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INDIAN SCHOOL SALALAH
FIRST TERM EXAMINATION – SEPTEMBER 2024



CHEMISTRY (043)

Class: XII

Date: 24-09-2024

Time: 3 Hrs.

Maximum Marks: 70

General Instructions:

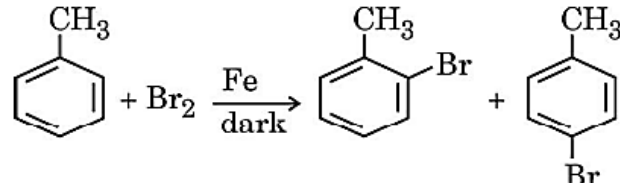
Read the following instructions carefully and follow them.

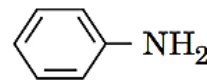
- (i) This question paper contains 33 questions. All questions are compulsory.*
- (ii) This question paper is divided into FIVE sections – Section A, B, C, D and E.*
- (iii) Section A – questions number 1 to 16 are Multiple Choice (MCQ) type questions carrying 1 mark each.*
- (iv) Section B – questions number 17 to 21 are Very Short Answer (VSA) type questions carrying 2 marks each.*
- (v) Section C – questions number 22 to 28 are Short Answer (SA) type questions carrying 3 marks each.*
- (vi) Section D – questions number 29 & 30 are case-based questions carrying 4 marks each.*
- (vii) Section E – questions number 31 to 33 are Long Answer (LA) questions carrying 5 marks each.*
- (viii) There is no overall choice given in the question paper. However, an internal choice has been provided in all the sections except section A.*
- (ix) Use of calculators is NOT allowed.*

SECTION A

Questions no. 1 to 16 are Multiple Choice type Questions, carrying 1 mark each.

- 1 Which of the following molecules has a chiral centre correctly labelled with an asterisk (*)? 1
- (a) $\text{CH}_3\text{C}^*\text{HBrCH}_3$
 - (b) $\text{CH}_3\text{C}^*\text{HClCH}_2\text{Br}$
 - (c) $\text{HOCH}_2\text{C}^*\text{H}(\text{OH})\text{CH}_2\text{OH}$
 - (d) $\text{CH}_3\text{C}^*\text{Br}_2\text{CH}_3$

- 2 Which of the following reactions is a halogen exchange reaction: 1
- (a) $\text{>C}=\text{C}< + \text{HX} \longrightarrow \begin{array}{c} \text{>C} - \text{C}< \\ | \quad | \\ \text{H} \quad \text{X} \end{array}$
- (b) $\text{R} - \text{X} + \text{NaI} \xrightarrow{\text{Dry acetone}} \text{R} - \text{I} + \text{NaX}$
- (c) $\text{R} - \text{OH} + \text{HCl} \xrightarrow{\text{ZnCl}_2} \text{R} - \text{Cl} + \text{H}_2\text{O}$
- (d) 

Cc1ccccc1.BrBr>>Cc1cccc(Br)c1.Cc1ccc(Br)cc1
- 3 CH_3CONH_2 on reaction with $\text{Na}/\text{C}_2\text{H}_5\text{OH}$ gives: 1
- (a) CH_3COOH (b) CH_3NH_2
 (c) $\text{CH}_3\text{CH}_2\text{OH}$ (d) $\text{CH}_3\text{CH}_2\text{NH}_2$
- 4 Aspirin is obtained by the acetylation of which of the following compounds? 1
- (a) Salicylaldehyde (b) Salicylic acid
 (c) Acetyl salicylic acid (d) Phenol
- 5 Which of the following alcohols will not undergo oxidation ? 1
- (a) Butanol (b) Butan-2-ol
 (c) 2-Methylbutan-2-ol (d) 3-Methylbutan-2-ol
- 6 Which of the following is least basic? 1
- (a) $(\text{CH}_3)_2\text{NH}$ (b) NH_3
 (c)  NH_2 (d) $(\text{CH}_3)_3\text{N}$
- 7 Which of the following would not be a good choice for reducing nitrobenzene to aniline? 1
- (a) LiAlH_4 (b) H_2/Ni
 (c) Fe and HCl (d) Sn and HCl
- 8 Which of the following solutions of KCl will have the highest value of molar conductivity? 1
- (a) 0.01 M (b) 1 M
 (c) 0.5 M (d) 0.1 M
- 9 A galvanic cell can behave as an electrolytic cell when : 1
- (a) $E_{\text{cell}} = E_{\text{ext}}$ (b) $E_{\text{cell}} > E_{\text{ext}}$
 (c) $E_{\text{cell}} = 0$ (d) $E_{\text{ext}} > E_{\text{cell}}$
- 10 If molality of a dilute solution is doubled, the value of the molal elevation constant (K_b) 1
 will be
- (a) halved (b) doubled
 (c) tripled (d) unchanged

