

Total No. of Printed Pages—6

307

3 SEM TDC CHM M 1

2013

( November )

43

20

CHEMISTRY

( Major )

Course : 301

( Inorganic Chemistry—I )

Full Marks : 48

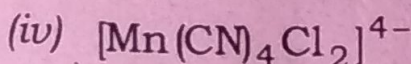
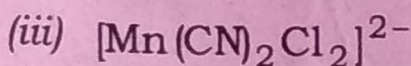
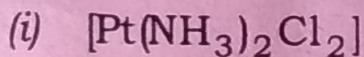
Pass Marks : 19

Time : 3 hours

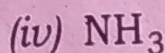
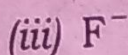
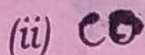
The figures in the margin indicate full marks for the questions

1. Select the correct answer : 1×5=5

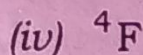
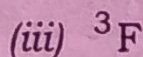
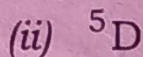
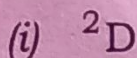
(a) Which of the following compounds does not exhibit geometrical isomerism?



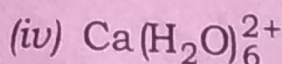
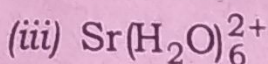
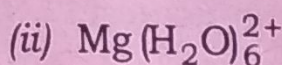
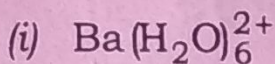
(b) Which of the following ligands has the lowest  $\Delta_0$  value?



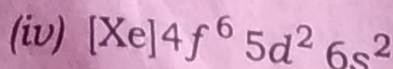
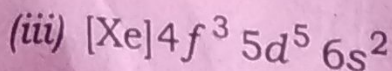
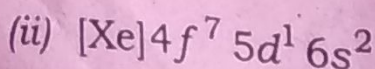
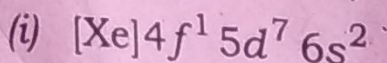
(c) The spectroscopic free ion ground term for  $d^1$  is



(d) Which of the following is least labile?



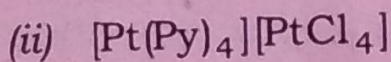
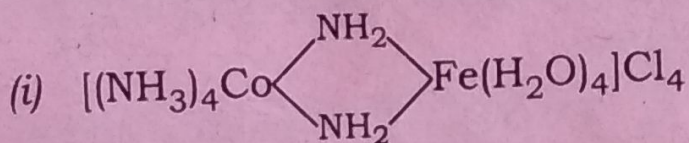
(e) The electronic configuration of gadolinium ( $Z = 64$ ) is



2. Answer the following questions : 2×5=10

(a) Write the name and structure of one macrocyclic ligand.

(b) Give the IUPAC name of the following :



(c) Define term symbol with example.

(d) What do you mean by concerted path of a reaction? Give an example.

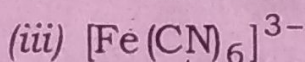
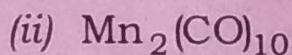
(e) Explain the causes of lanthanide contraction.

3. (a) Write the formula of the following compounds : 1×2=2

(i) Diamidotetraamminecobalt(III) methoxide

(ii) Tetraaminechloronitrito-N-cobalt(III) chloride

(b) What is Sidgwick effective atomic number rule? Determine the effective atomic number of the following compounds : 1+3=4



4. Answer any three questions :

5×3=15

(a) What are high-spin and low-spin complexes? Predict the spin state of the following and write down the configurations corresponding to these states :

(i)  $[\text{Co}(\text{NH}_3)_6]^{3+}$ , pairing energy  
=  $21000 \text{ cm}^{-1}$  and  $\Delta = 23000 \text{ cm}^{-1}$

(ii)  $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ , pairing energy  
=  $23500 \text{ cm}^{-1}$  and  $\Delta = 13400 \text{ cm}^{-1}$

1+2+2=5

(b) (i) Discuss the optical isomerism of metal coordination compounds of the types  $[\text{M}(\text{A}-\text{A})_2\text{ab}]^{n\pm}$  and  $[\text{M}(\text{A}-\text{A})_3]^{n\pm}$ .

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(ii) What do you mean by nephelauxetic effect?

2

(c) Calculate the number of unpaired electrons ( $n$ ), spin only magnetic moments  $\mu_s$  and CFSE in terms of  $\Delta_0$  for the complex ion  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ . What are the limitations of crystal field theory?

3+2=5

(d) Explain the structure of the following compounds with the help of valence bond theory :

(i) Hexaaquoiron(III) ion

(ii) Hexafluorocobaltate(III) ion

$2\frac{1}{2} \times 2 = 5$

(e) Draw the splitting patterns for octahedral, tetrahedral and square planar complexes in a crystal field. Explain why  $\Delta_0 > \Delta_t$ . 3+2=5

5. Answer either (a) or (b) :

(a) (i) What is base hydrolysis? Discuss the mechanism of base hydrolysis of the complex  $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$ . 5

(ii) Write the structure of the intermediate that are formed in  $\text{S}_\text{N}1$  and  $\text{S}_\text{N}2$  mechanism of  $[\text{MA}_5\text{X}]^{n+}$ . 2

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

(b) (i) Explain the associative and dissociative mechanism in ligand substitution reaction. 4

(ii) Discuss briefly what type of mechanism for acid hydrolysis of octahedral complexes is suggested by—

(1) charge on the substrate;

(2) strength of metal-leaving group bond. 4

(iii) What is meant by  $\text{S}_\text{N}1\text{CB}$  mechanism? 1

6. Answer any one question :

(a) Actinides exhibit large variety of oxidation states than lanthanides. Explain.

(b) Give three points of difference between lanthanides and actinides.

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