ANANDALAYA
PRE-BOARD EXAMINATION
Class: XII

विद्या सर्वार्थि साधिका

Subject: Chemistry (043) MM: 70
Date : 16-12-2024 Time: 3 hours

General Instructions:
Read the following instructions carefully.
1. There are 33 questions in this question paper with internal choice.
2. Section A consists of 16 multiple choice questions carrying 1 mark each.
3. Section B consists of 5 short answer questions carrying 2 marks each.
4. Section C consists of 7 short answer questions carrying 3 marks each.
5. Section D consists of 2 case - based questions carrying 4 marks each.
6. Section E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

SECTION A

1. What would be the reactant and reagent used to obtain 2, 4-dimethyl pentan-3-ol? (1)
   (A) Propanal and propyl magnesium bromide
   (B) 3-methylbutanal and 2-methyl magnesium iodide
   (C) 2-dimethylpropanone and methyl magnesium iodide
   (D) 2-methylpropanal and isopropyl magnesium iodide

2. Reaction of $C_6H_5CH_2Br$ with aqueous sodium hydroxide follow: (1)
   (A) SN_1 mechanism (B) SN_2 mechanism
   (C) (A) and (B) depending upon the temperature of reaction (D) Saytzeff rule

3. Cu^+ is less stable than Cu^{2+} in aqueous solution. This is due to: (1)
   (A) More negative hydration enthalpy of Cu^+ ion
   (B) More negative hydration enthalpy of Cu^{2+} ion
   (C) Less negative hydration enthalpy of Cu^{2+} ion
   (D) Less enthalpy atomization of Cu

4. According to Maxwell Boltzmann distribution of energy, (1)
   (A) The fraction of molecules with most probable kinetic energy does not change at higher temperatures.
   (B) The fraction of molecules with most probable kinetic energy increases at higher temperatures.
   (C) Most probable kinetic energy increases at higher temperatures.
   (D) Most probable kinetic energy decreases at higher temperatures.

5. How is electrical conductance of a conductor related with length and area of cross-section of the conductor? (1)
   (A) $G = l\ .\ a.K^{-1}$ (B) $G = K.\ l.a^{-1}$ (C) $G = K.a\ .l^{-1}$ (D) $G = K.\ l.a^{-2}$

6. Suppose the reaction: $A + 2B \rightarrow AB_2$ occurs by the following mechanism: (1)
   Step 1: $A + B \rightarrow AB$ (slow), Step 2: $AB + B \rightarrow AB_2$ (fast), Overall: $A + 2B \rightarrow AB_2$
   The rate law expression must be: Rate = _____.
   (A) k[A] (B) k[AB][B] (C) [A][B] (D) $k[A][B]^2$

7. Benzoic acid is treated with $SOCl_2$ and the product (X) formed is reacted with ammonia to give (Y). (Y) on reaction with Br_2 and KOH gives (Z). (Z) in the reaction is _____. (1)
(A) aniline (B) chlorobenzene (C) benzamide (D) benzoyl chloride

8. Cobalt (III) chloride forms several octahedral complexes with ammonia. Which of the following will not give test for chloride ions with silver nitrate at 25°C? (1)
(A) $CoCl_3.3NH_3$ (B) $CoCl_3.4NH_3$
(C) $CoCl_3.5NH_3$ (D) $CoCl_3.6NH_3$

9. Which of the following does not undergo Cannizzarro's reaction? (1)
(A) Benzaldehyde (B) 2-Methylpropanal
(C) p-Methoxybenzaldehyde (D) 2, 2-Dimethylpropanal

10. Which of the following statements is not correct for amines? (1)
(A) Most alkyl amines are more basic than ammonia solution.
(B) pK_b value of ethylamine is higher than benzylamine.
(C) CH_3NH_2 on reaction with nitrous acid releases N_2 gas.
(D) Hinsberg's reagent reacts with secondary amines to form sulphonamides

11. Methyl ketones are usually characterised through (1)
(A) Tollen's reagent (B) Iodoform test
(C) Schiff's test (D) Benedict solution test

12. In a reaction, $2X \rightarrow Y$, the concentration of X decreases from 0.50M to 0.38M in10 min. What is the rate of reaction in Ms^{-1} during this interval? (1)
(A) 2×10^{-4} (B) 4×10^{-2} (C) 2×10^{-2} (D) 1×10^{-2}

Q. 13 to Q. 16 are Assertion (A) and Reason (R) type questions. Select the most appropriate answer from the options given below:
(A) Both A and R are true and R is the correct explanation of A
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

13. A: Boiling points of alkyl halides decrease in the order: R-I > R-Br > R-Cl > R-F (1)
R: Van der Waals forces decrease with increase in the size of halogen atom.

14. A: Sucrose is optically active. (1)
R: Hydrolysis of sucrose brings about a change in rotation, from dextro (+) to laevo (–)

15. A: Cobalt (II) readily oxidises to Co (III) while forming complexes. (1)
R: Co (III) has a stable $t2g^3$ configuration in complexes.

16. A: N, N-Diethylbenzene sulphonamide is insoluble in alkali (1)
R: Sulphonyl group attached to nitrogen atom is a strong electron withdrawing group.

