REV-01
BSC/13/18

2023/06

SET A

B.Sc. CHEMISTRY
SIXTH SEMESTER
INORGANIC CHEMISTRY IV
BSC – 601
[USE OMR FOR OBJECTIVE PART]

Duration: 3 hrs. **Full Marks: 70**

(Objective)

Time: 30 min. **Marks: 20**

Choose the correct answer from the following: ***1X20=20***

1. For separation of cations, what is/are the group reagent/s for group III qualitative analysis?
   a. HCl and H_2S
   b. NH_4OH and H_2S
   c. Dilute HCl
   d. NH_4OH and NH_4Cl

2. In qualitative analysis, the principle of precipitation is based on:
   a. The formation of a colored complex between the analyte and a reagent
   b. The selective precipitation of an analyte as an insoluble solid
   c. The measurement of the absorbance of light by the analyte
   d. The conversion of the analyte into a gaseous state

3. The common ion effect is based on which principle?
   a. Le Chatelier's principle
   b. Boyle's law
   c. Avogadro's principle
   d. Hess's law

4. The Wilkinson catalyst, commonly used in homogeneous catalysis, consists of which metal?
   a. Palladium (II)
   b. Platinum (IV)
   c. Rhodium (I)
   d. None of the above

5. Hydroformylation is a process that involves the reaction of an olefin with which of the compounds to produce aldehydes?
   a. H_2O_2
   b. CO
   c. HCl
   d. None of the above

6. The Wacker process is used for the conversion of which'compound into an aldehyde or a ketone?
   a. Alkanes
   b. Alkenes
   c. Alcohols
   d. Aromatics

7. What will happen if the ion concentration exceeds the solubility product?
   a. The compound will dissolve further until equilibrium is reached.
   b. The compound will dissociate into ions.
   c. A precipitate will form.
   d. The compound will remain dissolved in the solution.

8. According to pi bonding theory
   a. It form a metal ligand pi bond
   b. It form dπ-dπ or dπ-pπ bond
   c. Both (a) and (b)
   d. None of the above

9. In outer sphere mechanism
   a. No chemical change
   b. No formation of bridged complex
   c. Both (a) and (b)
   d. None of the above

10. Which of the following is correct statement for inner sphere mechanism
   a. Both complexes should be inert
   b. Both complexes should be same spin
   c. The M-L bond distances in both must be comparable
   d. All of the above

11. Which of the following complex has less rate of aquation
   a. $[Co(NH_3)_5Cl]^{2+}$
   b. $[Co(en)(NH_3)Cl]^{2+}$
   c. $[Co(en)(diene)Cl]^{2+}$
   d. $[Co(tetraene)Cl]^{2+}$

12. According to solvation theory
   a. The greater the charge and smaller the size of the species, greater would be the extent of its hydration
   b. The smaller the charge and greater the size of the species, smaller would be the extent of its hydration
   c. Both (a) and (b)
   d. None of the above

13. Aquation through a square pyramidal intermediate always leads to
   a. Retention of geometry
   b. Racemisation
   c. Inversion of configuration
   d. None of the above

14. Homoleptic complexes are
   a. Compounds in which the ligands bound to the metal centres are different.
   b. Compounds in which the ligands bound to the metal centres are identical.
   c. Compounds in which ligands are not bound to the metal centres,
   d. None of the above.

15. Which one of the following is an organometallic compound
   a. $B(CH_3)_3$
   b. $B(OCH_3)_3$
   c. B_2H_6
   d. None the above.

16. Tetrameric structure of methyl lithium is a
   a. Distorted carbene type cluster
   b. Ordered carbene type cluster
   c. Linear type cluster
   d. None of the above.

17. Zeise's salt has a
   a. Tetrahedral structure
   b. Square planar structure
   c. Octahedral structure
   d. None of the above.

18. The effective atomic number of iron in $Fe(CO)_5$
   a. 36
   b. 34
   c. 31
   d. None of the above.

19. The dimeric cyclopentadienyl rhodiumchloride is having a
    a. Tetrahedral structure
    b. Square planar structure
    c. Trigonal bipyramidal structure
    d. None of the above.

20. Zeigler-Natta Catalyst is represented as
    a. A mixture of $AlEt_3$ & $TiCl_4$
    b. $AlEt_3$ only
    c. $TiCl_4$ only
    d. 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]

1. a. What is hydroformylation reaction and mention the organometallic catalyst used for this reaction? **4**
   b. What is Zeise's salt? How is it prepared? Give its structure? **1+2+1 =4**
   c. Show the synthesis of cis and trans [PtCl2(NO2)(NH3)]-. **2**

2. a. Explain the catalytic cycle of alkene hydrogenation reaction with proper diagram. **5+5=10**
   b. Explain the catalytic cycle of hydroformylation reaction with proper diagram.

3. a. Explain the catalytic cycle of Wacker process with proper diagram. **5+5=10**
   b. Why barium oxalate acts as interfering reagent in qualitative analysis. Explain why oxalate has to be removed before proceeding to group III.

4. a. What is synthesis gas? What is Fischer Tropsch process? **4+6=10**
   b. What do you mean by solubility product and common ion effect? Explain with examples. Explain in which environment H_2S helps in precipitating group I and group IV cations.

5. a. What is synergetic effect? Explain in terms of bonding in transition metal carbonyls. **2+3=5**
   b. How is IR data used to explain the extent of back bonding in metal carbonyls? **5**

6. a. What is Zeigler –Natta Catalyst? How does it cause the polymerization of ethylene? **1+2=3**
   b. Give an account of the solutions of Grignard reagent in diethyl ether solution at equilibrium? **2**
   c. What is ferrocene? How it was originally synthesized? How is it formed by reaction of cyclopentadiene with thallium hydroxide? **5**

7. a. How is triethyl aluminium formed? What happens when it reacts with hydrogen halides? **4**
   b. Discuss acid hydrolysis of octahedral complexes with examples. **4**
   c. Write the postulates of solvation theory. **2**

8. a. Explain the two theories of trans effect. **5+5=10**
   b. Explain the inner sphere mechanism of electron transfer reaction.

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