झ४ङ्गुरा.ङ्ग२पव क्रश्रषङ्ग२०१७ङ्ग१

(REVISED COURSE) **QP Code : 20274**

(2½ Hours) **[Total Marks : 75]**

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 D_{3h} point group with a suitable example. **5**
   (B) (a) Explain the vertical plane of symmetry with a suitable example. **2**
   (b) What is inversion centre ? Draw the structure and state whether the following molecules have inversion centre. **3**
   (i) SF_6 (ii) BF_3 (iii) Transdichloroethylene (iv) H_2O
   (C) Identify the symmetry elements and assign the point groups to H_2O and HCl molecules. **5**
   (D) Draw a neat labelled molecular orbital diagram for BeH_2 molecule showing the distribution of electrons in various energy levels. Predict its magnetic property. **5**
   (E) What is Walsh Correlation diagram ? Draw a neat and labelled Walsh Correlation diagram for linear and bent AH_2 type of molecule. **5**
   (F) On the basis of band theory, discuss the electrical properties of conductors and insulators. **5**

2. Attempt **any three** of the following :–
   (A) Define Packing Density. Show that packing density for simple cubic (sc) lattice is 0·52. **5**
   (B) For hexagonal close packed structure, calculate – **5**
   (a) Number of atoms per unit cell (hcp)
   (b) Atomic radius (r), if length of unit cell is 240 pm.
   (C) (a) Derive a relationship between lattice constant and density of the crystal material. **3**
   (b) Mention different types of point defects found in crystals. **2**
   (D) Explain Schottky defect with suitable example. **5**
   (E) Write short note on High Temperature Superconductors (HTSC). **5**
   (F) Explain with the help of suitable diagram :– **5**
   (a) Unit cell and lattice parameters
   (b) Superconducting transition temperature (Tc)

3. Attempt **any three** of the following :–
   (A) Explain the following :
   (a) Apart from 3+ oxidation state cerium show 4+ while europium shows 2+ oxidation state. **3**
   (b) Zirconium and hafnium are called chemical twins. **2**
   (B) Write note on solvent extraction method of separating lanthanides from each other. **5**
   (C) What are inner transition elements ? Give name and electronic configuration of lanthanides. **5**
   (D) Explain the following :
   (a) Paramagnetic behaviour of lanthanon is not proportional to the number of unpaired electrons. **3**
   (b) Electronic spectra of lanthanon ions exhibit characteristic sharp bands. **2**

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(E) Give reasons for the following :–
- (a) Colour of lanthanide complexes is not appreciably affected by the nature of the ligand. **3**
- (b) Lanthanides preferably exhibit 3+ oxidation state. **2**

(F) How does uranium occur in nature ? Discuss the extraction of uranium from pitchblende by solvent extraction method. **5**

4. Attempt **any three** of the following :–

(A) What are supercritical liquids ? Explain with phase diagrams for CO_2. **5**

(B) With reference to liquid ammonia as the solvent, explain the following with balanced equations – **5**
- (a) Auto ionization reaction (b) Redox reactions (c) Acid base reactions.

(C) (a) Explain, among the halogens iodine only forms hepta fluoride. **2**
- (b) Write note on preparation of interhalogen compounds. **3**

(D) What are Pseudohalogens ? Discuss the differences between pseudohalogens and halogens. **5**

(E) Discuss any one method of preparation, two properties and bonding of XeF_6. **5**

(F) (a) Explain ammonia is 'water like' solvent. **2**
- (b) Explain with equation XeF_6 cannot be stored in glass vessels. **3**

5. Answer the following :–

(A) Select and write the appropriate answer :– **4**
- (a) Trans dichloroethylene belongs to ________ point group.
  (i) $C_{\infty v}$ (ii) C_{2v} (iii) C_{2h}
- (b) The angle of rotation for a C_3 axis is _________ .
  (i) 90° (ii) 120° (iii) 180°
- (c) The structure of H_3^+ ion is __________ .
  (i) tetrahedral (ii) triangular (iii) linear
- (d) The p-type semiconductor is obtained when Si is doped with ________.
  (i) As (ii) Sb (iii) Al

OR

(A) State whether the following statements are **true** or **false** :– **4**
- (p) Photoelectron spectrum of water shows three bands
- (q) Though BeH_2 and H_2O molecules have same number of peripheral atoms their structures are different.
- (r) Identity is a doing nothing operation.
- (s) The collection of very closely spaced energy levels is called energy band.

(B) Select and write the qppropriate answer :– **4**
- (a) ABC ... ABC closest packing of atoms result in ___________ lattice.
  - (i) simple cubic (sc)
  - (ii) body centered cubic (bcc)
  - (iii) face centered cubic (fcc)
- (b) A point in crystal lattice signifies ___________ of particles.
  (i) size (ii) volume (iii) position of centre

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(c) Frenkel defect occurs in ionic crystals with ________ radius ratio.
(i) low (ii) high (iii) almost equal to 1

(d) The effect of ejecting out the flux lines of magnetic field is known as __________
(i) Meissner effect (ii) Dopler effect (iii) Line effect.

OR

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

(p) Void spaces in body centered cubic unit cell is 32%.

(q) Nearest neighbour distance in hexagonal close packed structure is a =2r

(r) Frenkel defects do not affect the density of the ionic crystal.

(s) Conventional superconductors require liquid nitrogen for cooling.

(C) Select and write the appropriate answer :– **4**

(a) The electronic configuration of Yb^{2+} is ____________.
(i) $[Xe]4f^{14}$ (ii) $[Xe]4f^{1}$ (iii) $[Xe]4f^{2}$

(b) The lanthanide ions which are diamagnetic are ___________.
(i) La^{3+} and Lu^{3+} (ii) La and Ce^{2+} (iii) La and Lu

(c) The lanthanide ion that is colourless is ___________.
(i) Eu^{3+} (ii) La^{3+} (iii) Sm^{2+}

(d) Uranium 235 is used as ____________.
(i) Nuclear fuel (ii) Utensils (iii) both (i) and (ii)

OR

(C) State whether the following statements are **true** or **false** :– **4**

(p) Compared to actinides, lanthanides show weaker tendency to form complexes.

(q) Uranium is the starting material for the synthesis of transuranic elements.

(r) Most of the tripositive lanthanide ions are characterized by well defined sharp line like spectra.

(s) Freshly prepared uranium is a bright, white lustrous metal which becomes brown on standing.

(D) Select and write the appropriate answer :– **3**

(a) Among the following which is an aprotic solvent.
(i) H_2O (ii) liquid SO_2 (iii) H_2SO_4

(b) BrF_3 molecule has a __________ structure.
(i) linear (ii) bent T shaped (iii) Trigonal pyramidal

(c) Among the following which is not a pseudohalide.
(i) N_3^- (ii) NO_2^- (iii) CN^-

OR

(D) State whether the following statements are **true** or **false** :– **3**

(p) The anions of pseudohalogens are called as pseudohalides.

(q) The bond strength of the interhalogens increases as the electronegativity difference between the halogens increases.

(r) Noble gases were also named as rare gases.

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