SECTION B

17. (a) Illustrate the effect of catalyst on activation energy graphically. (2)
(b) Catalysts have no effect on equilibrium constant. Why?

18. (a) Name the branched chain component of starch. (2)
(b) How do Ribose in RNA and deoxyribose in DNA differ in the structure?

OR

(a) Write the product when D-glucose reacts with conc. HNO_3.
(b) Amino acids show amphoteric behaviour. Why?

19. (a) Although both $[NiCl_4]^{2-}$ and $[Ni(CO)_4]$ have sp^3 hybridisation yet $[NiCl_4]^{2-}$ is paramagnetic and $[Ni(CO)_4]$ is diamagnetic. Give reason. (Atomic no. of Ni = 28) (2)
(b) Write the electronic configuration of d^5 on the basis of crystal field theory when
(i) $\Delta o < P$ and (ii) $\Delta o > P$

20. The decomposition of NH_3 on platinum surface: $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$ is a zero-order reaction with $k = 2.5 \times 10^{-4}$ mol L^{-1} s^{-1}. What is the rate of production of H_2? (2)

21. Write structures of main compounds A and B in each of the following reactions: (2)

(a) $CH_3CH_2OH \xrightarrow{PCC} A \xrightarrow{CH_3OH\ /\ dry\ HCl(g)} B$

(b) $C_6H_5COCH_3 \xrightarrow{NaOI} A + B$

SECTION C

22. Give equations for the following reactions: (3)
(a) Phenol is treated with conc. HNO_3.
(b) Propene is treated with B_2H_6 followed by H_2O_2 /OH^-.
(c) Sodium t-butoxide is treated with CH_3Cl.

23. a) Arrange the following in increasing order of crystal field splitting energy: (3)
$[Cr(CN)_6]^{3-}$, $[Cr(NH_3)_6]^{3+}$, $[CrCl_6]^{3-}$
b) Write IUPAC name of the complex $[Cr(NH_3)_4Cl_2]^+$. Draw structures of geometrical isomers for this complex.

24. Calculate the mass of NaCl (molar mass = 58·5 g mol^{-1}) to be dissolved in 37·2 g of water to lower the freezing point by 2^0C, assuming that NaCl undergoes complete dissociation. (K_f for water = 1·86 K kg mol^{-1}) (3)

25. Give reasons: (3)
(a) $(CH_3)_2NH$ is more basic than $(CH_3)_3N$ in an aqueous solution.
(b) Aromatic diazonium salts are more stable than aliphatic diazonium salts.
(c) Methylamine in water reacts with ferric chloride to precipitate hydrated ferric acid.

26. (a) Write the structure of major alkene formed by β-elimination of 2,2,3–trimethyl–3– bromopentane with sodium ethoxide in ethanol. (3)
(b) Identify the compounds in the following pairs which is chiral.
2-bromobutane or 3-bromopentane
(c) Write the products of the reactions when:
(a) bromobenzene reacts with Mg in presence of dry ether
(b) bromobenzene reacts with sodium in presence of dry ether

OR

How can you convert the following?
(a) But-1-ene to 1-iodobutane
(b) Benzene to acetophenone
(c) Ethanol to propanenitrile

27. (a) From the given cells: Lead storage cell, Mercury cell, Fuel cell and Dry cell, answer the following: (3)
(i) Which cell is used in hearing aids?
(ii) Which cell was used in Apollo Space Programme?
(iii) Which cell is used in automobiles and invertors?
(iv) Which cell does not have long life?

(b) In an aqueous solution, how does specific conductivity of electrolytes change with addition of water?

28. Write the IUPAC name of the following compounds. (3)
(a) $[Ag(NH_3)_2][Ag(CN)_2]$ (b) $[CoCl_2(en)_2]Cl$ (c) $K_3[Al(C_2O_4)_3]$

SECTION D

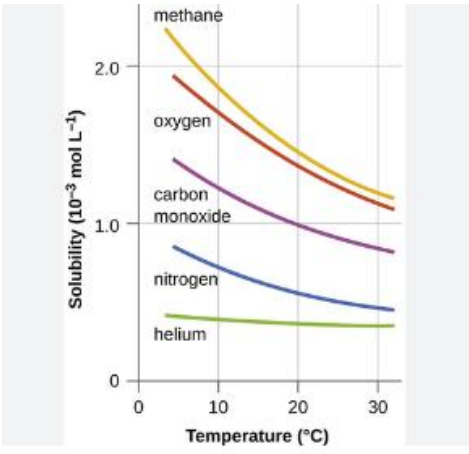
29. Proteins are poly peptide chains made up of amino acids. There are 20 types of amino acids joined together by peptide bond between amino and carboxylic acid group. The amino acids are of two types-essential amino acids and non-essential amino acids. The primary structure of a protein is defined as the sequence of amino acids linked together to form a polypeptide chain. The first amino acid of sequence is called N-terminal amino acid and last amino acid of peptide chain is called C-terminal amino acid. The secondary structure of protein forms helix. There are three types of secondary structure- α-helix, β-pleated sheet structure and collagen helix. The tertiary structure of proteins represents overall folding of the polypeptide chains i.e., further folding of the secondary structure. The spatial arrangement of these subunits with respect to each other is known as quaternary structure. (4)

Answer the following questions:
(a) How many peptide bonds will be formed when ten amino acids polymerise?
(b) Name the amino acid which is not optically active.
(c) What is the effect of denaturation on the structure of proteins? Give two examples of denaturation.

