Question Paper Code : 5727

M.Sc. (Semester-II) Examination, 2018

CHEMISTRY

[First Paper]

(Inorganic Chemistry)

[CH-201]

Time : Three Hours] **[Maximum Marks : 70**

Note : Answer **five** questions in all. Question **no. 1** is **compulsory**. Besides this, attempt **one** question from each Unit.

1. Write short notes on the following : [3x10=30]

    (a) Derive relationship between stepwise and overall formation constants of metal complexes.

    (b) Discuss the structures of

    $Ru_6 Cl (CO)_{17}$ and $Cu_2 (RCOO)_4 \cdot 2H_2O$

    (c) Explain lability and inertness of octahedral complexes on the basis of VBT or CFT.

(d)   What is the difference between acid hydrolysis of Cis-$[Co(en)_2 ClOH]^+$ and of Trans- $[Co(en)_2 Cl NO_2]^+$ complex ions.

(e)   Write a note on "Frank-Condon Principle" in $\bar{e}$-transfer between metal complexes.

(f)   Giving example, discuss Wades's rule for predicting structures of metal clusters.

(g)   Give reaction between diethylberyllium with TMEDA tetramethyl hydrazine and tetramethyl tetrazine.

(h)   Why $[M (CH_2 Si\ Me_3)_n]$ is more stable than $[M (CH_2 C\ Me_3)_n]$

(i)   Cr(III) octahedral organometallic complexes are more stable than the similar Mn(III) or V(III) complexes.

(j)   How many fundamental vibrational frequencies are expected to be observed in IR absorption spectra of H_2O molecule. Show all IR active vibrational modes for H_2O molecule diagrametically.
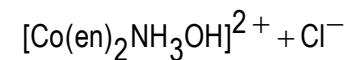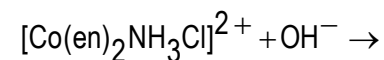
UNIT-I

2.   (a)   How does nature of metal cation affects the stability of metal complexes.   [5]

(b) Giving example explain reason for the stability of chelate complexes tabing special reference to their thermodynamic origin. [5]

3. (a) Discuss low nuclearity and high nuclearity in carbonyl cluster compounds. [4]

(b) Classify the structural type of following compounds and draw their structures : [6]

(i) 1, 7 $C_2B_{10}H_{12}$

(ii) B_5H_{11}

(iii) $[Fe(C_2B_9H_{11})_2]^{2-}$

UNIT-II

4. (a) Discuss outer sphere or inner sphere mechanism of $\bar{e}$ transfer reaction. [5]

(b) Why $\bar{e}$ transfer reaction in $[CO(NH_3)_6]^{2+}$ - $[CO(NH_3)_6]^{3+}$ system is slower than in $[Fe(CN)_6]^{3-}$- $[Fe(CN)_6]^{4-}$ system. [5]

5. (a) Discuss in detail mechanism for the following reaction [7]

$$[Co(en)_2NH_3Cl]^{2+} + OH^- \rightarrow$$

$$[Co(en)_2NH_3OH]^{2+} + Cl^-$$

(b) Why the rate of above reaction decreases on addition of H_2O_2. [3]

UNIT-III

6. (a) Discuss nature of bonding in metal carbonyls. [5]

(b) Giving reason arrange following in order of increasing C-O bond order : [3]

$[Ni(CO)_4]$, $[Co(CO)_4]^-$, $[Fe(CO)_4]^{2-}$

(c) Give reason for the stability of square planar organometallic complexes of Ni (II), although these complexes do not obey $18\bar{e}$ rule. [2]

7. (a) Discuss the rate of reactivity of organoberyllium compounds with N, O, S and P donors. [4]

(b) M-C bond cleavage reaction in Transition metal alkyls. [3]

(c) Why σ-bonded organometallic compounds of transition metals are less stable compared to their main group analogue. [3]

UNIT-IV

8. (a) Discuss microwave spectroscopy and give selection rule for rotational spectra of a molecule [5]

(b) First line corresponding to J=O appears at 3.84235 cm^{-1} in the rotational spectrum of $^{12}C^{16}O$ molecule (C-12 O-16). Calculate its moment of inertia and bond length. [5]

(h= 6.626 x 10^{-27} erg/sec, N=6.022x10^{23})

9. (a) Discuss application of IR spectra in elucidating the structure and properties of polyatomic molecules. [5]

(b) Explain why in IR spectrum of CO_2 molecule, only two absorption bonds at 2349 cm^{-1} and 667cm^{-1} respectvely are observed. [5]

OR

Discuss the factors which affect the band position and intensities in i.r. region.

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