Roll No. .....

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(2034)

UG (CBCS) IIIrd Year Annual Examination

2991

B.Sc. CHEMISTRY

(Chemistry of Transition and Inner Transition Elements, Coordination Chemistry, Organometallics, Acids and Bases)

(DSE–2B)

Paper : CHEM 304 TH

Time : 3 Hours] **[Maximum Marks : 50**

Note :– Attempt *five* questions in all, selecting *one* question from each Section. All questions carry equal marks. Section–E is compulsory.

Section–A

1. (a) Calculate in Bohr magneton the expected magnetic moment for the following ions (Spin only magnetic moment) :

(i) Fe^{3+}

(ii) Ni^{2+}

(iii) Cu^{+}.

(b) What is meant by Latimer diagram ? How does it predict weather a given species can disproportionate or not ?

(c) Explain :

(i) Salts of Zn, Cd and Hg are white

(ii) Transition elements exhibit good catalytic properties. 3,3,4

2. (a) Write notes on the following :

(i) Basic strength of lanthanides hydroxides

(ii) Stability of oxidation states of lanthanides.

(b) Discuss oxidation states and paramagnetism in case of actinides.

(c) What are problems in separation of lanthanides from one another ? 4,3,3

Section–B

3. (a) Why square planar complexes do not show optical isomerism whereas tetrahedral complexes do not display geometrical isomerism ? Explain.

(b) Write a note on effective atomic number concept giving examples. What are various exceptions to this rule ?

(c) What is EDTA ? Write the structure of metal-EDTA complex. Why are metal-EDTA complexes highly stable ? 3,3,4

4. (a) Which of the following species obey effective atomic number rule and why ?

(i) $Co(CO)_4$

(ii) $H_3CMn(CO)_5$

(iii) $Fe(CO)_3C_4H_6$

(iv) $Fe(\pi\text{-}C_5H_5)_2$

(b) Give the classification of organometallic compounds on the basis of nature of bonding.

(c) Discuss structure of the following :

(i) $Fe_2(CO)_9$

(ii) $[PtCl_3(C_2H_4)]^-$ ion. 4,3,3

Section–C

5. (a) Discuss crystal field splitting in square planar complexes.

(b) State and explain Jahn-Teller effect.

(c) Define crystal field stabilization energy (CFSE). Calculate its value for d^5 low and high spin octahedral complexes. 3,4,3

6. (a) Discuss the structure of the following complexes on the basis of crystal field theory :

(i) $[Co(NH_3)_6]^{3+}$

(ii) CoF_6^{3-}

(iii) $[Fe(H_2O)_6]^{2+}$

(iv) $[Fe(CN)_6]^{4-}$.

(b) $CuSO_4.5H_2O$ is coloured compound while $CuSO_4$ (anhydrous) is white. Explain on the basis of CFT.

(c) Give the number of unpaired electron in a strong and weak octahedral field for :

(i) Cr^{3+}

(ii) Fe^{3+}

(iii) Co^{2+}. 4,3,3

Section–D

7. (a) What are levelling and differentiating solvents ? Discuss *one* example in each case.

(b) Explain the following :

(i) BF_3 behaves as a weaker Lewis acid than BI_3.

(ii) R_2NH is a stronger base than R_3N ($R = CH_3$).

(c) What is Lux-Flood concept of acids and bases ? Give example. 3,4,3

8. (a) What is HSAB principle ? How can it explain the stability of complexes ?

(b) Compare basic strength of the following :

(i) Pyridine and 2-methyl pyridine

(ii) $(CH_3)_3N$ and NH_3.

(c) π-Bonding and electronegativity can be used to explain the hardness and softness of acids and bases. Explain. 3,4,3

Section–E

(Compulsory Question)

9. (i) The structure of $Ni(CO)_4$ is ..... .

(ii) All actinides have an oxidation state of +3 like lanthanides. (True/False)

(iii) The element next to samarium in the periodic table is ..... .

(iv) The *d*-orbital involved in dsp^2 hybridization is dz^2. (True/False)

(v) The ligand NO is named as ..... .

(vi) CO group is called π-acceptor ligand.

(True/False)

(vii) The colour of the crystals of ferrocene is ..... .

(viii) $[Fe(CN)_6]^{4-}$ is a diamagnetic complex.

(True/False)

(ix) If Δ_0 is greater than P, the complex will be ..... spin complex.

(x) Conjugate acid of NH_2^- is ..... .

1×10=10