

BANKIM SARDAR COLLEGE
B.Sc (Hons), Sem- IV, Paper CC-4-10
Subject - Chemistry

Group- A

(Marks 1x10=10)

1. Select the correct answers:

i) Transitions are permitted when

a) $\Delta s=0$ b) $\Delta s<0$ c) $\Delta s>0$ d) none of these

ii) The allowed transition is

a) $2s \rightarrow 2p$ b) $1s \rightarrow 2s$ c) $3s \rightarrow 3d$ d) none of these

iii) d-d transitions are

a) laporte forbidden b) laporte allowed c) redox transition d) none of these

iv) Spin magnetic moment of a single unpaired 1 e system is

a) 2.73 B.M b) 3.13B.M c) 1.73B.M d) none of these

v) Wavelength and wave number is related

a) inversely b) equally c) proportionally d) none of these

vi) The complementary colour of green is

a) blue b) yellow-green c) purple d) none of these

vii) The oxidation state of Ni in $\text{Ni}(\text{CO})_4$ is

a) 0 b) 1 c) 2 d) none of these

viii) The following order of trans effect is

ia) $\text{NH}_3 > \text{OH}^- > \text{H}_2\text{O}$ b) $\text{Br}^- > \text{I}^- > \text{NO}_2^-$ c) $\text{PH}_3 > \text{NO}_2^- > \text{Cl}^-$ d) none of these

ix) An associative mechanism reveals dependence of the rate on the

a) concentration of both ligand and the reacting complex b) concentration of reacting complex

c) concentration of the ligand only d) none of these

x) Jahn-Teller effects are found in octahedral complex of the

a) d^4 high spin b) d^5 high spin c) d^8 high spin d) none of these

Group-B

(Full marks -30)

- 2.1 Write down the laboratory preparation procedure of $[\text{Co}(\text{NH}_3)_4\text{CO}_3]\text{NO}_3 \cdot 5\text{H}_2\text{O}$ 10
- 2.2 Complete the reaction below 3x2
- a) i) $\text{K}_2\text{Cr}_2\text{O}_7 + 7\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O} \rightarrow \dots\dots\dots$
- ii) $2\text{Fe}(\text{OH})_3 + 3\text{H}_2\text{C}_2\text{O}_4 + 3\text{K}_2\text{C}_2\text{O}_4 \rightarrow \dots\dots\dots$
- (Write the name of the products in each case)
- b) What happens when Oxalic acid solution is added to the acidic solution of Mohr' salt , mixture boiled and cooled? Give reaction.. 2+2
- 2.3 a) What are the reagents required to prepare $\text{Fe}(\text{acac})_3$ 2
- b) Write down the relevant formation reaction of $\text{Fe}(\text{acac})_3$ 4
- c) How much amount of the product Tris - ethylene diamine nickel (II) chloride is expected to form according to the reaction if you take 6 gm of $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$. 4

Group –C (F.M=50) (10X2 +5X6)

Q.3. Answer any ten questions each of which carries 2 marks :-

- i). Explain trans effect with specific example.

- ii) $[\text{Co}(\text{NH}_3)_6]^{3+}$ ion has a maximum absorbance at a wavelength of 437nm. Express this value of Δ for this ion in cm^{-1}

- iii) Explain why a solution of CuCl_2 in aqueous HCl is deep greenish blue whereas similar aqueous HCl solution of CuCl is colourless.
- iv) The magnetic moment of $\text{K}_3[\text{CoF}_6]$ is 4.2 B.M and that of $\text{K}_3[\text{CuF}_6]$ is 2.8 B.M-Explain.
- v) Explain the origin of colour in HgS (Red)
- vi) Why are compounds of s and p block elements not coloured.
- vii) Cu^{2+} ions are coloured and paramagnetic while Zn^{2+} ions are colourless and diamagnetic. Explain
- viii) What is the expression of magnetic moments of lanthanides by taking into consideration spin as well as orbital contribution?

- ix) The ligand group orbitals capable of π interaction in an octahedral complex fall into four symmetry categories. What are those?

- x). Define superexchange with an example.
- xi). How many number of unpaired electrons are present in $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
- xii). Explain briefly the principle of separation of lanthanides by ion exchange method.

(Answer any 6 questions, each carries 5 marks.)

4.

- a) Solution of $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ ions are pale blue green whereas that of CrO_4^{2-} is intense yellow. Characterise the origins of the transition and explain the relative intensities. (3)
- b) What do you mean by 'dynamic Jahn– Teller distortion" (2)

5.

- a) Draw a molecular orbital energy diagram for an octahedral complex such as $[\text{Co}(\text{NH}_3)_6]^{3+}$ 3 involving sigma bonding only.
- b) Give the electronic configuration of the above complex ion and what is its magnetic property?(2)

6.

- a) Compare the chemistry of Zn and Cd with that of Hg. (3)
- b) Actinides form oxo cations but lanthanides don't? (2)

7.

- a) What do you mean by lanthanide contraction? (3)
- b) The third ionization energy for Eu and Yb are comparatively higher than the other lanthanides. Explain. (2)

8.

- a) Of the two Co^{2+} and Cr^{3+} one is highly prone to form octahedral but the other forms tetrahedral complexes. Give reason in favour of judgement. (3)
- b) HgCl_2 is colourless but HgI_2 is intensely coloured. Explain. (2)

9.

- a) Predict the geometry of the compound on the basis of magnetic moment value:-
 $[\text{Mn}(\text{CN})_6]^{3-}$: 2.8 BM (3)
- b) Calculate CFSE of the complex ion $[\text{Co}(\text{NO}_2)_6]^{4-}$ (2)

10.

- a) Arrange the ligands H_2O , NH_3 , NO_2^- and Cl^- in order of increasing trans effect. (2)
- b) Design two steps synthesis of the cis isomers of $(\text{Pt}(\text{NH}_3)(\text{NO}_2)_2]$ starting from $\text{K}_2[\text{PtCl}_4]$ (3)

11. a) What do you mean by labile complexes? (2)

- b) Which d^n configurations do generally behave as labile complexes and why? (3)