

3 SEM TDC CHM M 1 (N/O)

2 0 1 8

(November)

CHEMISTRY

(Major)

Course : 301

(Inorganic Chemistry—I)

(New Course)

Full Marks : 48

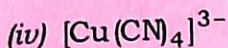
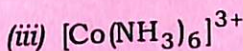
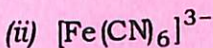
Pass Marks : 14

Time : 2 hours

*The figures in the margin indicate full marks
for the questions*

1. Select the correct answer : 1×5=5

(a) The complex ion which does not obey EAN rule is



(2)

(b) In the complex $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$, the metal ion has

(i) d^1 -configuration

(ii) d^2 -configuration

(iii) d^3 -configuration

(iv) d^5 -configuration

(c) The free ion ground term for Ni^{2+} ion is

(i) 4F

(ii) 2D

(iii) 3F

(iv) 3D

(d) Which of the following has the highest lability?

(i) SF_6

(ii) $[\text{PF}_6]^-$

(iii) $[\text{SiF}_6]^{2-}$

(iv) $[\text{AlF}_6]^{3-}$

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(Continued

(3)

(e) The number of 4f-electron in lanthanum is

(i) 0

(ii) 1

(iii) 2

(iv) 5

2. Answer the following questions : $2 \times 8 = 16$

(a) What is spectrochemical series? Write one application of the spectrochemical series. $1 + 1 = 2$

(b) Find out the values of L and S for $3P$, $1D$, $3F$ and $2G$. $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 2$

(c) Write the name and formula of each of the following types of ligand : $1 \times 2 = 2$

(i) A bidentate ligand with one acidic and one neutral donor

(ii) A tridentate ligand with three neutral donors

(d) Write the IUPAC names of the following compounds : $1 + 1 = 2$

(i) $\text{Na}_3[\text{Co}(\text{CN})_5\text{NO}]$

(ii) $[(\text{NH}_3)_5\text{Co} - \text{NH}_2 - \text{Co}(\text{NH}_3)_5]\text{Cl}_3$

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(Turn Over)

(e) Write the formulas of the following complexes : 1+1=2

(i) Dichloro-bis-(triphenyl phosphine) palladium (II)

(ii) Pentaamine (dinitrogen) ruthenium (II) chloride

(f) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ is labile but $[\text{Fe}(\text{CN})_6]^{4-}$ is inert. Explain. 2

(g) Explain inert and labile complexes with examples. 2

(h) What are the problems in the separation of lanthanides from one another? 2

3. Answer any three questions : 3×3=9

(a) What do you mean by crystal field stabilization energy (CFSE)? Calculate CFSE for each of the following octahedral systems :

(i) d^5 -high spin

(ii) d^6 -low spin

1+2=3

(b) Discuss the geometrical isomerism of $[\text{Ma}_2\text{X}_2]^{n\pm}$ and $[\text{MA}_4\text{X}_2]^{n\pm}$ type complexes. 1½+1½=3

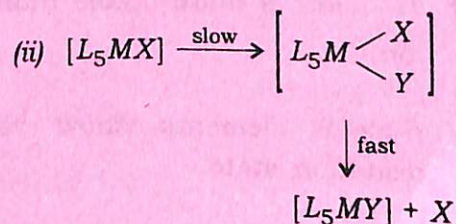
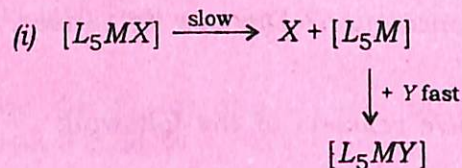
(c) $\text{Ni}(\text{CO})_4$ is tetrahedral while $[\text{Ni}(\text{CN})_4]^{2-}$ ion is square planar. Explain in the light of valence bond theory. 1½+1½=3

(d) Draw and explain the Orgel diagram for a d^1 -system. 3

(e) What are inner complexes? Give the characteristics of inner complexes. 1+2=3

4. (a) Write a note on acid hydrolysis of cobalt (III) compounds with suitable example. 3

(b) Explain the mechanisms of reactions in the following : 2+2=4



5. (a) State and explain the following with suitable examples : 2+2=4

(i) Laporte selection rule

(ii) Spin selection rule

- (b) The complex ion $[\text{Co}(\text{NH}_3)_6]^{3+}$ is octahedral and diamagnetic and $[\text{CoF}_6]^{3-}$ is also octahedral but paramagnetic. How does valence bond theory account for this observation?

2+2=4

6. Answer either (a) or (b) : 3

(a) What do you understand by lanthanide contraction? Discuss its causes. 1+2=3

(b) Give reasons of the following :

(i) Ti^{4+} ion is more stable than Ti^{3+} ion.

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(ii) d-block elements show variable oxidation state.

1 1/2