

6/CHE-350 Syllabus-2023

2026

(May-June)

FYUP : 6th Semester Examination

CHEMISTRY

(Inorganic Chemistry—II)

(CHE-350)

Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions.

1. (a) What are the drawbacks of valence bond theory and how are these defects rectified by crystal field theory? 5
- (b) Explain the splitting of d -orbitals in octahedral field. Calculate crystal field stabilizing energy (CFSE) for the following : 5
 - (i) $[\text{NiCl}_4]^{2-}$
 - (ii) $[\text{FeF}_6]^{3-}$

(2)

- (c) State and explain Jahn-Teller effect. Explain why Cu(II) complexes adopt a tetragonally distorted octahedral configuration. 5
- (d) How will you account for the non-existence of tetrahedral complexes with low-spin configuration? Give the sequence of energy level of d -orbitals in square planar crystal field. 4

OR

2. (a) Construct molecular orbital energy diagram for $[\text{Co}(\text{NH}_3)_6]^{3+}$. How does it explain the magnetic properties? 5
- (b) What are the factors which affect the magnitude of crystal field stabilising energy ($10Dq$)? 5
- (c) Explain why some metals have tendency to form mainly octahedral complexes whereas some others form both octahedral and tetrahedral complexes. 4
- (d) Draw a schematic diagram of variation in the ionic radii of divalent cations of the metals of the first transition series. Why do the ionic radii of Ca^{2+} , Mn^{2+} and Zn^{2+} show a smooth decrease whereas the ionic radii of other bivalent metal ions of the first transition series show an irregular pattern? 5

(3)

3. (a) How can you prepare ferrocene? Explain why the aromatic character of ferrocene is different from benzene. 4
- (b) Explain the nature of metal-carbon bonding in metal carbonyl complexes with the help of an illustrated schematic diagram. 5
- (c) Discuss the mechanism for the hydrogenation of alkenes using Wilkinson's catalyst. 5
- (d) Explain with a suitable example each for an oxidative addition reaction and a reductive elimination reaction. 5

OR

4. (a) Verify that the metal atoms $\text{Os}_3(\text{CO})_{12}$, $\text{Fe}_3(\text{CO})_{12}$ and the two forms of $\text{Co}_2(\text{CO})_8$ satisfy the EAN rule. 5
- (b) What are π -acid ligands? Show different modes of coordination of NO in metal nitrosyl. Explain why NO^+ is a bad donor but good acceptor while CN^- is a good donor but a bad acceptor. 5
- (c) Discuss Monsanto process for the synthesis of acetic acid using rhodium carbonyl iodide catalyst. 5
- (d) Discuss one method of preparation and structure of R_3SnX and R_2SnX_2 . 4

5. (a) What are the essential criteria for the essential elements? 4
- (b) What is dose-response curve? How do physiological effects vary with the change in concentration of essential and toxic elements? Explain with a suitable graph. 5
- (c) What are metalloporphyrins? How do the substituent group and redox properties affect the porphyrin ring in metalloporphyrins? 5
- (d) Discuss the possible mechanism involved in the hydrolysis of an amide linkage of a polypeptide using carboxypeptidase. 5

OR

6. (a) Write a short note on pH of biological fluids. 4
- (b) Why has myoglobin greater affinity for oxygen than hemoglobin and the reverse is true for CO_2 ? Explain the cooperativity effect of oxygen bonding in hemoglobin. 5
- (c) Discuss the role of platinum complexes used as anticancer agents. Write the empirical rule governing platinum complexes having chemotherapeutic potential. 5

- (d) Discuss the main features of the structure of chlorophyll and its role in photosynthesis. 5
7. (a) What is trans effect? Write different theories to explain trans effect. 4
- (b) Write the mechanism of water substitution in octahedral complexes. What is the effect of non-replaceable anionic legands? 4
- (c) Explain stepwise and overall formation constants, and their relationships. How does steric hindrance cause anomalies in stepwise formation constants? 5
- (d) Discuss in detail the mechanism of racemization of tris-chelate complexes. Why does $[\text{Co}(\text{en})_3]^{3+}$ racemise slowly but $[\text{Cr}(\text{en})_3]^{3+}$ faster? 5

OR

8. (a) Discuss by giving suitable examples the types of intermediates that are formed in $\text{S}_\text{N}1$, $\text{S}_\text{N}2$ and $\text{S}_\text{N}1(\text{CB})$ mechanisms. 5
- (b) Discuss the substitution reactions in square planar complexes with emphasis on the influence of solvent, cis-effect and ionic potential of metal ion. 4

(6)

- (c) Explain with example kinetic and thermodynamic controls in the formation of coordination compound reactions. Explain in what way the acid hydrolysis of *cis*-[Co(en)₂Cl(OH)]⁺ complex differ from that of *trans*-[Co(en)₂Cl(NO₂)]⁺ complex. 4
- (d) What are the factors affecting the reactivity of co-ordination compounds? 5

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