

FINAL B. SC. EXAMINATION, 2018

(2nd Semester)

CHEMISTRY (HONOURS)**PAPER - XVII****INORGANIC CHEMISTRY**

Time : Two hours

Full Marks : 50

- b) Substitution of CO in metal carbonyls generally passes through dissociative path rather than associative one-explain.
- c) In $[\text{Fe}_3(\text{CO})_{12}]$ there are two bridging $\mu_2\text{-CO}$ while in $[\text{Ru}_3(\text{CO})_{12}]$ and $[\text{Os}_3(\text{CO})_{12}]$ there is no $\mu_2\text{-CO}$ - justify.
- d) Give an example (i) where CO coordinates through both C and O atoms; (ii) NO as $\mu_4\text{-NO}$.
- e) Explain the bonding of singlet carbene in Fischer type carbene complexes and triplet carbene in Schrock type carbene complexes.
- f) Explain the observation : $10Dq$ follows the order $[\text{V}(\text{CO})_6]^- < [\text{Cr}(\text{CO})_6] < [\text{Mn}(\text{CO})_6]^+$ 2×4

1. a) Write a brief account on *any two* of the following :
- i) Crown-ether complexes.
 - ii) Structure and function of carbonic anhydrase.
 - iii) Comparison of coordination chemistry of silicon and germanium.
- b) Comment on the structure of *any two* of the following :
- i) Grignard reagent
 - ii) Pb(II)-EDTA complex.
 - iii) tris-oxalato antimony(III) ($2\frac{1}{2}+2\frac{1}{2}$)+($1\frac{1}{2}+1\frac{1}{2}$)
2. a) Describe the role of alkyl trihydroxy silanes in silicone formation.
- b) Show with proper equations, the role of benzoyl peroxide in the preparation of silicone rubbers. What are the advantages of these rubbers over natural rubber ?
- c) How would you prepare N, N, N trimethyl borazine ? Show the reaction(s) involved.

[Turn over

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- d) What happens when borazine is heated to 340°C ?
- e) What happens when $[\text{NPCl}_2]_3$ reacts with NH_3 (NH_3 present as excess reactant)? Why is a similar product not obtained in case of H_2O (i.e. when H_2O is present as excess reactant)? $1\frac{1}{2}+2\frac{1}{2}+1\frac{1}{2}+1+2$
3. a) Interpret the effect of cone angle in cyclopentadienyl complexes with the variation of steric bulk of Cp ligand.
- b) Mention the factors affecting the C-C bond length in M-alkene complexes.
- c) Give a brief account on the structure and bonding in metal-diene complexes.
- d) Give two examples of piano-stools cyclopentadienyl complexes.
- e) Give two examples of palladium catalyzed C-C cross coupling reactions. $1+2+3+1+1\frac{1}{2}$
4. a) i) Distinguish between essential metals and beneficial metals within the family of bio-metals.
- ii) Si, Al, Ti and Zr are abundant in earth's crust but these are not accepted in the biological process. Explain the fact.

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- b) How does nature protect Fe(II) in haemoglobin from its irreversible oxidation in the presence of O_2 ? Justify the answer by considering the properties of a suitable model compound.
- c) Write down briefly about the following two diseases : *Minamata* and *Itai-itai byo*.
- d) Explain the magnetic properties of oxy-Mb using molecular orbital theory. $(1+1)+(1+1)+(1+1)+2\frac{1}{2}$
5. a) Lanthanoides in their 3+ states can be separated by cation exchange resin. Explain each step with the relevant equilibrium phenomena.
- b) Why Lanthanoides in their 3+ states form less stable coordination compound in comparison to 3d metal ions in their 3+ states?
- c) U (III) may be oxidized with water, Np (III) requires air but Pu(III) needs Cl_2 gas for its oxidation. Why? $4+2+2\frac{1}{2}$
6. Answer **any four** of the following :
- a) In the adduct $\text{H}_3\text{B} \leftarrow \text{CO}$, ν_{CO} stretching frequency is higher than the free CO. How would you justify the observation?

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