



9. Ziegler-Natta catalyst consists of
- TiCl<sub>4</sub>
  - Al(C<sub>2</sub>H<sub>5</sub>)<sub>3</sub>
  - TiCl<sub>4</sub> in hydrocarbon solvent in presence of Al(C<sub>2</sub>H<sub>5</sub>)<sub>3</sub>
  - none of the above
10. In Sharpless epoxidation, allyl alcohol or a derivative is
- oxidised with tertiary hydro peroxide in presence of a Chiral ligand
  - alcohol in presence of Zeigler-Natta catalyst
  - Propyl alcohol is treated with Rhodium- alloy
  - none of the above
11. Total number of electrons and protons present in the biological nitrogen cycle respectively
- 8, 8
  - 6, 6
  - 7, 9
  - 6, 10
12. Which of the following diseases may occur due to deficiency of copper
- Menkes disease
  - Wilson's disease
  - Arthritis disease
  - None of the above
13. Biominerals can be either infinite
- Metallic bond or ionic
  - Hydrogen bond or ionic
  - Covalent networks or ionic
  - None of the above
14. A specific interaction region on the RNA is known as the
- Fron regulatory protein
  - Fron-responsive element
  - Transferrin
  - Ferritin
15. Which of the following statement is not true about phtosubstitution reaction ?
- Ligand exchange between primary and secondary coordination sphere happens
- Coordination number of metal ion remains same
  - Oxidation state of the metal ion remains same
  - None of the above
16. "Light must be absorbed by a chemical substance in order for a photochemical reaction to take place" stated by
- Grotthuss-Draper law
  - Stark-Einstein law
  - Beer-Lambert Law
  - None of the above
17.  $cis-[CoCl_2(en)_2]^+ \xrightleftharpoons{h\nu} trans-[CoCl_2(en)_2]^+$  is example of
- Isomerisation reaction
  - Racimization reaction
  - Substitution reaction
  - Dissociation reaction
18. Transition metal complexes results in photochemical reaction due to
- Electronic transition from t<sub>2g</sub> to e<sub>g</sub> orbital
  - Electronic transition from ligand to metal orbital
  - Electronic transition from metal to ligand orbital
  - All of the above



19.  $[\text{Co}(\text{NH}_3)_5\text{SCN}]^+$  shows isomerization reaction due to
- d-d transition
  - LMCT
  - MLCT
  - None of the above
20. Nitrogenase contains which of the following proteins
- MoFe-protein
  - Fe-protein
  - Both (a) and (b)
  - None of the above

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**( Descriptive )**

Time : 2 hrs. 30 mins.

Marks : 50

*[ Answer question no.1 & any four (4) from the rest ]*

- Define photochemical reaction. Give examples where photochemistry plays crucial roles in nature. 3+3+2+2  
=10
  - Discuss the mechanism of metal hydrides as hydrogen storage materials.
  - Give a brief account of the activation of small molecules by Coordination.
  - Define the terms biomineralization and demineralization with examples
- Classify photochemical reactions with a flowchart. 5+5=10
  - Explain in detail, using the concept of inert and labile complexes, why  $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$  and  $[\text{Co}(\text{CN})_6]^{3-}$  complexes are generally inert under thermal conditions but reactive in the presence of light.
- Draw molecular orbital diagram for a metal complex and show d-d and charge transfer transitions with arrows. 4+3+3  
=10
  - Give examples of photosubstitution, photoisomerization, photorecemicization reactions.
  - Calculate the mass percentage of hydrogen in  $\text{NaBH}_4$  and state whether or not this material might be used as hydrogen storage?

4. a. Egyptian blue is pale blue and the spinel  $\text{CoAl}_2\text{O}_4$  is an intense blue-green. Explain the differences. 3+5+2  
=10
- b. Describe the properties of an ideal photocatalyst for water splitting.
- c. Why is not  $\text{BeH}_2$  Considered to be suitable hydrogen storage materials?
5. a. "Substitution of Mg by small amounts of Li and Al into  $\text{MgH}_2$  improves its hydrogen-storage properties." Write a formula for this lithium aluminium magnesium dihydride and explain how Li and Al would be incorporated into the structure. 4+3+3  
=10
- b. How hydrogen and carbon monoxide can be converted to hydrocarbon and water by reaction over iron or cobalt catalysts by Fisher-Trops Process.
- c. Give a short account of the Asymmetric oxidation where appropriate Chiral ligands can be used in conjunction with d-metal catalyst to introduce chirality.
6. a. Give the general mechanism of cobalt carbonyl catalysed hydro formylation reaction as proposed by Heek and Breslow. 5+5=10
- b. Give an account of the Rhodium based Monsanto Process for highly selective generation of ethanoic acid.
7. a. Discuss the characteristics of Wilkinson's Catalyst for generation of alkene. 2+4+4  
=10
- b. What are the enzymes involves in the nitrogen cycle? Explain mechanism of the nitrogen cycle.
- c. Write the active site of hydrogenases and explain the mechanism of the hydrogen cycle.
8. a. Write the hierarchy of control mechanisms of the formation of biominerals. 5+5=10
- b. Explain how Proteins that sense Cu and Zn levels in the cells.

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