'समानो मन्त्रः समितिः समानी'

UNIVERSITY OF NORTH BENGAL

B.Sc. Honours Part-III Examination, 2022

CHEMISTRY

PAPER-VIII

Time Allotted: 4 Hours | Full Marks: 65

The figures in the margin indicate full marks.
All symbols are of usual significance.

Answer Question No. 1 and any *five* from the rest

1. Answer the following:

   (a) The V-C bond length in $[V(CO)_6]^-$ and $[V(CO)_6]$ are 193 pm and 200 pm respectively. Why? 2

   (b) Square planar d^8-paramagnetic complexes are rare — Comment on. 2

   (c) Explain why NH_4Cl acts as a strong acid in liq. NH_3. 2

   (d) True octahedral complexes of Cu(II) does not exist. — Explain. 2

   (e) The electronic absorption spectra of tri-positive lanthanide ions give rise to multiple sharp peaks — Explain. 3

   (f) Mn^{2+} is faintly coloured whereas solution of MnO_4^- is intensely coloured — Explain. 2

   (g) Give examples of mono-hapto and penta-hapto cyclopentadienyl complexes (one each only). 2

2. (a) Starting from Schrödinger wave, set up the wave equation for the hydrogen atom and deduce an expression for its energy. 5

   (b) Distinguish between an orbit and an orbital. 2

   (c) Draw the radial probability distribution curves for 3*s* and 3*p* orbitals. 3

3. (a) Write down the electrophilic substitution reaction in ferrocene. 5

   (b) How are *cis*- and *trans*- form of $[Pt(NH_3)_2Cl_2]$ identified? 3

   (c) $[Co(en)_3]^{3+}$ is thermodynamically stable than $[Co(NH_3)_6]^{3+}$ — Explain. 2

4. (a) Name the metal ion(s) present in the active site of the following biomolecules: 2
   (i) Carbonic anhydrase (ii) Nitrogenase

   (b) Show graphically the dose response range of an essential element as its concentration increased from deficiency to excess — Briefly elucidate the 3

curve.

(c) What changes occur in the heme group of hemoglobin on going from deoxy to oxyhemoglobin? 3

(d) What happens when SO_3 is added to liq. NH_3? 2

5. (a) Fe_3O_4 is an inverted spinel — Explain. 3

(b) How many isomers are possible for the following complexes: 2

(i) $[Co(en)_3]^{3+}$ (ii) $[Co(en)_2Cl_2]^{+}$

(c) Indicate the splitting of *d*-orbitals caused by John-Teller effect in d^9-system. 3

(d) Explain the paramagnetism of molecular oxygen by MO theory. 2

6. (a) What happen when alkali metals are dissolved in liquid NH_3? 2

(b) Why do lanthanides exhibit common oxidation state of +3? 2

(c) Discuss the number of unpaired electron and CFSE for $[Cr(NH_3)_6]^{3+}$. 2

(d) Write down the difference between lanthanides and actinides. 3

(e) What is Bohr effect? 1

7. (a) What is Zeise's salt? Discuss briefly about the structure and bonding in Zeise's salt. 1+1+3

(b) Mention one important source of the following metal: 2

(i) Titanium (ii) Platinum

(c) Account for the carbonyl stretching frequency (γ_{CO} in cm^{-1}) of the following: 3

$[V(CO)_6]^-$	$[Cr(CO)_6]$	$[Mn(CO)_6]^+$
1860	2000	2090

8. Write short notes on: (any ***four***) $2\frac{1}{2} \times 4 = 10$

(a) 18 electron rule

(b) Wilkinson's Catalyst

(c) Wacker Process

(d) Trans effect

(e) Structure of ferrocene

(f) Different methods used for the detection of complex formation.

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