

AQ - 823

First Semester M. Sc. (Part - I) Examination

**CHEMISTRY**

Paper - I

(Inorganic Chemistry)

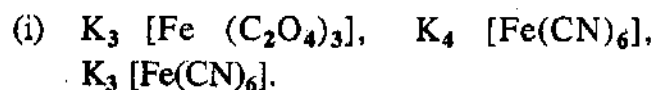
P. Pages : 5

Time : Three Hours]

[Max. Marks : 80

Note : All questions are compulsory and carry equal marks.

- (b) Arrange the following complexes in the increasing order of their stability. Give reasons.



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- (c) How will you determine the composition and stability constant of complex by Job's method ?

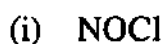
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**OR**

- (p) Explain the term stability constant. Derive the relationship between overall stability constant ( $\beta_n$ ) and stepwise stability constant ( $K_1$   $k_2$  ---  $k_n$ ).

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- (q) What is solvent system concept ? Identify the following compounds as acids or bases along with their solvents.

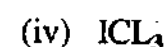
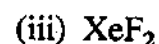


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- (r) Both  $[Cd(CH_3NH_2)_4]^{2+}$  and  $[Cd(en)_2]^{2+}$  are formed from  $[Cd(H_2O)_4]^{2+}$ . But why the latter is far more stable than the former ? Explain, giving the reactions.

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1. (a) Explain the shapes of following molecules on the basis of VSEPR theory.

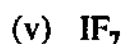
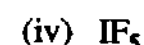
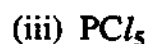
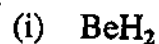


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- (b) Give Coulson's M.O. diagram of CO molecule and explain its bond order.

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- (c) Mention the type of hybridisation and shape of the following molecules.



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OR

- (p) What are the characteristics of  $sp^3d$  hybridisation ? Explain with suitable example. 6

- (q) Give M. O. diagram of  $C_2H_4$  molecule and explain its bond order. 5

- (r) Explain the shapes and bond angles in  $H_2O$  and  $H_2S$  molecules on the basis of VSEPR theory. 5

2. (a) What is Jahn-Teller theorem ? Explain the distortion in  $[Cu(NH_3)_4(H_2O)_2]^{++}$  ion. 6
- (b) What is high spin-low spin cross over ? Explain with suitable example. 5
- (c) What are spinels ? How CFSE helps to site preference in spinel structures ? 5

OR

- (p) Explain whether distortion would occur in the following ions in their high spin and low spin state. Give reasons.

(i)  $d^4$  (ii)  $d^5$

(iii)  $d^6$  6

- (q) Give three conditions responsible for orbital magnetic moment. Does octahedral high spin complex of  $Fe^{2+}$  show orbital contribution ? Explain. 5

- (r) Explain in brief limitations of crystal field theory. 5

3. (a) What are cluso and nido boranes ? Explain the topological structures of Diborane and Tetraborane with styx scheme. 6
- (b) Explain the factors affecting the formation of metal clusters. Give the structure of  $Rh_6(CO)_{16}$ . 5
- (c) Give preparation of Isopolyacids of Mo and W. What are their applications ? 5

OR

- (p) Discuss structure and bonding in Diborane. Explain its hydrogen bridge structure. 6
- (q) With the help of Wade's rules, calculate total electron count and number of skeletal electron pairs in the following carbonyl clusters.

(i)  $Os_5(CO)_{16}$  and (ii)  $Co_6(CO)_{16}$ . 5

- (r) What are metal carbides ? Give their classification and industrial applications. 5

4. (a) Give at least two examples of substances acting as acids and bases in liq.  $N_2O_4$ . Explain the following reactions in it.

(i) Reaction with metals (ii) Solvolysis 6

5. (a) Explain the following terms :—

(i) Identity

(ii) Centre of symmetry.

(iii) Axis of symmetry.

6

(b) Identify the symmetry point groups in the following molecules :—

(i)  $C_2H_4$

(ii)  $NO_2$

(iii)  $[Ni(CN)_4]^{2-}$

(iv)  $NH_3$

(v)  $CH_4$

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(c) What are proper and improper axis of symmetry ? Explain, giving example on each.

5

OR

(p) Give the rules that are to be followed for a complete set of operations to form a group.

6

(q) Explain the reducible and irreducible representations.

5

(r) Derive character table for  $C_{3v}$  point group.

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