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PG/IS/CEM-103/13

M.Sc 1st Semester Examination, 2013

CHEMISTRY

( *Inorganic* )

PAPER – CEM- 103

*Full Marks : 40*

*Time : 2 hours*

Answer any **five** questions taking  
at least **two** from each Group

*The figures in the right hand margin indicate marks*

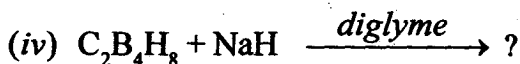
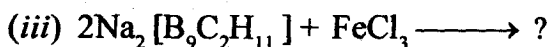
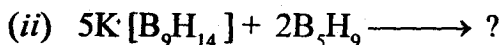
GROUP – A

1. (a) Explain why a crystal can not have  $C_5$  axis of symmetry. 3  
(b) For the  $H_2O$  molecule, show that each of the symmetry operations belongs to a different class. 3

( *Turn Over* )

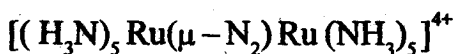
- (c) Write the "Hermann-Mauguin" notation for the following point groups : 2  
 $C_{2v}, C_{3v}$
2. (a) "With equilateral triangle only three regular polyhedrons are possible." – Explain. 2
- (b) Using "Great Orthogonality Theorem." verify that the vectors whose components are the characters of two different irreducible representations are orthogonal. 3
- (c) Derive the matrix form of  $C_n(x)$  symmetry element. 3
3. (a) Find out the point group of the following species : 2
- (i)  $B_2H_6$
- (ii) Ferrocene (in staggered form)
- (b) Classify the following species as Closo, Nido, Archno, Hypo  
 $[B_{12}H_{12}]^{2-}, B_5H_{11}, C_8H_8, B_6H_{19}$  2

(c) Complete the following Reactions : 2



(d) What do you mean by metalloboranes and metallocarboranes? Cite examples. 2

4. (a) How ruthenium-dinitrogen complex,



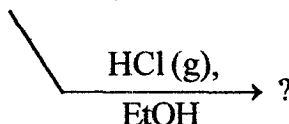
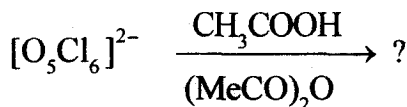
is synthesized? Write down its structure. 1 + 1

(b) How  $[Ru_2OCl_{10}]^{4-}$  is synthesized from  $RuO_4$ ?

Explain the diamagnetism of the complex

(with MO diagram). 1 + 3

(c) Complete the following reactions –



2

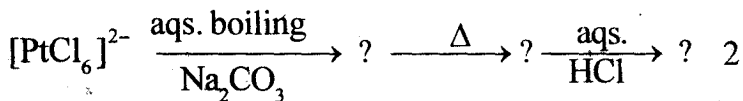
GROUP – B

5. (a) Write down deoxy- and oxy- forms of hemerythrin. 2
- (b) Explain the oxygen binding mechanism of hemerythrin. 2
- (c) Schematically present the iron storage in ferritin. 2
- (d) Write down the chemical reactions occur during ferritin mineralization. 2
6. (a) What do you mean by 'ionophores'? Write down the classification of ionophores. 1 + 2

- (b) What is the overall reaction of 'Na<sup>+</sup> - K<sup>+</sup> pump'? 1
- (c) Write down the active site structure of 'Carbonic anhydrase'. Schematically present the functional mechanism of 'carbonic anhydrase'. What is the role of 'Zinc'-metal ion in this enzyme. 1 + 2 + 1
7. (a) Calculate the STYX number of the following compound and comment on their structure (I)B<sub>3</sub>H<sub>3</sub><sup>+</sup>. 2
- (b) What do you mean by BNCT (Boron Neutron Capture Therapy)? Give the nuclear reaction involving in this therapy. Give at least two examples of first generation and second generation BNCT agents. 2 + 2
- (c) "trans-[OsO<sub>2</sub>(OH)<sub>4</sub>]<sup>2-</sup> is diamagnetic." - Explain. 2
8. (a) Draw the MO diagram of octahedral [Mo(CO)<sub>6</sub>] complex (indicating both σ and π interaction with proper symmetry). 3

( 6 )

(b) Complete the following reaction -



(c) What do you mean by 'Platinum blue' ? 1

(d) Calculate the  $\mu_{\text{eff}}$  value of  $[\text{Ni}(\text{en})_3]^{2+}$  complex.  
(Given,  $\Delta_{\text{oct}} = 11,500 \text{ cm}^{-1}$ ;  $\lambda = 315 \text{ cm}^{-1}$ ) 2