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ICH 401

I Semester M.Sc. Degree Examination, April 2021
(CBCS)

INDUSTRIAL CHEMISTRY
Inorganic Chemistry

Time : 3 Hours

Max. Marks : 70

Instruction : Answer **any five** questions from Part – A and **any five** questions from Part – B. Figures to the **right** indicate marks.

PART – A

Answer **any five** questions :

1. a) What is spectrochemical series ? Explain. (5×2=10)
- b) The Δ_0 values of $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$ and $[\text{Rh}(\text{NH}_3)_6]^{3+}$ are 9300, 23000 and 34000 cm^{-1} respectively. Account for this observation.
- c) Why does NO form both bent and linear metal nitrosyls ?
- d) Alkynes can function as 2e-or 4e-donors. Illustrate with an example for each.
- e) How is Frost diagram useful in predicting oxidizing property ?
- f) What is hydrometallurgy ? Mention its applications.
- g) By matrix multiplication show that $C_2 \sigma_n = 1$ and $C_n \sigma_n = S_n$.
- h) Give the Mulliken symbol for the table given below :

	E	$2C_3$	$3\sigma_v$
Γ_1	1	1	1
Γ_2	1	1	-1
Γ_3	2	-1	0

PART – B

Answer **any five full** questions :

(5×12=60)

2. a) Describe structural isomerism in coordination compounds taking suitable examples.
- b) State the postulates of Werner's coordination theory. What are its demerits ?
- c) Sketch the M.O energy level diagram of $[\text{CoF}_6]^{3-}$ and comment on its magnetic properties.

(4+4+4)

P.T.O.



3. a) What are stepwise and overall stability constants ? How are they related ? Discuss the factors which affect the stability of coordination compounds.
- b) Explain the splitting pattern of metal d-orbitals in octahedral and tetrahedral complexes. Explain why $10 Dq$ value of an octahedral complex is greater than that of tetrahedral complex. **(6+6)**
4. a) With appropriate examples, discuss the classification of organometallic compounds based on hapticity of ligand.
- b) Discuss the structure and bonding in $\text{Cr}(\eta^6 - \text{C}_6\text{H}_6)_2$.
- c) How is Zeises's salt prepared ? Explain the structure and bonding in it. **(4+4+4)**
5. a) Write briefly on preparation and synergic bonding in metal carbonyls.
- b) Give methods of preparation of ferrocene and explain its structural features.
- c) Explain the merits and exceptions of 18e-rule with suitable examples. **(4+4+4)**
6. a) Draw and explain Ellingham diagram for the formation of CO and CO_2 . Illustrate the use of C in the reduction of metal oxides.
- b) What is pyrometallurgy ? Describe the theory and its application in the extraction of Titanium.
- c) Discuss the different methods of reduction of oxide ores. **(4+5+3)**
7. a) Discuss the principle and applications of powder metallurgy.
- b) How are Latimer diagrams useful in predicting the redox chemistry of metals ?
- c) Explain the method of extraction of uranium from burnt nuclear fuels. **(4+4+4)**
8. a) Using great orthogonality theorem derive the character table for D_2 point group.
- b) Derive the transformation matrix for the axis of rotation and mention the matrix for C_2^z rotation.
- c) Assign point groups to SF_4 , $\text{B}(\text{OH})_3$ and HCN. **(5+4+3)**
9. a) Construct the character table for C_{3v} point group with proper explanation.
- b) Show that three reflections of ammonia constitute a class.
- c) Using Cartesian coordinate method find the Γ_{cart} for water molecule. **(4+4+4)**
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