Paper / Subject Code: 24227 / Chemistry: Inorganic Chemistry(6 Units)

(Time: 3 Hours) **Total marks: 100**

N.B. (1) All questions are compulsory.
(2) Figures to the right indicate full marks.
(3) Use of logarithmic table/non-programmable calculator is allowed

1. Attempt **any four** of the following:
   A. Classify the symmetry operations with suitable examples.Give symmetry elements associated with them. 5
   B. Discuss the symmetry operations and assign the point group to NH_3 molecule. 5
   C. Draw a neat well labelled Molecular Orbital diagram of BeH_2 molecule. Give its structure,magnetic property and molecular configuration. 5
   D. Describe the molecular orbital energy level diagram of CO with respect to bond order and magnetic property (Hybridisation not required). 5
   E. Explain the geometry of H_3^+ ion on the basis of Walsh diagram and molecular orbital theory. 5
   F. a. Explain why covalent bond energy in heteronuclear diatomic molecule is reduced. 3
   b. Define: (i) Symmetry Operation (ii) Order of group 2

2. Attempt any four of the following:
   A. Explain with the help of a diagram: 5
   (i) Unit Cell (ii) Lattice parameters.
   B. Define Packing density.Show that packing density for simple cubic lattice is 0.52 5
   C. For a face centered cubic (fcc) lattice, calculate: 5
   (i) Number of atoms per unit cell (fcc)
   (ii) Lattice constant (a), if atomic radii (r) of a metal is 138 pm,
   D. With suitable example, explain Schottky defect in ionic solids. 5
   E. Explain the terms: 5
   (i) Superconducting Transition Temperature (T_c) (ii) Meissner's effect.
   F. Write a short note on Fullerenes and Alkali metal fullerides. 5

3. Answer any four of the following:
   A. What are *f*-block elements? Give the ideal and observed electronic configurations of actinides. 5
   B. Explain the spectral properties of lanthanides. 5
   C. Explain the method of separation of lanthanides from each other by ion exchange method. 5
   D. Give reasons:
   (i) Post lanthanide elements have abnormal high densities. 3
   (ii) Cerium can forms compounds with +4 oxidation state. 2

E. Explain the oxidation states of lanthanides on the basis there electronic configurations. **5**

F. Give the applications of lanthanides. **5**

4. Attempt **any four** of the following:

A. What are ionizing and nonionizing solvents? Explain with suitable examples. **5**

B. With reference to liquid Dinitrogen tetroxide (N_2O_4) as a solvent, give balanced equations of (i) Acid base reactions (any two) (ii) Redox reaction with metals (any two) **5**

C. Name the oxyacids of Chlorine. Discuss the structure of any two on the basis of VSEPR theory. **5**

D. Give any two preparations and any three properties of interhalogens. **5**

E. With reference to the elements of Group-16, discuss the following: **5**
(i) Electronic configuration. ii) Oxidation states.

F. Discuss the role of V_2O_5 catalyst in the oxidation of SO_2 to SO_3. **5**

5. Answer the following :

A. Match the column : (Any five) **5**

A		B
a) Inversion centre	i)	Td
b) Homonuclear diatomic molecule	ii)	paramagnetic
c) Trans-dichloroethylene	iii)	H_2 molecule
d) Higher symmetry point group	iv)	linear
e) NO molecule	v)	monocentric
f) Rotation – Reflection axis	vi)	3pz
g) Atomic orbitals	vii)	C_{2h}
h) HCl	viii)	i
	ix)	C_{2v}
	x)	Sn
	xi)	polycentric

B. Select and write the appropriate answer. **5**

a. AB – AB type of arrangement of spheres is found in ________ close packing.
(i) simple cubic (ii) face centered cubic (iii) hexagonal

b. Voids in body centered cubic lattice is ______.
(i) 32% (ii) 48% (iii) 52%

c. Due to Frenkel defect in ionic solids, density __________.
(i) increases (ii) decreases (iii) remains same

d. Nb_3Sn is an example of ____________ superconductor.
(i) conventional (ii) high temperature (iii) organic

e. A point in crystal lattice signifies _______ of particles.
(i) size (ii) volume (iii)) position of centre.

f. Frenkel defect occurs in ___________.
(i) Alkali halides (ii) Silver halides (iii) Alkali metal halides

g. The coordination number in body centered cubic lattice is ________.
(i) 6 (ii) 8 (iii) 12

h. High temperature superconductors require ________ for cooling.
(i) Liquid Helium (ii) Liquid Hydrogen (iii) Liquid Nitrogen

C. State whether the following statements are **true or false (any five):-** **5**

a. Colour of lanthanide ions is mainly because of charge transfer transitions.
b. Outer electronic configuration of Dy^{4+} is [Xe] $4f^8$
c. $Gd^{3+}$is colourless.
d. Nobel character of Ir may be attributed to lanthanide contraction.
e. An average separation factor of 1.5 is achieved for adjacent lanthanides in 10.8M nitric acid.
f. Compounds of $Ce^{4+}$are oxidising agents.
g. La^{3+} has zero magnetic moment.

D. Fill in the blank with appropriate words given below (any five): **5**

(Water, O_2, Liquid SO_2, Trigonal, NH_2^-, two, Bent T shape, NH_2^+, one, Flourine, O_4, 98% H_2SO_4, Iodine)

a. Among the following ________ is an aprotic solvent.
b. BrF_3 molecule has a __________ structure.
c. One of the products of autoionisation of liquid NH_3 is _________.
d. Elements of Group-17 need only ___ electrons to complete their octet.
e. __________ does not form an oxyacid.
f. An allotropic form of oxygen is ________.
g. _______ is used to absorb Sulphur trioxide in Contact Process.
