

This question paper contains 4+2 printed pages]

Your Roll No.

1259

B.Sc. (Hons.)/III

A

CHEMISTRY—Paper XIII

(Inorganic Chemistry—III)

Time : 3 Hours

Maximum Marks : 38

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt six questions in all.

Q. No. 1 carries 8 marks.

All other carry 6 marks each.

1. Explain with reasons any four of the following observations :

(a) Lanthanides show sharp line like bands in the absorption spectra while transition elements show broad bands.

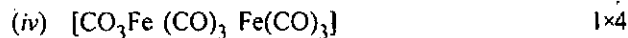
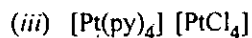
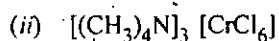
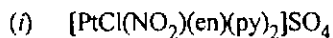
(b) 4d and 5d elements usually form low spin complexes.

(c) The basic strength of lanthanide oxides, La_2O_3 , decreases with increase in oxidation number.

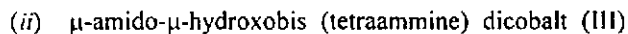
P.T.O.

- (d) CrO_3 is strongly oxidizing but WO_3 is not.
- (e) Knowledge of magnetic moment is often necessary for a correct assignment of the electronic configuration according to valence bond theory. 2×4

2. (a) Name the following complexes according to IUPAC system of nomenclature :



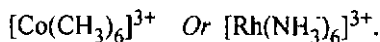
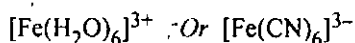
- (b) Write the formulae of the following complexes :



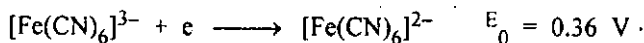
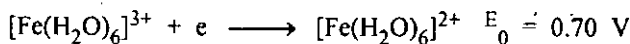
ion

1×2

3. (a) The magnetic moments of $[\text{MnBr}_4]^{2-}$ and $[\text{Mn}(\text{CN})_6]^{3-}$ are 5.9 and 2.8 BM respectively. Using valence bond theory, assign geometries to these complexes. 3
- (b) Which complex in each of the following pairs will have greater crystal field splitting and why? 2



- (c) From the following data, predict in which case it is easier to oxidize Fe(II) to Fe(III): 1



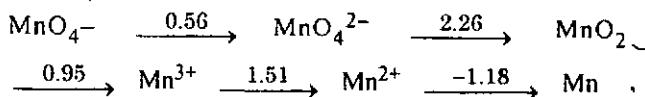
4. (a) For $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$, the mean pairing energy, P, is found to be 23500 cm^{-1} and Δ_0 value is 13900 cm^{-1} .
- (i) Calculate the CFSE for this complex corresponding to high-spin and low-spin states.
- (ii) Which state is more stable? 4
- (b) Is FeFe_3O_4 a normal or inverted spinel? Explain. 2

5. Giving reasons, account for the following :

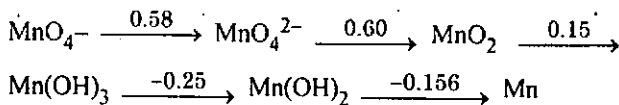
- (a) The magnitude of the crystal field splitting, Δ_p , in tetrahedral complexes is considerably less than that in octahedral fields.
- (b) Ethylene diammine forms a more stable complex than its tetramethyl derivative.
- (c) Actinides show a greater tendency to form complexes than lanthanides. 3×2

6. (a) Use the Latimer diagrams below to answer the following questions :

Acid :



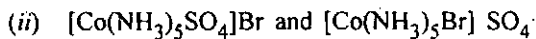
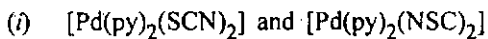
Alkali :



- (i) Find out the oxidation states in acidic medium which undergo disproportionation.
- (ii) In which medium, acidic or alkaline, is Mn (III) more stable ?

(b) In the crystal structure of CuF_2 , Cu^{2+} ion is surrounded by six F^- with four F^- at a distance of 193 pm while two F^- at 227 pm. Explain giving reasons. 2×3

7. (a) Name the type of isomerism in each of the following pairs :



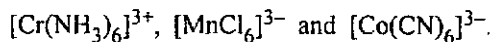
(b) Draw the structures of all possible isomers of $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ ion.

(c) Giving chemical equations, state what happens when :

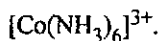
(i) Hydrogen peroxide is added to acidified potassium dichromate solution forming a blue colour.

(ii) Potassium permanganate is added to cold concentrated sulphuric acid. 3×2

8. (a) Which of the following complexes are expected to be labile according to valence bond theory :



- (b) Draw the MO energy diagram for the complex ion



- (c) $[\text{FeF}_6]^{3-}$ ion is colourless although iron (III) is a d^5 ion. Explain. 3×2