- 11 Value of Henry's constant K_H : 1
(a) increases with decrease in temperature.
(b) decreases with increase in temperature.
(c) increases with increase in temperature.
(d) remains constant.
- 12 Reaction of 1-phenyl-2-chloropropane with alcoholic KOH gives mainly: 1
(a) 1-phenylpropene (b) 3-phenylpropene
(c) 1-phenylpropan-3-ol (d) 1-phenylpropan-2-ol

For Questions number 13 to 16, two statements are given – one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(C) Assertion (A) is true, but Reason (R) is false.
(D) Assertion (A) is false, but Reason (R) is true.
- 13 Assertion (A): Phenol gives 2,4,6-trinitrophenol on treatment with concentrated HNO_3 and concentrated H_2SO_4 . 1
Reason (R): OH group in phenol is meta-directing.
- 14 Assertion (A): Proteins are polymers of α -amino acids connected by a peptide bond. 1
Reason (R): A tetrapeptide contains 4 amino acids linked by 4 peptide bonds.
- 15 Assertion (A): Osmotic pressure is a colligative property. 1
Reason (R): Osmotic pressure is proportional to the molality.
- 16 Assertion (A): Conductivity decreases with decrease in concentration of electrolyte. 1
Reason (R): Number of ions per unit volume that carry the current in a solution decreases on dilution.

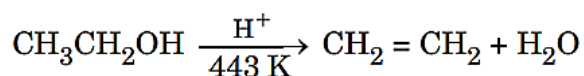
SECTION B

- 17 (A) An alkyl halide (A) of molecular formula $\text{C}_6\text{H}_{13}\text{Cl}$ on treatment with alcoholic KOH gives two isomeric alkenes (B) and (C) of molecular formula C_6H_{12} . Both alkenes on hydrogenation give 2,3-dimethylbutane. Deduce the structures of (A), (B) and (C). 2

OR

- (B) Account for the following:
(i) Benzyl chloride is highly reactive towards $\text{S}_{\text{N}}1$ reaction.
(ii) (\pm)-Butan-2-ol is optically inactive, though it contains a chiral carbon atom.
- 18 For the pair phenol and cyclohexanol, answer the following: 2
(a) Why is phenol more acidic than cyclohexanol?
(b) Give one chemical test to distinguish between the two.

- 19 (i) Write the mechanism of the following reaction: 2



- (ii) Write the equation involved in Reimer-Tiemann reaction.

- 20 (A) Give reasons: 2

(i) Aniline on nitration gives good amount of m-nitroaniline, though $-\text{NH}_2$ group is ortho/para directing in electrophilic substitution reactions.

(ii) Ammonolysis of alkyl halides is not a good method to prepare pure primary amines.

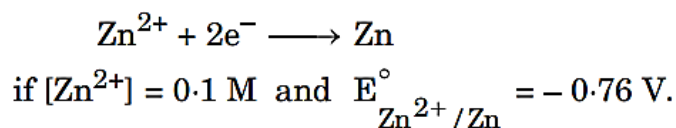
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- (B) Write the reaction involved in the following:

(i) Carbylamine test

(ii) Gabriel phthalimide synthesis

- 21 Calculate the half-cell potential at 298 K for the reaction 2



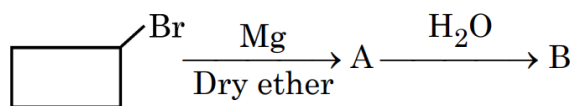
SECTION C

- 22 (a) Which isomer of C_5H_{10} gives a single monochloro compound $\text{C}_5\text{H}_9\text{Cl}$ in bright sunlight? 3

