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(Pre-CBCS)

(5th Semester)

CHEMISTRY

SIXTH PAPER (CHEM-352)

(Inorganic Chemistry—II)*Full Marks : 55**Time : 2½ hours***(PART : A—OBJECTIVE)***(Marks : 20)**The figures in the margin indicate full marks for the questions*

SECTION—A

(Marks : 5)

Tick (✓) the correct answer in the brackets provided :

1×5=5

1. In a closed packed array of N spheres, the number of tetrahedral holes is(a) $N/2$ ()(b) $4N$ ()(c) $2N$ ()(d) N ()**2.** Which of the following transition elements does not show colour in its ionic state?(a) Ti^3 ()(b) Sc^3 ()(c) Cu^2 ()(d) V^3 ()

3. Which of the following oxoacids of nitrogen shows +3 oxidation state of N?
- (a) HNO_2 ()
(b) HNO_3 ()
(c) $\text{H}_2\text{N}_2\text{O}_2$ ()
(d) $\text{H}_4\text{N}_2\text{O}_4$ ()
4. Which of the following is not a Lewis acid?
- (a) SbF_6 ()
(b) SO_2 ()
(c) CN ()
(d) AlCl_3 ()
5. Which of the following systems has the maximum number of unpaired electrons?
- (a) d^6 (tetrahedral) ()
(b) d^9 (octahedral) ()
(c) d^4 (octahedral, low spin) ()
(d) d^7 (octahedral, high spin) ()

SECTION—B

(Marks : 15)

Answer the following questions :

3×5=15

1. On the basis of molecular orbital theory, explain why hydrogen forms diatomic molecule while helium remains monatomic.
2. Write notes on the Frenkel and Schottky defects emphasizing on their differences.
3. Give one method of preparation of ClF_3 .
4. What are the factors contributing to transition metals to form complexes?
5. Explain solvolysis reaction in liquid ammonia.

(PART : B—DESCRIPTIVE)

(Marks : 35)

The figures in the margin indicate full marks for the questions

1. (a) What are the factors affecting the solubility of ionic solids? 2
(b) What are meant by non-stoichiometric defects of crystals? Explain the consequences of metal excess defect. 1+2=3
(c) Iron crystallizes in a b.c.c. system with edge length 2.861 Å. The atomic weight of iron is 55.85 g/mol. Calculate the density of iron. 2

OR

2. (a) What is lattice energy? 1
(b) What are semiconductors? Explain what are meant by *n*-type and *p*-type semiconductions. What is the effect of temperature on semiconduction? 1+2+2=5
(c) The radii of B³⁺ and O²⁻ ions are 0.23 Å and 1.40 Å respectively. Calculate the radius ratio of boron oxide. 1

3. (a) Draw the molecular orbital diagram of NO and state whether it is diamagnetic or paramagnetic. 3
(b) Discuss the effect of van der Waals' forces on melting point and boiling point of compounds. 2
(c) What do you understand by the terms 'bonding' and 'anti-bonding' of molecular orbitals? Why are they so called? 2

OR

4. (a) Describe the formation of N₂ molecule giving molecular orbital diagram and calculate its bond order. 3
(b) Calculate the bond order of the following molecules/ions : 2
O²⁺ and O₂⁺
(c) Write a note on dipole-dipole interaction giving an example. 2

5. (a) Explain the structure and bonding of XeF₄. 3
(b) What is inert pair effect? 2
(c) Write the differences between pseudohalogens and interhalogens with examples. 2

OR

6. (a) What is catenation? Why does sulphur show more catenation property than nitrogen? 2
- (b) Write the preparation and briefly explain the structure of B_2H_6 . 3
- (c) Write notes on the relative stability of oxidation state of *p*-block elements. 2
7. (a) Explain the following terms : 1½×2=3
- (i) Plane of symmetry
- (ii) Identity
- (b) On the basis of HSAB principle, give reason why $[CoF_6]^{3-}$ is more stable than $[CoI_6]^{3-}$. 2
- (c) What are protic and aprotic solvents? Is liquid HF a protic or aprotic solvent? 2

OR

8. (a) Evaluate the symmetry elements and symmetry point group of BF_3 . 2
- (b) What are meant by Lewis concepts of acid and base? What are the characteristics of hard acid, soft acid, hard base and soft base? 3
- (c) What are the conditions for a molecule to form a group? 2
9. (a) What are the main points of differences among 1st, 2nd and 3rd transition series? 3
- (b) Discuss crystal field splitting giving a neat diagram in octahedral complexes. 2
- (c) Explain CFSE. 2

OR

10. (a) Discuss crystal field splitting of *d*-orbitals in the case of tetrahedral complexes with a neat diagram. 3
- (b) Describe the bonding in $[Ni(CO)_4]$ on the basis of VBT. 3
- (c) Explain why Sc^{3+} and Zn^{2+} ions are colourless. 1

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