text{CN})_6]^{3-}$ is more stable than $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$. 3

OR

10. (a) Account for the smaller magnitude of crystal field splitting in tetrahedral than in octahedral complexes. 2
- (b) Illustrate the factors that affect the magnitude of crystal field splitting. 3
- (c) Calculate CFSE of the following complexes : 1+1=2
- (i) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$
- (ii) $[\text{CoCl}_4]^{2-}$

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(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 : 1×5=5

1. The coordination number of each sphere in hexagonal closed-packed structure is

(a) 6 ()

(b) 8 ()

(c) 10 ()

(d) 12 ()

2. Dipole-dipole interactions are also called

- (a) London forces ()
- (b) Debye forces ()
- (c) Keesom forces ()
- (d) Ion-dipole interactions ()

3. The hardest abrasive substance ever made artificially is

- (a) boron carbide ()
- (b) carborundum ()
- (c) aluminium carbide ()
- (d) beryllium carbide ()

4. Pyrophosphorus acid ($\text{H}_4\text{P}_2\text{O}_5$) is a

(a) monobasic acid ()

(b) dibasic acid ()

(c) tribasic acid ()

(d) tetrabasic acid ()

5. Square planar complexes are usually

(a) low spin ()

(b) high spin ()

(c) Both (a) and (b) ()

(d) None of the above ()

SECTION—II

(Marks : 15)

Answer the following questions : 3×5=15

1. What are the consequences of Frenkel defects in crystals?

2. Differentiate between bonding and anti-bonding molecular orbitals.

3. Why does nitrogen show catenation properties less than phosphorus?

Answer the following questions

4. What are the consequences of Frenkel defects in crystals?

4. Explain how BF_3 acts as a Lewis acid. 3

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(PART : A—OBJECTIVE)

Marks : 20

Put a Tick (✓) mark against the correct answer in the margin.

SECTION—I

(Marks : 3)

Put a Tick (✓) mark against the correct answer in the margin.

1. The coordination number of Al^{3+} in hexagonal closed-packed structure is

- (a) 6
- (b) 8
- (c) 10
- (d) 12

5. Give reasons why transition elements exhibit variable oxidation states.

- (a) London forces
- (b) Debye forces
- (c) Keesom forces
- (d) Ion-dipole interactions

3. The hardest abrasive substance ever made artificially

- (a) boron carbide
 - (b) carborundum
 - (c) aluminum carbide
 - (d) beryllium carbide
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