(b) Arrange the following compounds in increasing order of reactivity towards $\text{S}_{\text{N}}2$ reaction:

2-Bromopentane, 1-Bromopentane, 2-Bromo-2-methylbutane

(c) Identify A and B in the following:



- 23 (A) What happens when 3

(i) Anisole is treated with $\text{CH}_3\text{Cl}/\text{anhydrous AlCl}_3$?

(ii) Phenol is oxidised with $\text{Na}_2\text{Cr}_2\text{O}_7/\text{H}^+$?

(iii) $(\text{CH}_3)_3\text{C}-\text{OH}$ is heated with $\text{Cu}/573 \text{ K}$?

Write chemical equation in support of your answer.

OR

- (B) Write the chemical equation for the following:

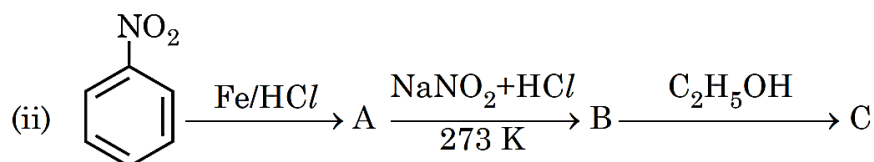
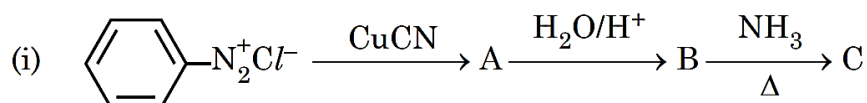
(i) Hydration of propene in presence of an acid.

(ii) Reaction between Ethyl bromide and $\text{C}_2\text{H}_5\text{ONa}$.

(iii) Reaction between Dimethyl ether and excess of Hydrogen iodide.

24 An organic compound 'A' having molecular formula C_3H_8O on treatment with Cu at 573K, gives 'B'. 'B' does not reduce Fehling's solution but gives a yellow precipitate of the compound 'C' with I_2 and NaOH. Deduce the structures of A, B and C with proper explanation. 3

25 Write the structures of A, B and C in the following reactions: 3



26 (A) Write the structure of product when D-Glucose reacts with the following: 3

(i) HCN

(ii) Conc. HNO_3

(iii) Br_2 / water

OR

(B) Give reasons for the following observations

(i) Penta-acetate of glucose does not react with hydroxylamine.

(ii) Amino acids behave like salts.

(iii) The two strands in DNA are complimentary to each other.

27 The molar conductivities of NH_4^+ and Cl^- ion are $73.8 \text{ Scm}^2/\text{mol}$ and $76.2 \text{ Scm}^2/\text{mol}$ respectively. The conductivity of 0.1M NH_4Cl is $1.29 \times 10^{-2} \text{ Scm}^{-1}$. Calculate its molar conductivity and degree of dissociation. 3

28 The vapour pressure of pure liquid X and pure liquid Y at $25^\circ C$ are 120 mm Hg and 160 mm Hg respectively. If equal moles of X and Y are mixed to form an ideal solution, calculate the vapour pressure of the solution. 3

SECTION D

The following questions are case-based questions. Read the case carefully and answer the questions that follow.

29 The carbon – oxygen double bond is polarised in aldehydes and ketones due to higher electronegativity of oxygen relative to carbon. Therefore they undergo nucleophilic addition reactions with a number of nucleophiles such as HCN, $NaHSO_3$, alcohols, ammonia derivatives and Grignard reagents. Aldehydes are easily oxidised by mild oxidising agents

as compared to ketones. The carbonyl group of carboxylic acid does not give reactions of aldehydes and ketones. Carboxylic acids are considerably more acidic than alcohols and most of simple phenols.

