

2022

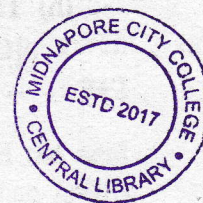
5th Semester Examination

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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(g) Calculate the ground state magnetic moment of  $Sm^{3+}$  at room temperature.

(h) The experimental magnetic moment of  $[Co(H_2O)_6]^{2+}$  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  $[Ti(H_2O)_6]^{3+}$ .

(b) Explain why  $Fe^{3+}$  and  $Fe^{2+}$  form complexes with  $CN^-$  ions but not with  $NH_3$ .  $3+2$

4. (a)  $[K_3W_2Cl_9]$  is diamagnetic whereas  $[K_3Cr_2Cl_9]$  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)  $2+3$

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5. (a) An octahedral  $Ni(II)$  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  $[Cr(H_2O)_6]^{3+}$  ion, given  $\Delta = 17,400 cm^{-1}$ .  $3+2$

6. (a) Explain why cation exchange resins in the acid form absorb  $La(III)$  ions more strongly than  $Lu(III)$  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  $[Fe(CN)_6]^{3-}$  and  $[Fe(CN)_6]^{4-}$  is much faster than between  $[Co(NH_3)_6]^{2+}$  and  $[Co(NH_3)_6]^{3+}$ ?

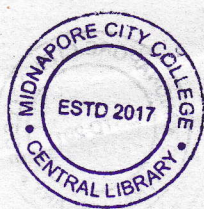
(b) In terms of CFT, explain why all six  $Cu - OH_2$  distances in  $[Cu(H_2O)_6]^{2+}$  are not equal.  $2+3$

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  $Fe(II)$  ion, the mean pairing energy 'P' is found to be 23500  $cm^{-1}$  and magnitude of  $\Delta$  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  $\text{Ln(III)}$  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  $\text{V(III)}$  and  $\text{Cr(III)}$  complexes, the d-d transition frequencies are of the order  $\nu_1 < \nu_2 < \nu_3$ . Explain why  $10Dq$  correspond to  $\nu_1$  for  $\text{Cr(III)}$  but  $\nu_2 - \nu_1$  for  $\text{V(III)}$ .
- (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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