2023

CHEMISTRY

Total marks : 70 Time : 3 hours

General instructions:

i) Approximately 15 minutes is allotted to read the question paper and revise the answers.

ii) The question paper consists of 30 questions. All questions are compulsory.

iii) Marks are indicated against each question.

iv) Internal choice has been provided in some questions.

N.B: Check that all pages of the question paper is complete as indicated on the top left side.

1. Unit of rate constant for second order reaction is **1**
   (a) S^{-1} (b) $L\ mol^{-1}S^{-1}$ (c) $moll^{-1}S^{-1}$ (d) $L^{-1}mol^{-1}S$.

2. The metal carbon bond in metal carbonyls exhibit **1**
   (a) only σ-character (b) only π-character
   (c) both σ and π-character (d) ionic character.

3. Alcohol boils at higher temperature than the corresponding hydrocarbon due to **1**
   (a) intermolecular hydrogen bond
   (b) intra molecular hydrogen bond
   (c) van der waal's force of attraction
   (d) dipole-dipole interaction.

4. In the carbonyl group, the carbon atom undergoes **1**
   (a) sp hybridization (b) sp^2 hybridization
   (c) sp^3 hybridization (d) sp^3d hybridization.

5. Which of the following is a basic amino acid? **1**
   (a) Alanine (b) Aspartic acid
   (c) Glycine (d) Lysine.

6. **a.** State Dalton's law of partial pressure.
   Or **1**
   b. What are colligative properties?

7. What is molar conductivity? **1**

8. Name the radioactive element in lanthanoids series. **1**

9. What are vinylic halides? **1**

10. **a.** Write the IUPAC name of $C_2H_5-\underset{\displaystyle CH_3}{\underset{|}{N}}-CH_3$

Or **1**

b. Draw the structural formula of Butan-2-amine.

11. **a.** What is a pseudo first order reaction? Give an example.

Or **2**

b. Mention two points of differences between order and molecularity of a reaction.

12. **a.** Write the IUPAC name of the coordination compounds:

i) $[Cr(NH_3)_3(H_2O)_3]Cl_3$

ii) $[CoCl_2(en)_2]Cl$.

Or **2**

b. Write two applications of coordination compounds.

13. **a.** On the basis of valence bond theory, predict the shape and hybridization of $[Fe(H_2O)_6]^{3+}$.

Or **2**

b. Predict the number of unpaired electrons and magnetic behavior in $[Ni(CN)_6]^{2-}$

14. **a.** i) Among the following, which has the highest reactivity towards SN^2 reaction:

$$CH_3CH_2I,\ CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-F,\ CH_3-\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-Cl$$

ii) Define Swarts reaction.

Or **2**

b. Explain the nature of C-X bond of halo alkane.

15. **a.** Complete the following reaction:

i) $C_6H_5CONH_2 \xrightarrow{LiAlH_4 / ether} ?$

ii) $CH_3NC + 4[H] \xrightarrow{LiAlH_4 / Ni} ?$

Or **2**

b. What is carbylamine reaction? Write the reaction.

16. **a.** Write the classification of vitamins.

Or **2**

b. What is an amylose and amylopectin?

17. **a.** Concentrated nitric acid used in laboratory work is 68% nitric acid by mass in aqueous solution. What should be the molarity of such a sample of the acid if the density of the solution is 1.504 gML^{-1}.

Or **3**

b. A solution of an organic compound is prepared by dissolving 34.2g in 500g of water. Calculate the molar mass of the compound and freezing point of the solution. Given that K_b for water = 0.52 K Kg mol^{-1}, boiling point of solution = 100.104°C and K_f for water = 1.86K Kg mol^{-1}.

18. **a.** What is isotonic solution? Why do gases always tend to be less soluble in liquids as the temperature is raised?

Or **3**

b. What is solubility? What are the factors affecting the solubility of solid in a liquid?

19. **a.** The electrical resistance of a column of 0.05 mol L^{-1} NaOH solution of diameter 1cm and length 50 cm is 5.55×10^3 ohm. Calculate its resistivity, conductivity and molar conductivity. **3**

Or

b. The molar conductivity of 0.025 $molL^{-1}$ methanoic acid is 46.1S cm^2 mol^{-1} . Calculate its degree of dissociation and dissociation constant. Given- $\lambda^o (H^+)$=349.6 S cm^2 and $\lambda^o (HCOO^-)$ =54.6S cm^2 mol^{-1}.

