

MAY 2015

P/ID 40125/PCHE

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Time : Three hours

Maximum : 100 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions.

1. What is nephelauxetic effect?
2. How CFT attempts to explain the observed ionic radii of the first row transition metals?
3. How many microstates are theoretically possible for  $d^2$  system?
4. Why X-rays and not other regions of the electromagnetic spectrum (UV, IR, microwave) are used to study crystal coordinates?
5. How is  $Na^+/K^+$  balance maintained in a living cell?
6. What is the active centre of carbonic anhydrase? What is its function?
7. Draw the density of states (DOS) curves for metals, insulators and semiconductors.
8. Name two inorganic phosphors.

9. What are the pumps commonly used in HPLC systems?
10. What is known as thermalization in neutron activation analysis?

PART B — (4 × 20 = 80 marks)

Answer ALL questions.

11. (a) (i) To what extent CFT is successful?
- (ii) Explain Jahn-Teller distortion.
- (iii) Explain the Orgel diagram for  $d^1$ ,  $d^4$  (high spin),  $d^6$  (high spin) and  $d^9$  ions in octahedral and tetrahedral fields. (5 + 5 + 10)

Or

- (b) (i) Why are square planar complexes common in Ni and Pt?
- (ii) Determine the spin-only magnetic moment for
- (1)  $[\text{FeF}_6]^{3-}$  and
- (2)  $[\text{Fe}(\text{CN})_6]^{3-}$ .
- (iii) Construct the M.O. energy level diagram for  $[\text{Cr}(\text{CO})_6]$ . How the  $\sigma$ -bond energies alter with  $\pi$  overlap? (5 + 5 + 10)

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12. (a) (i) Describe the structural features of rubredoxin.
- (ii) Explain the biological role of copper.
- (iii) Correlate the structural features of hemoglobin to its biological functions.  
(5 + 5 + 10)

Or

- (b) (i) Write briefly on carboxy peptidase.
- (ii) Explain the nitrogen cycle briefly.
- (iii) Give a brief account of the salient features of the photosynthetic process.  
(5 + 5 + 10)
13. (a) (i) With the help of a neat sketch of the mineral perovskite, explain the coordination numbers of the constituent atoms/ions.
- (ii) Explain the band theory of solids.
- (iii) (1) Taking suitable examples explain the complementary nature of X-ray and neutron diffractions.
- (2) Write briefly on super structures of spinels. (5 + 5 + 5 + 5)

Or

- (b) Write briefly on each of the following :
- (i) Superconductors.
  - (ii) Garnets.
  - (iii) Principle and applications of electron diffraction. (5 + 5 + 10)

14. (a) (i) What is the basic principle involved in the separation of analytes by liquid chromatography?
- (ii) Write briefly on radiometric titrations.
- (iii) Describe the principle and instrumentation involved in GLC. (5 + 5 + 10)

Or

- (b) (i) Write briefly on the spectral and chemical interferences in AAS.
- (ii) Trace and explain the TG thermogram of  $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ .
- (iii) Give an account of isotopic dilution analysis. (5 + 5 + 10)