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(CBCS)

(5th Semester)

CHEMISTRY

FIFTH PAPER

(Inorganic Chemistry—II)

Full Marks : 75

Time : 3 hours

(PART : A—OBJECTIVE)

(*Marks* : 25)

The figures in the margin indicate full marks for the questions

SECTION—A

(*Marks* : 10)

Tick (✓) the correct answer in the brackets provided : 1×10=10

1. The unit cell of a cubic close packing (ccp) contains

(a) 10 spheres ( )

(b) 12 spheres ( )

(c) 14 spheres ( )

(d) 16 spheres ( )

2. The coordination number in body-centred cubic structure is

(a) 8 ( )

(b) 6 ( )

(c) 9 ( )

(d) 4 ( )

3. In NO molecule, the bond order according to MO theory is

(a) 3 ( )

(b) 2·5 ( )

(c) 1·5 ( )

(d) 2 ( )

4. Debye force is attributed to

(a) dipole-dipole interaction ( )

(b) dipole-induced dipole interaction ( )

(c) instantaneous dipole-induced dipole interaction ( )

(d) ion-dipole interaction ( )

5. Marshall's acid is

(a) $H_2S_2O_8$ ( )

(b) $H_2S_2O_6$ ( )

(c) $H_2S_4O_8$ ( )

(d) $H_2S_3O_8$ ( )

6. Carborundum is

(a) SiC ( )

(b) CaC_2 ( )

(c) BN ( )

(d) S_4N_4 ( )

7. The symmetry point group of H_2O is

(a) C_2V ( )

(b) C_2h ( )

(c) D_2h ( )

(d) D_2d ( )

8. Interhalogens are more reactive than halogens because

(a) they have more electrons ( )

(b) they have polar bonds ( )

(c) their lone pair of electrons are more exposed ( )

(d) None of the above ( )

9. Most of the transition metals are coloured due to the

(a) unpaired *d-d* electronic transitions ( )

(b) charge transfer transition ( )

(c) pi-pi electronic transition ( )

(d) None of the above ( )

10. The complex $[Fe(H_2O)_6]^3$ is a

(a) low-spin complex ( )

(b) high-spin complex ( )

(c) diamagnetic complex ( )

(d) None of the above ( )

SECTION—B

(*Marks* : 15)

Answer the following questions : 3×5=15

1. Calculate the lattice energy of NaCl crystal using Born-Landé equation. (Given : e $4{\cdot}8\times10^{10}$ esu; A 1·7476; N $6{\cdot}0238\times10^{8}$ cm; n 8 for NaCl; r_0 $2{\cdot}76\times10^{8}$ cm)

OR

Explain the concept of Frenkel defect and its consequences.

2. Using molecular orbital energy-level diagram, calculate the bond order of N_2 molecule.

OR

Explain the concept of dipole-induced dipole interaction.

3. Discuss in brief the uses of carbides in industry.

OR

Explain what is meant by inert pair effect.

4. Nitrous acid can behave as oxidizing agent. Explain with suitable examples.

OR

Discuss the structure of chlorine trifluoride ClF_3.

5. Explain why $Ni(CO)_4$ is diamagnetic and tetrahedral in geometry.

OR

Transition metals are less reactive than alkali and alkaline earth metals. Explain.

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

1. *(a)* Define crystal lattice. Name the seven crystal systems with suitable examples. 1+4=5

(b) Explain the malleability and ductility of metals and correlate with the crystal close packing structures. 3

(c) Discuss the consequences of metal excess defects. 2

OR

2. *(a)* Discuss the Born-Haber cycle taking the example of NaCl. 3

(b) Deduce the Born-Landé equation for calculation of lattice energy of a crystal. 5

(c) On what type of compounds Schottky defects are mostly found? 2

3. *(a)* Draw the MO diagram of O_2. 3

(b) Bond order of O_2 is more than O_2, explain why. 2

(c) Explain in brief van der Waals' forces and their effect on melting and boiling points. 5

OR

4. *(a)* Draw MO diagram of CO molecule and calculate the bond order. 4

(b) Discuss the conditions under which atomic orbitals combine to form MO. 3

(c) What are the informations given by the bond order? 3

5. *(a)* Define catenation with suitable example. 2

(b) Discuss the types of interhalogen compounds with suitable examples. 3

(c) Discuss briefly isolation and separation of noble gases by fractionalization of liquid air. 5

OR

6. *(a)* Pb(IV) is good oxidizing agent and Pb(II) is not whereas Ge(II) is good reducing agent and Ge(IV) is not. Explain. 3

(b) Discuss the formation of clathrates with suitable example. 4

(c) Discuss the structure of XeF_6. 3

7. *(a)* Define Brönsted-Lowry concepts of acids and bases. 2

(b) Illustrate the *(i)* solvolysis and *(ii)* precipitation reactions in liq. NH_3. 5

(c) Discuss the rules for a molecule to form a group. 3

OR

8. *(a)* Give an example of complex formation reaction shown by ammono base in liq. NH_3. 2

(b) Evaluate the symmetry elements and symmetry point group of H_2O_2. 4

(c) Discuss the solvent system concept of acids and bases. 4

9. *(a)* What are inner sphere and outer sphere complexes? Explain with examples. 5

(b) Discuss the characteristics of 1st row transition elements for the ability to form complexes and the magnetic properties. 3

(c) Why is $[Cr(NH_3)_6]^3$ paramagnetic? Explain. 2

OR

10. *(a)* Explain why *d*-block elements are called transition elements. 2

(b) Discuss the factors affecting the magnitude of CFSE. 3

(c) Draw and explain the crystal field splitting pattern in octahedral geometry. 5

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