NEW / OLD

2015

M.Sc. Part–I Examination

CHEMISTRY

PAPER—III

(Inorganic Chemistry)

The figures in the right-hand margin indicate full marks.

Candidates are required to give that answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

New Syllabus

Answer questions of Group—A and B and C.

Answer *five* questions taking at least *two* from Group—A and B.

Full Marks : 100   **Time : 4 Hours**

Old Syllabus

Answer questions of Group—A and B.

Answer *five* questions taking at least *two* from each group.

Full Marks : 75   **Time : 3 Hours**

Group—A

(New & Old Syllabus)

1. (a) Draw the active site structure of Cytochrome–C. Explain structure and function of ferritin and transferrin. 2+3

   (b) Explain the formation of hematin and discuss how this can be prevented? 4

   (c) What is Bohr effect? How it helps in functioning of hemoglobin? 4

   (d) What is the difference between oxidation and oxygenation? 2

2. (a) State and explain the statistical and non-statistical factors which effect the stability of a complex. 5

   (b) How will you determine the composition of a complex by slope ratio method? 5

   (c) Explain D-mechanism with a suitable example. 5

3. (a) Explain Irving-William series. 3

   (b) Discuss Chelate and Macrocyclic effect. 4

   (c) A Ni^{2+} complex shows observation bands at 10750, 17500 and 28200 cm^{-1}. Assign the bands from Orgel diagram and point the transitions responsible for the colouration of the complex. Calculate the 10 Dq value from the above data in KK unit. 3+3+2

4. (a) What do you mean by 'trans effect'? How a pair of geometrical isomers of $[Pt(NH_3)_2Cl_2]$ can be distinguished using trans effect? 5

   (b) What is Clathrate? Is it a true chemical compound? Why He and Ne do not form any clathrate compound? 3

   (c) The C–C bond distance (1·37Å) in $K^+[PtCl_3(C_2H_4)]$ is slightly longer than in the free ethylene (1·34Å) — explain. 4

   (d) Comment on the bonding of $(SN)_x$ in an one dimensional polymer. 3

5. (a) Show that no two class of a group can share a common element. 6

(b) The order of a group is integral multiple of the order of its sub-group — justify. 4

(c) Find the point group for the following : 5

(i) Cis-[Pt(NH$_3$)$_2$Cl$_2$] ;

(ii) Toluene ;

(iii) [Co(gly)$_3$] ;

(iv) Ethane (Staggered) ;

(v) H$_3$BO$_3$.

Group—B

(New & Old Syllabus)

6. (a) What do you mean by 'Abelian group' & 'Cyclic group'? Give one example in each case. 3

(b) Construct Group Multiplication table for ammonia molecule. 5

(c) State GOT. 2

(d) Find the matrix representation of all the symmetry elements present in H$_2$O molecule, when three Cartesian co-ordinates serve as base vectors. 5

7. (a) State the essential conditions for a collection of elements to form a mathematical group. 4

(b) Find all the irreducible representations for C$_3$V point group and assign their Mullican symbols. For this purpose use the corollaries that are obtained from GOT. 6
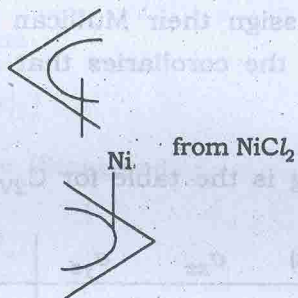
(c) The following is the table for C$_{2V}$ point group :

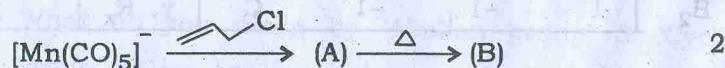| C$_{2V}$	E	C$_2$(z)	σ_{xz}	σ_{yz}		
A$_1$	1	1	1	1	z	x^2, y^2, z^2
A$_2$	1	1	A	−1	R$_z$	xy
B$_1$	1	B	1	−1	x, R$_y$	xz
B$_2$	1	−1	−1	C	y, R$_x$	yz

Find the value of A, B, C. 5

8. Write notes on : 5×3

(a) Wilkinson's Catalyst ;

(b) Vascas' Complex ;

(c) Tungsten bronze ;
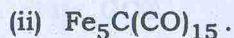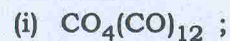
(d) Ruthenium red ;

(e) Interhalogens.

9. (a) How will you synthesis the following :   2
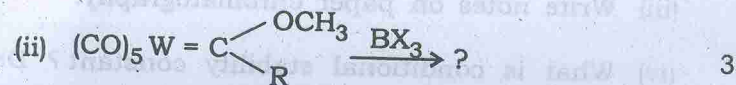

from $NiCl_2$

(b) Predict the product :   [A] & [B]

$$[Mn(CO)_5]^- \xrightarrow{} (A) \xrightarrow{\Delta} (B)$$ 2

(c) Determine the structure of the following using Wade's model :   2×2

(i) $CO_4(CO)_{12}$;

(ii) $Fe_5C(CO)_{15}$.

(d) In chromium dioxide CrO_3, Cr is in +6 oxidation state and isoelectronic with Ca^{2+}. Despite this CaO is white but CrO_3 has a deep red color. — Explain.   3

(e) Write the following product :   2×2

(i) $W(CO)_6 \xrightarrow[\text{(ii) } CH_2N_2]{\text{(i) R Li}}$?

(ii) $(CO)_5 W = C\begin{smallmatrix} OCH_3 \\ \\ R \end{smallmatrix} \xrightarrow{BX_3}$?   3
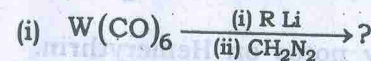
10. (a) How will you explain the diamagnetic property of $[Re_2Cl_8]^{2-}$?   3

(b) Calculate the Styx number of B_5H_9 and comment on the probable structure.   4

(c) In $[Cu(H_2O)_6]^{2+}$, two water molecules undergo exchange with bulk solvent molecule much more rapidly than the other four — Explain.   3

(d) Comment on the π-bond of phosphonitric compounds.   2

(e) Explain Metal Carbon bonding in Fisher and Shrock Carbene complexes.   3

Group—C

(*New Syllabus*)

Answer any *five* questions.

11. (i) Write down the active site structure of carbonic anhydrase. Hence show the reaction mechanism involved for the conversion of CO_2. 5

(ii) Write explanatory notes on Hemerythrin. 5

(iii) Write notes on paper chromatography. 5

(iv) What is conditional stability constant ? Derive an expression for this. 5

(v) What is BNCT ? Give two examples of 1st generation BNCT agent. 5

(vi) What do you mean by 'Stereochemical non rigidity' ? — Explain with example. Why NMR spectroscopy is applied to detect such behaviour ? What is agostic interaction ? 5

(vii) Discuss the active site structure and function of the enzyme increase. Draw the active site structure of the enzyme Carboxypeptidase. 5

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