

2016

CHEMISTRY

Paper : 203

INORGANIC CHEMISTRY

(Old Course)

Full Marks : 80

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Answer any five of the following questions: 2X5=10
- (a) Why high coordination numbers are common for transition metals occurring on the left of the periodic table?
- (b) How many isomers do we expect for a square planer complex of formula MX_2L_2 ? Give symmetry point group (s) of the probable isomers (s).
- (c) Predict the coordination geometries of $[\text{NiBr}_4]^{2-}$ and $[\text{AuCl}_4]^-$. Justify your answer.
- (d) Write the IUPAC name of
- (i) $[\text{Co}(\text{en})_2\text{Cl}_2]^+$
- (ii) $\text{K}_2[\text{OsCl}_5(\text{NH}_3)]$
- (e) What are the two different structures possible for a metal complex with coordination number eight?

(f) Describe the two methods to identify the complex formation.

2. Answer any four questions: $5 \times 4 = 20$

(a) Define crystal field stabilization energy. Calculate its value for the following systems

(i) d^5 low spin octahedral (iii) d^5 high spin octahedral.

(ii) d^4 tetrahedral (iv) d^6 tetrahedral

(b) Define diagram showing splitting in square planer complexes and tetrahedral complexes.

(c) The magnetic moment of $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ is 5.92 B.M.

and that of $[\text{Fe}(\text{H}_2\text{O})_6]^{3-}$ is 1.73 B.M. Explain on the basis of CFT.

(d) Why hexaaquairon (II) is nearly colourless, tris (bipyridyl) iron (II) is red in colour. Explain this difference in the observed colours of the two examples of iron (II)

(e) Draw diagram showing splitting of terms p^2 configuration.

3. Answer any one question: 1×10

(a) Discuss the structure and bonding of $\text{Re}_2\text{Cl}_8^{2-}$.

(b) What are the major structural types in compound with M-M multiple bonds? Explain the bonding in any one of them.

4. Answer any two questions: $2 \times 5 = 10$

(a) Explain the structure and bonding of metal-nitrosyl complexes.

(b) Find the structure and draw the structure of the following from the total electron counts-

(i) $[\text{Os}_8(\text{CO})_{22}]^{2-}$, (ii) $\text{H}_2\text{Os}_6(\text{CO})_{18}$,

(iii) $[\text{Os}_4\text{Ni}(\text{CO})_{12}]^-$

(c) How can you prepare ferrocene? The aromatic character of ferrocene is different from benzene. Explain.

5. Answer any four question: $4 \times 5 = 20$

(a) Define *trans* effect. Illustrate *trans* effect using reaction

$[\text{PtCl}_4]^{2-}$ and $[\text{Pt}(\text{NH}_3)_4]^{2+}$

(b) How does the nature of central metal ion as well as light affect the stability of the complexes?

(c) Find the relation between stepwise and overall stability constants.

(d) Is the reaction $[\text{Co}(\text{NH}_3)_6]^{3+} + [\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ likely to proceed by an inner sphere or outer sphere mechanism? Explain your answer.

(e) Explain what you mean by labile and inert complexes. Why the high spin d^4 complex ion $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ is labile but the low spin d^4 complex ion $[\text{Cr}(\text{NH}_3)_6]^{4+}$ is inert?

6. Answer all questions:

(a) Name the d-block element that occurs in lanthanoids bearing minerals.

- (b) What are the oxidation states in the earlier actinides Ac-Pu and later actinides Am-Lr? 2
- (c) Describe the basic character of hydroxides of lanthanides elements. 2
- (d) Describe the extraction of thorium from monazite sands. 5

Or

Give a brief description of separation of lanthanides by ion exchange method.

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