

2022

5th Semester Examination

CHEMISTRY (Honours)

Paper : C 11-T

[Inorganic Chemistry-IV]

[CBCS]

Full Marks : 40

Time : Two Hours

*The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.*

Group - A

Answer any *five* questions from the following :

2×5=10

1. (a) Explain why freshly prepared hydroxide of Co^{2+} is blue but turns pink on warming.
- (b) Write the differences between 'Lanthanide and Actinide Contraction'.
- (c) ReO_4^- is colourless while MnO_4^- is violet. Explain.
- (d) What is purple of Cassius? What is its use?
- (e) Why does KCN reduce $Cu(II)$ to $Cu(I)$?
- (f) State the reasons why 'chromic acid' is used to clean laboratory glass wares.

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(2)

- (g) Calculate the ground state magnetic moment of Sm^{3+} at room temperature.
- (h) The experimental magnetic moment of $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ is different than the calculated value. - Explain.

Group - B

Answer any *four* questions from the following : $5 \times 4 = 20$

2. (a) What happen when
- (i) K_2PtCl_4 in dilute HCl solution is treated with ethylene.
- (ii) Chromyl Chloride is added to a saturated solution of potassium chloride.
- (b) What is the common oxidation state of lanthanides? 2+2+1
3. (a) Using appropriate Orgel diagram, explain the electronic transition for $[\text{Tl}(\text{H}_2\text{O})_6]^{3+}$.
- (b) Explain why Fe^{3+} and Fe^{2+} form complexes with CN^- ions but not with NH_3 . 3+2
4. (a) $[\text{K}_3\text{W}_2\text{Cl}_9]$ is diamagnetic whereas $[\text{K}_3\text{Cr}_2\text{Cl}_9]$ is strongly paramagnetic.
- (b) Comment on the observed magnetic moments (300K) of the following :
- K_3CoF_6 (5.5 B.M); K_3CuF_6 (2.8 B.M); K_3NiF_6 (0.0 B.M) 2+3

(3)

5. (a) An octahedral $\text{Ni}(\text{II})$ complex shows d-d absorption bands at 10,750, 17,500 and 28,200 cm^{-1} . Assign the bands from the Orgel diagram.
- (b) Predict the colour of $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ ion, given $\Delta = 17,400 \text{ cm}^{-1}$. 3+2
6. (a) Explain why cation exchange resins in the acid form absorb $\text{La}(\text{III})$ ions more strongly than $\text{Lu}(\text{III})$ ions from aqueous solution?
- (b) Ce^{3+} and Tb^{3+} are colourless but show strong absorption in UV region. Give proper reasons. 2+3
7. (a) Why electron transfer between $[\text{Fe}(\text{CN})_6]^{2-}$ and $[\text{Fe}(\text{CN})_6]^{4-}$ is much faster than between $[\text{Co}(\text{NH}_3)_6]^{2+}$ and $[\text{Co}(\text{NH}_3)_6]^{3+}$?
- (b) In terms of CFT, explain why all six $\text{Cu} - \text{OH}_2$ distances in $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ are not equal. 2+3

Group - C

Answer any *one* question from the following : $10 \times 1 = 10$

8. (a) Differentiate between 'crystal field strength' and 'crystal field stabilization energy'. For the $\text{Fe}(\text{II})$ ion, the mean pairing energy 'P' is found to be 23500 cm^{-1} and magnitude of Δ is 13900 cm^{-1} . Calculate the CFSE for the complex in configuration corresponding to high spin and low spin state.

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- (b) Why $\text{trans-[Co(en)}_2\text{Cl}_2\text{]}^+$ is more intensely coloured than $\text{trans-[Co(en)}_2\text{F}_2\text{]}^+$?
- (c) Explain the diamagnetic nature of the chromium (III) acetate dihydrate complex.
- (d) The electronic spectrum of Ln(III) ion gives rise to multiple sharp peaks— Explain. 4+2+2+2
9. (a) The nitrite ion forms both the complexes $[\text{Co(NH}_3)_5(\text{ONO})]^{3+}$ (O-bonded) and $[\text{Co(NH}_3)_5(\text{ONO})]^{3+}$ (N-bonded), but the latter is more stable. — Explain.
- (b) In octahedral V(III) and Cr(III) complexes, the d-d transition frequencies are of the order $\nu_1 < \nu_2 < \nu_3$. Explain why $10Dq$ correspond to ν_1 for Cr(III) but $\nu_2 - \nu_1$ for V(III) .
- (c) What is spin equilibrium? Explain with an example.
- (d) Explain why diamagnetic $[\text{NiCl}_4]^{2-}$ would be highly unstable?
- (e) Explain of inorganic optically active complex with an example. 2+2+2+2+2
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