Chemistry Paper II

TYBSc sem V

Inorganic chemistry

QP Code : 76968

[Total Marks : 75]

(2 ½ Hours)

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

1. Attempt **any three** of the following :-
   (A) Explain the symmetry elements and assign a point group in NH_3 molecule with proper diagrams. 5
   (B) Give an account of the following with suitable examples. 5
      (i) Identity
      (ii) Proper rotation axis
   (C) Explain the term ' improper rotation axis'. Discuss the same with suitable example. 5
   (D) Draw a neat labelled MO diagram for H_2O molecule. Give its structure and magnetic property. 5
   (E) Write the wave equations for the formation of molecular orbitals in BeH_2 molecule. [MO diagram not expected] 5
   (F) What is doping? Explain p- type semiconductor with suitable example. 5

2. Attempt **any three** of the following :- 5
   (A) Explain with the help of a diagram
      (i) Unit cell and Lattice parameter.
      (ii) Closest packing of rigid spheres in two dimension arrangement.
   (B) Define Atomic Packing Factor (APF). Show that Atomic Packing factor for bcc lattice is 0.68. 5
   (C) Show that packing density for fcc lattice is 74%. 5
   (D) A metal crystallises out in simple cubic (sc) unit cell. If the lattice constant (a) is 3.36×10^{-8} cm and molar mass (M) is 209 g mol^{-1}. Calculate the atomic radii and density of the metal. Avagadro's No. (N) is 6.023×10^{23} mol^{-1}. 5
   (E) Explain Schottky defect by giving a suitable example. 5
   (F) What is Superconductivity? Give the applications of superconductors. 5

3. Attempt **any three** of the following :-
   (A) Discuss the comparative chemistry of lanthanides and actinides. 5
   (B) What is lanthanide contaction? Discuss it's effect on basicity. 5
   (C) (i) What are 4 f block elements? Discuss their position in the periodic table. 2
      (ii) Discuss the applications of lanthanides. 3

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(D) Explain the following :
(i) The absorption spectra of lanthanide ions are characterised by very sharp bands.
(ii) Zirconium and hafnium are known as chemical twins.
(E) Discuss the magnetic properties of lanthanides.
(F) Discuss the applications of Uranium with reference to two important sources.

4. Attempt **any three** of the following :-
(A) What are (i) Protonic (ii) Aprotic (iii) Amphiprotic solvents? Explain with suitable examples.
(B) Explain the following :-
(i) The properties and advantages of ionic liquids over other solvents.
(ii) Super critical liquids.
(C) Discuss the preparation and bonding of interhalogens of the type XY_5, with suitable example.
(D) What are pseudohalogens? Discuss the methods of preparation and structure of cyanogen.
(E) Discuss the methods of preparation, properties and bonding of XeF_4 molecule.
(F) (i) Explain with equations, Xenon fluorides are good fluorinating agents.
(ii) Explain ammonia is 'Water like' solvent.

5. Answer the following :-
(A) Select and write the most appropriate answer.
(a) _____ molecule belongs to D_3h point group.
(i) NH_3
(ii) BF_3
(iii) Trans-dichloroethylene
(b) The angle of rotation for a C_2 axis is _____.
(i) 60^0 (ii) 180^0 (iii) 120^0
(c) In H_3^+ ion, the total number of valence electrons available for bonding are _____.
(i) 4 (ii) 2 (iii) 3
(d) The n-type semiconductor is obtained, when silicon is doped with_____.
(i) Ga (ii) In (iii) As

OR

(A) State whether the following statements are **true** or **false**. 4

(p) HCl molecule has D∞h point group.

(q) The molecules having same number of peripheral atoms shows similar structures.

(r) According to symmetry rules symbol 't' denotes double degenerate orbitals.

(s) Electrical conductivity of a metal decreases with rise in temperature.

(B) Select and write the most appropriate answer. 4

(a) In a simple cubic unit cell, the atomic radii and lattice constant are related by _____.

(i) a = r (ii) a = 2r (iii) a = 4 r

(b) The number of atoms in hexagonal close packed cell is _____.

(i) 2 (ii) 4 (iii) 6

(c) In _____ defect, missing ion occupies an interstitial position between the lattice points.

(i) Frenkel

(ii) Schottky

(iii) Both (i) & (ii)

(d) Carbon atoms in fullerene are _____ hybridised.

(i) sp (ii) sp^2 (iii) sp^3

OR

(B) State whether the following statements are **true** or **false**. 4

(p) Positions occupied by particles in crystal lattice are called Lattice points.

(q) The vacant space in simple cubic (sc) unit cell is 52%.

(r) Conventional superconductors required Liquid Helium for cooling.

(s) Frenkel defect occurs in Silver halides.

(C) Select and write the most appropriate answer. 4

(a) The lanthanide ion that is colourless is _____.

(i) Lu^{3+} (ii) Nd^{3+} (iii) Er^{3+}

(b) One of the important mineral from which uranium is extracted is _____.

(i) haematite (ii) ilmenite (iii) pitchblende

(c) The electronic configuration of Lanthanum is _____.

(i) [Xe] $4f^0, 5d^1, 6s^2$

(ii) [Xe] $4f^0, 5d^2, 6s^2$

(iii) [Xe] $4f^0, 5d^1, 6s^1$

(d) _____ is the starting material for the synthesis of transuranic elements.
(i) Cerium (ii) Uranium (iii) Lanthanum

OR

5. (C) State whether the following statements are **true** or **false**.
(p) The Gd^{3+} ion is colourless.
(q) Compared to actinides, lanthanides show stronger tendency to form complexes.
(r) The compounds of actinides are less basic, as compared to lanthanides.
(s) In actinides, the 5f orbitals can take part in bonding. Hence they form covalent Compounds.

5 (D) Select and write the most appropriate answer.
(a) Heat absorbed by one mole of a substance to convert from solid to liquid state is called_____.
(i) molar heat of fusion
(ii) enthalpy change
(iii) heat of vaporization
(b) The bond strength of the interhalogens_____ as the electronegativity difference between the halogens increases.
(i) decreases (ii) increases (iii) remains same
(c) The anions of pseudohalogens are called as _____.
(i) halogens
(ii) halides
(iii) Pseudohalides

OR

5. (D) State whether the following statements are **true** or **false**.
(p) Interhalogens are soluble in organic as well as in some inorganic solvents.
(q) Chemical formula for Thiocyanogen is $(CN)_2$.
(r) The electronic configuation of xenon is $[Kr]\ 4d^{10}, 5S^1, 5P^1$.
