

C 4756

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Name.....

Reg. No.....

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, JUNE 2016

(CUCSS)

Chemistry

CH 2C 06—CO-ORDINATION CHEMISTRY

(2015 Admissions)

Time : Three Hours

Maximum : 36 Weightage

Part A

Answer all questions.

Each question carries 1 weightage.

1. Prove that for the formation of $[\text{Cu}(\text{NH}_3)_4]^{2+}$ from Cu^{2+} and NH_3 , $\beta_4 = k_1 \cdot k_2 \cdot k_3 \cdot k_4$.
2. What are the geometries exhibited by 5, 6 and 7-coordinate complexes ?
3. Calculate the CSFE for a high spin octahedral complex and tetrahedral complex of cobalt (II). Which is greater ? Why ?
4. Order the following ligands in spectrochemical series and nephelauxetic series: Cl^- , H_2O , F^- , NH_3 , CN^- , CO . Justify your answer.
5. The energy of charge transfer transition in $[\text{Co}(\text{NH}_3)_5\text{X}]^{2+}$ ($\text{X} = \text{halide ion}$) decreases in the order : $\text{F}^- < \text{Cl}^- < \text{Br}^- < \text{I}^-$.
6. Explain Curie and Curie-Weiss laws.
7. Explain the terms (i) isomer shift and (ii) quadrupole splitting as applied to Mössbauer spectroscopy.
8. Describe the energy level diagram of an one electron system in a magnetic field and explain the resonance condition of EPR.
9. $\text{Cr}(\text{H}_2\text{O})_6^{2+}$ is labile and $\text{Cr}(\text{CN})_6^{2-}$ is inert. Why ?
10. The aquation reaction $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$ is faster than that of $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$. Explain.
11. Describe photo-isomerisation and photoracemization reactions with examples.
12. What are prompt and delayed reactions in photochemistry ?

(12 × 1 = 12 weightage)

Part B

Answer any eight questions.

Each question carries 2 weightage.

13. $[\text{CoF}_6]^{3-}$ contains two unpaired electrons and $[\text{Co}(\text{NH}_3)_6]^{3+}$ is diamagnetic. Explain how valence bond theory can be used to explain the magnetic behaviour of these complexes.

Turn over

14. How formation constant of a metal complex is determined by pH-metry ?
15. Among Mn_3O_4 and Fe_3O_4 which would have normal spinel structure ? Why ?
16. Explain valence bond theory and its limitations with respect to the bonding in coordination compounds.
17. What is temperature independent magnetism ?
18. What are the selection rules for electronic spectra of transition metal complexes ?
19. What is group frequency concept used in IR spectroscopy ?
20. Explain the basic principle of Mössbauer spectroscopy.
21. What is trans effect ? Using trans effect, suggest a method for preparing three isomers of $[Pt(NH_3)(Py)BrCl]$ from $[PtCl_4]^{2-}$.
22. Describe the A and D mechanisms of substitution reactions involving coordination complexes. How can you distinguish between them ?
23. Explain the mechanism of outer sphere redox reactions.
24. Write briefly on water photolysis.

(8 × 2 = 16 weightage)

Part C

Answer any two questions.

Each question carries 4 weightage.

25. How do Tanabe-Sugano diagrams differ from Orgel diagrams ? Draw Tanabe-Sugano diagram for $[V(H_2O)_6]^{3+}$ and explain the electronic transitions.
26. How EPR spectra is used to study the nature of bonding in copper (II) complexes ?
27. Describe the base hydrolysis of $[Co(NH_3)_5Cl]^{2+}$ and give experimental evidence in support of the mechanism.
28. Account for the photoreactive excited states of Cr (III) complexes. Giving suitable examples discuss the photoaquation reactions of Cr(III) complexes

(2 × 4 = 8 weightage)