

M.Sc. CHEMISTRY
Third Semester
INORGANIC CHEMISTRY-III
(MSC - 302)

Duration: 3Hrs.

Full Marks: 70

Part-A (Objective) =20
Part-B (Descriptive) =50

(PART-B: Descriptive)

Duration: 2 hrs. 40 mins.

Marks: 50

Answer any four from Question no. 2 to 7
Question no. 1 is compulsory.

1. Describe the preparation, reactivity and bonding in Metal Carbene complexes.
(3+3+4=10)
2. (a) Explain the interaction between the heme and dioxygen.
(b) Write the mechanism of oxygen transport and co-operativity.
(5×2=10)
3. (a) Explain the structure of $(LiCH_3)_4$.
(b) Explain the preparation and use of Organo-silicon compounds.
(5×2=10)
4. (a) Explain the Toxicity of organo-mercuric compounds.
(b) Write briefly about hydroformylation reaction with $RhH(CO)(PPh_3)_3$.
(5×2=10)
5. What is vitamin B_{12} ? Draw the structure of 5'- deoxyadenosylcobamin and give an account of its structural aspects.
(1+5+4=10)
6. (a) What are the theories of trans effect?
(b) Explain outer sphere and inner sphere mechanism using examples.
(c) Write the mechanism for acid hydrolysis of octahedral complexes.
(3+4+3=10)

7. (a) Explain Rutile structure and perovskite structure with examples.
- (b) A compound formed by element A and B has a cubic structure in which A atoms are at the corners of the cube and B atoms are the face centres. Derive the formula of the compound.
- (c) CsCl has cubic structure. Its density is 3.99g/cm^3 . What is the distance between Cs^+ and Cl^- ions? (At. Mass of Cs= 133)
- (d) What are the electrical properties of solids?

(4+2+2+2=10)

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Duration: 20 minutes

Marks – 20

(PART A - Objective Type)

I. Choose the correct answer:

1×20=20

- Out of the following cyclopentadiene compounds, oxidation occurs very easily in case of –
(a) $(\eta^5\text{-C}_5\text{H}_5)_2\text{Fe}$ (b) $(\eta^5\text{-C}_5\text{H}_5)_2\text{Co}$
(c) $(\eta^5\text{-C}_5\text{H}_5)_2\text{Ru}$ (d) $(\eta^5\text{-C}_5\text{H}_5)_2\text{Co}^+$
- Out of the following compounds which compound has only σ - bonded ligands?
(a) $\text{W}(\text{CH}_3)_6$ (b) $(\eta^5\text{-C}_5\text{H}_5)_2\text{Fe}$
(c) $\text{K}[\text{PtCl}_3(\text{C}_2\text{H}_4)]$ (d) $(\text{CO})_5\text{WC}(\text{R})(\text{OMe})$
- The correct order of following carbonyl compounds according to decreasing ν_{CO} stretching frequency is-
(a) $\text{Mn}(\text{CO})_6^+ > \text{Cr}(\text{CO})_6 > \text{Crdien}(\text{CO})_3 > \text{V}(\text{CO})_6^-$
(b) $\text{Crdien}(\text{CO})_3 > \text{Cr}(\text{CO})_6 > \text{V}(\text{CO})_6^- > \text{Mn}(\text{CO})_6^+$
(c) $\text{Cr}(\text{CO})_6 > \text{V}(\text{CO})_6^- > \text{Mn}(\text{CO})_6^+ > \text{Crdien}(\text{CO})_3$
(d) $\text{V}(\text{CO})_6^- > \text{Mn}(\text{CO})_6^+ > \text{Crdien}(\text{CO})_3 > \text{Cr}(\text{CO})_6$
- The replacement of Co by Rh metal catalysts resulted in development of hydrogenation process at-
(a) lower temperature and higher pressure (b) lower temperature and lower pressure
(c) higher temperature and higher pressure (d) higher temperature and lower pressure
- The release of alkane in β -Hydrogen transfer reaction is –
(a) An elimination process (b) A reductive process
(c) A Reductive elimination process (d) An Oxidative elimination process
- Multicenter bonds are formed by nontransition elements with organic ligands when-
(a) valence shell of M is less than half filled and the M^{n+} cation is strongly polarizing.
(b) valence shell of M is less than half filled and the M^{n+} cation is strongly non-polarizing.
(c) valence shell of M is more than half filled and the M^{n+} cation is strongly polarizing.
(d) valence shell of M is more than half filled and the M^{n+} cation is strongly non- polarizing.
- The organometallic compounds of nontransition compounds are hydrolysed by water and facilitated by
(a) the presence of empty orbitals on the metal and the non-polarity of M-C bond.
(b) the absence of empty orbitals on the metal and the non-polarity of M-C bond.
(c) the absence of empty orbitals on the metal and the polarity of M-C bond.
(d) the presence of empty orbitals on the metal and the polarity of M-C bond.

8. Tick the correct statement.
- Alkylboranes are not hydrolysed by water but are pyrophoric.
 - Alkylboranes are hydrolysed by water and are pyrophoric.
 - Alkylboranes are not hydrolysed by water and are not pyrophoric.
 - Alkylboranes are hydrolysed by water and are not pyrophoric.
9. In Hemethyryn the uptake of O_2 is accompanied by
- One electron process
 - Two electron process
 - Three electron process
 - Four electron process
10. In Hemocyanins the O_2 is in the
- O_2^+ state
 - O_2^- state
 - O_2^{2-} state
 - None of the above
11. The difference in the corrin ring and the porphyrin ring is the missing of one –
- $= C =$ group
 - $\equiv C -$ group
 - $= CH -$ group
 - $= CH_2$ group
12. For a typical cell, the concentration ratio for $[Na^+]_{outside} / [Na^+]_{inside}$ is
- 10
 - 15
 - 25
 - 35
13. When the group $Q = -CHO$, $R = -CH_3$ then the heme in cytochrome is
- Heme 'a'
 - Heme 'b'
 - Heme 'c'
 - None of the above
14. The co-ordination number of the Ba^{2+} ions in barium fluorides is 8. The co ordination number of the fluoride ion is
- 8
 - 4
 - 1
 - 2
15. The ionic radius is smaller than atomic radius for
- Neon
 - Nitrogen
 - Sodium
 - Sulfure
16. The number of corner-shared oxygen atoms present in each tetrahedron of $[Si_3O_9]^{6-}$
- 0
 - 1
 - 2
 - 4
17. Zinc selenide crystallizes in zinc blende structure. The number of Zn and Se present in its unit cell are
- 8
 - 6
 - 4
 - 12
18. Calcium fluoride crystallizes in flurite structure. The coordination number for the cation and anion respectively
- 6,6
 - 6,4
 - 4,6
 - 8,4
19. The correct decreasing order of relative trans effect
- $C_2H_4 > NO_2 > Br^- > Cl^-$
 - $NO_2 > C_2H_4 > Br^- > Cl^-$
 - $C_2H_4 > NO_2 > Cl^- > Br^-$
 - None of these
20. In the CsCl structure, the number of ions in a unit cell is
- 2
 - 4
 - 6
 - 8