OR

(a) Differentiate between Fibrous proteins and Globular proteins.

30. The chemical structures of the solute and solvent dictate the types of forces possible and, consequently, are important factors in determining solubility. For example, under similar conditions, the water solubility of oxygen is approximately three times greater than that of helium, but 100 times less than the solubility of chloromethane, $CHCl_3$. Considering the role of the solvent's chemical structure, note that the solubility of oxygen in the liquid hydrocarbon hexane, C_6H_{14}, is approximately 20 times greater than it is in water. Other factors also affect the solubility of a given substance in a given solvent. Temperature is one such factor, with gas solubility typically decreasing as temperature increases (Figure). This is one of the major impacts resulting from the thermal pollution of natural bodies of water. (4)



When the temperature of a river, lake, or stream is raised abnormally high, usually due to the discharge of hot water from some industrial process, the solubility of oxygen in the water is decreased. Decreased levels of dissolved oxygen may have serious consequences for the health of the water's ecosystems and, in severe cases, can result in large-scale fish kills

Answer the following questions:
(a) What is effect of temperature on solubility of gas in liquid?
(b) Name two factors which affect the value of K_H?
(c) When natural waters subjected to thermal pollution, how does it affect aquatic life?

OR

(c) Find the boiling point of a solution containing 0.52g of glucose ($C_6H_{12}O_6$) dissolved in 80.2 g of water (Given Kb for water = 0.52 K/m).

SECTION E

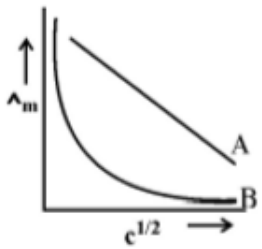
31. (a) E^0 cell for the given redox reaction is 2.71 V (5)
Mg(s) + Cu^{2+} (0.01 M) → Mg^{2+} (0.001 M) + Cu(s)
Calculate E_{cell} for the reaction.

(b) Write the direction of flow of current when an external opposite potential applied is
(i) less than 2.71 V and (ii) greater than 2.71 V

OR

(a) A steady current of 2 amperes was passed through two electrolytic cells X and Y connected in series containing electrolytes $FeSO_4$ and $ZnSO_4$ until 2.8 g of Fe deposited at the cathode of cell X. How long did the current flow? Calculate the mass of Zn deposited at the cathode of cell Y. (Molar mass: Fe = 56 g mol^{-1} Zn = 65.3 g mol^{-1}, 1F = 96500 C mol^{-1})

(b) In the plot of molar conductivity (Λ_m) vs square root of concentration ($\sqrt{C}$), following curves are obtained for two electrolytes A and B:



Answer the following:
(i) Predict the nature of electrolytes A and B.
(ii) What happens on extrapolation of Λ_m to concentration approaching zero for electrolytes A and B?

32. (a) Carry out the following conversions: (5)
(i) Ethanal to 3-hydroxybutanal
(ii) Benzene to 3-nitroacetophenone

(b) An alkene with molecular formula C_5H_{10} on ozonolysis gives a mixture of two compounds, B and C. Compound B gives positive Fehling test and also reacts with iodine and NaOH solution. Compound C does not give Fehling's solution test but forms iodoform. Identify the compounds A, B and C.

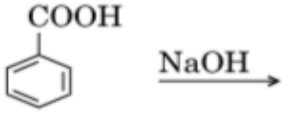
OR

(a) Carry out the following conversions:
(i) Benzoic acid to aniline
(ii) Bromomethane to ethanol

(b) Write the structure of major product(s) in the following:

(i) $CH_3-CH_2-\underset{\underset{O}{\|}}{C}-H \xrightarrow[\text{(b) KOH, Glycol/heat}]{\text{(a) } H_2N-NH_2}$

(ii) $CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-CHO \xrightarrow{\text{conc. NaOH}}$

(iii)  $\xrightarrow{\text{NaOH}}$

33. (a) Give reasons: (5)

(i) Transition metals and their compounds show catalytic activities.

(ii) Separation of a mixture of Lanthanoid elements is difficult.

(iii) Zn, Cd and Hg are soft and have low melting point.

(b) Write the preparation of the following:

(i) $Na_2Cr_2O_7$ from Na_2CrO_4 (ii) K_2MnO_4 from MnO_2

OR

(a) Why there are greater horizontal similarities in the properties of the transition elements?

(b) On what ground can you say that scandium (Z = 21) is a transition element but zinc (Z = 30) is not?

(c) Transition elements have high melting points. Why?

(d) Why the metals of the second and third series have greater enthalpies of atomisation than the corresponding elements of the first series?

(e) The radii of the second (4d) series of the elements are virtually the same as the third (5d) series. Why?