20. **a.** The rate of chemical reaction doubles for an increase of 10K in absolute temperature from 298 K. Calculate Ea.(Log 2=0.3010, R=8.314KJ mol^{-1}).

Or **3**

b. The half life for radioactive decay of ^{14}C is 5730 years. An archeological artifact containing wood had only 80% of the ^{14}C found in living tree. Estimate the age of the sample.

21. **a.** (i) Give reason why Fe^{3+} is more stable than Fe^{2+}?
(ii) Why is silver a transition metal but zinc is not?

Or **3**

b. What are interstitial compounds? Write four characteristics of interstitial compound.

22. **a.** (i) Chlorobenzene is less reactive towards nucleophilic substitution than chloromethane. Why?
(ii) What happens when bromobenzene is treated with magnesium in dry ether?

Or **3**

b. (i) What are freons?
(ii) How does halo alkanes undergo dehydrohalogenation? Give example.

23. **a.** Write the preparation of ether by Williamson's synthesis. Give the chemical reactions.

Or **3**

b. Explain why cleavage of phenyl alkyl ethers with HBr always produces phenol and alkyl bromide and not bromobenzene and alkanols?

24. **a.** What happens when methanal, ethanal and propanone react with Grignard reagent?

Or **3**

b. (i) Why are alcohols soluble in water?
(ii) Explain why alcohols have higher boiling point than ether?

25. **a.** Give the conversion of:
(i) Propanone to Propene
(ii) Propanal to Butanone

Or **3**

b. Explain the structure of carbonyl group in carbon atoms.

26. **a.** Give a test to distinguish between primary, secondary and tertiary amines by Hinsberg's reagent.

Or **3**

b. (i) Arrange the following sets in order of their basic strength in aqueous solution: NH_3, $C_6H_5NH_2$, CH_3NH_2, $(CH_3)_3N$, $(CH_3)_2NH$.
(ii) Why tertiary amines do not undergo acylation?

27. **a.** Explain the structure of proteins on the basis of their molecular shape.

Or **3**

b. What are enzymes? Explain the mechanism of enzymes.

28. **a.** i) What is electrochemical series? Write its application.

ii) The cell in which the following reaction occurs:
$2Fe^{3+}(aq)+2I^{-}(aq) \rightarrow 2Fe^{2+}(aq)+ I_2(s)$ has E^{o} cell =0.236V at 298K. Calculate the standard Gibbs energy and the equilibrium constant of the cell reaction. ($R=8.314\ JK^{-1}mol^{-1}$, F=96500C).

Or **5**

b. Write the Nernst equation for the cell:
$Mg(s)/Mg^{2+}(0.001M)//Cu^{2+}(0.0001M)/Cu(s)$ where
$E^{o}\ Mg^{2+}/Mg = -2.37V$
$E^{o}\ Cu^{2+}/Cu = 0.34V$
Write the reaction occurring at each of the electrode and its net cell reaction, also determine its cell potential.

29. **a.** (i) Write the reaction of oxidizing action of $K_2Cr_2O_7$ in acidic medium with iodide and H_2S.

(ii) Compare the chemistry of actinoids with that of the lanthanoids with special reference to the following:

(a) electronic configuration
(b) oxidation states
(c) chemical reactivity

Or **5**

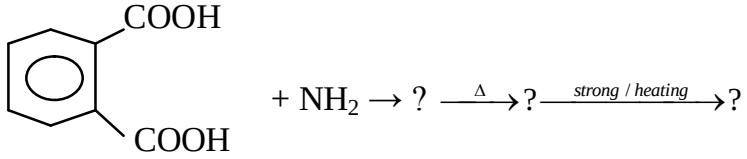
b. (i) Why do transition metal form complex compound?

(ii) What is lanthanoid contraction? Explain its consequences.

30. **a.** (i) What is formalin?

(ii) Write the mechanism of esterification of carboxylic acid.

(iii) Complete the following reaction:



Or **5**

b. Explain the following reactions:

(i) Cannizaro reaction.
(ii) Rosenmund reduction.
(iii) What happens when acetone is treated with hydroxylamine?

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