[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 8351 **C** **Roll No.....**

Unique Paper Code : 217561

Name of the Paper : CHPT-505 : CHEMISTRY V

Name of the Course : B.Sc. (Programme) Physical Science / Life Science

Semester : V

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **3** questions from Section A and **3** questions from Section B.
3. Sections A and B are to be attempted in separate portions of the same answer sheet.
4. Please indicate the section you are attempting at the appropriate place and do not intermix the sections. The questions should be numbered in accordance to the number in the question paper.
5. Calculators and log tables may be used.

SECTION A

Attempt **any 3** questions.

1. (a) Give brief reasons for **any 3** of the following :

   (i) The geometry of a four coordinate Ni(II) complex depends on the ligand. Explain using VBT.

   (ii) An aqueous solution of a Cu(II) salt is blue while that of a Zn(II) salt is colourless.

   (iii) Transition metals are less reactive than Group1 and Group2 metals.

   (iv) The absorption spectrum of a lanthanide is sharp and not influenced by ligands.

P.T.O.

(v) Compounds of transition metals in higher oxidation states are more covalent than those in lower oxidation states.

(b) $[CoCl(NH_3)_5]^{2+}$ undergoes ligand substitution reaction when treated with $NaNO_2$ to give 2 products A and B depending on the experimental conditions. A and B are isomeric pentaammine ions. Draw their structures and indicate the isomerism. (9,3½)

2. (a) An octahedral complex of Cu(II) is generally distorted and two bonds are longer than the other four. Explain and draw the splitting diagram. What is the driving force towards this distortion ?

(b) Give the IUPAC names of any **3** of the following :

(i) $K_3[V(S_2O_3)_2]$

(ii) $[Cr(NH_3)_6][Cu(CN)_5]$

(iii) $Na[Mn(CO)_5]$

(iv) $[(en)_2Co(O_2)Co(en)_2](OH)_4$

(c) The magnetic moments of $[Fe(H_2O)_6]^{3+}$ and $[Fe(CN)_6]^{3-}$ are 5.9 BM and 1.8 BM respectively. Explain on basis of VBT. Indicate which of these is inner orbital and which is outer orbital. (5,4½,3)

3. (a) Predict the appropriate choice and give brief reasons :

(i) Greater number of oxidation states	Fe, Mn
(ii) Bidentate ligand	$C_2O_4^{2-}$, SCN^-
(iii) Higher magnetic moment	Cr(III), Cu(II)
(iv) Good reducing agent	Ce(IV), Sm(II)

(b) Write the formulae of **any 3** of the following :

(i) Caesium tetrafluorooxochromate (III)

(ii) Pentaamminesulphatorhodium(III) perchlorate

(iii) Zinc tetrabromoiodate(III)

(iv) Tetraaquapalladium(II) amminetrichloropalladate(II)

(c) How can you chemically distinguish between the following ? State the isomerism displayed.

$[Co(en)_2I_2]Cl$ and $[Co(en)_2ICl]I$ (6,4½,2)

4. (a) Calculate the CFSE in terms of Δ_t of a d^7 metal ion placed in a tetrahedral field. Draw the splitting diagram and predict the magnetic behaviour.

(b) A and B have the molecular formula $[Cr(en)_2Cl_2]^+$. A is not resolvable into enantiomers but B is. Draw the structures of A and B and explain briefly.

(c) Why is potassium dichromate intensely coloured ?

(d) Construct the Latimer diagram of copper from the following data :

$Cu^{2+} + e^- \longrightarrow Cu^+$ $E^0 = 0.52V$

$Cu^+ + e^- \longrightarrow Cu$ $E^0 = 0.15V$

Find the E^0 value for the reduction of Cu^{2+} to Cu. Explain by showing necessary calculations why Cu^+ has a tendency to disproportionate.

OR

(d) Write short notes on **any 2** of the following :

(i) Lanthanide contraction and 2 consequences

(ii) Inner and outer orbital complexes

(iii) Catalytic properties of 3d metals and their compounds (4½,2,1,5)

SECTION B

Attempt **any 3** questions.

($c = 3 \times 10^8 ms^{-1}$, $h = 6.62 \times 10^{-34}$ J s^{-1}, mass of electron $= 9.11 \times 10^{-31}$ kg)

5. (a) Attempt **any 3** parts :

(i) State which of the following wave functions are acceptable over the range $x = 0$ to 2π.

(a) tan x (b) cosec x (c) cos x + sin x

(ii) Normalize the wave function $\psi = A \sin(n\pi x/a)$ for a particle in a one dimensional box of length 'a'.

P.T.O.

(iii) Do the operators 'x' and d/dx commute with each other ?

(iv) What is molar extinction coefficient ?

(v) State the laws of photochemistry.

(b) Calculate the wavelength of a ball of mass 100 g moving with a velocity of 10^3 cms^{-1}. (9,3½)

6. (a) Solve the Schrodinger wave equation for a particle of mass 'm' moving in a one dimensional box.

(b) Explain with suitable examples low quantum yield and high quantum yield reactions.

(c) Why does an aqueous solution of potassium dichromate not follow Lambert – Beer's law ? Will the law be followed if this is acidified with dilute sulphuric acid ? Explain. (4½,4,4)

7. (a) What are the selection rules for a molecule to be rotationally active and vibrationally active ?

(b) Which of the following molecules are rotationally active and why (any 3) ?
(i) CH_4 (ii) CS_2 (iii) SO_2 (iv) CH_3Cl (v) HCN

(c) Calculate the frequency of oscillation of a ball with one end fixed through a spring to a wall.

OR

(c) On what factors does the vibrational frequency of a molecule depend ? (4,4½,4)

8. (a) Write short notes on **any 3** of the following :

(i) Bathochromic shift

(ii) Chromophores

(iii) Chemiluminiscence

(iv) Photoelectric cells

(b) What are the differences between fluorescence and phosphorescence ? (9,3½)