a Write the name of the product when an aldehyde reacts with excess alcohol in presence of dry HCl. 1

b Why carboxylic acid is a stronger acid than phenol? 1

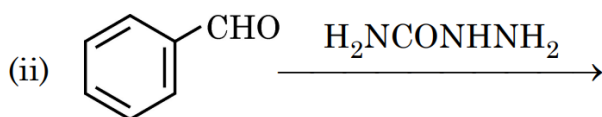
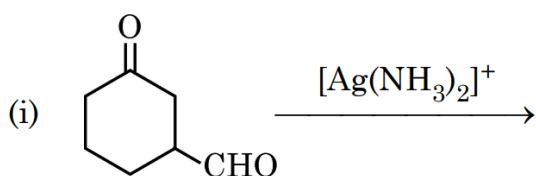
c (A)(i) Arrange the following compounds in increasing order of their reactivity towards CH_3MgBr : 2



(ii) Write a chemical test to distinguish between propanal and propanone.

OR

(B) Write the main product in the following:



30 Living systems are made up of various complex biomolecules like carbohydrates, proteins, nucleic acids, lipids, etc. Carbohydrates are optically active polyhydroxy aldehydes or ketones or molecules which provide such units on hydrolysis. They are broadly classified into three groups monosaccharides, oligosaccharides and polysaccharides. Monosaccharides are held together by glycosidic linkages to form disaccharides like sucrose, maltose or polysaccharides like starch and cellulose. Another biomolecule: proteins are polymers of alpha amino acids which are linked by peptide bonds. Ten amino acids are called essential amino acids. Structure and shape of proteins can be studied at four different levels i.e. primary, secondary, tertiary and quaternary, each level being more complex than the previous one.

a What is the difference between a glycosidic linkage and peptide linkage? 1

b Which amino acids are called essential amino acids? 1

c (A) What are the common types of secondary structures of proteins? Write any two forces which stabilise the secondary and tertiary structures of protein. 2

OR

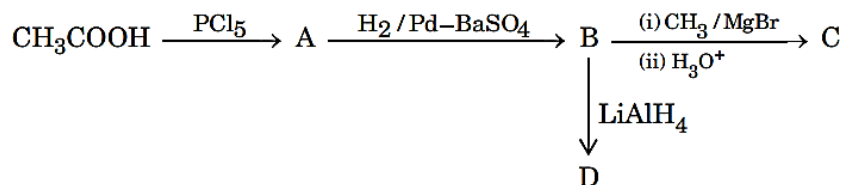
(B) Define denaturation of protein with an example. During denaturation which structures of protein lose their biological activity?

SECTION E

31 (A) (i) Carry out the following conversions:

5

- (1) Ethanal to But-2-en-1-al
 - (2) Propanoic acid to 2-chloropropanoic acid
- (ii) Write the structure of oxime of acetone.
- (iii) Identify A to D.



OR

(B) (i) Write the reaction involved in Cannizaro's reaction.

(ii) Why are the boiling point of aldehydes and ketones lower than that of corresponding carboxylic acids?

(iii) An organic compound 'A' with molecular formula $\text{C}_5\text{H}_8\text{O}_2$ is reduced to n-pentane with hydrazine followed by heating with NaOH and Glycol. 'A' forms a dioxime with hydroxylamine and gives a positive Iodoform and Tollen's test. Identify 'A' and give its reaction for Iodoform and Tollen's test.

32 (A) (i) Give reasons:

5

- (1) Mercury cell delivers a constant potential during its life time.
 - (2) In the experimental determination of electrolytic conductance, Direct Current (DC) is not used.
- (ii) State Kohlrausch's law of independent migration of ions.
- (i) Using E° values of X and Y given below, predict which is better for coating the surface of Iron to prevent corrosion and why?

$$\text{Given : } E^\circ_{\text{X}^{2+}/\text{X}} = -2.36 \text{ V}$$

$$E^\circ_{\text{Y}^{2+}/\text{Y}} = -0.14 \text{ V}$$

$$E^\circ_{\text{Fe}^{2+}/\text{Fe}} = -0.44 \text{ V}$$

OR

(B) (i) Define fuel cell with an example. What advantages do the fuel cells have over primary and secondary batteries?

(ii) When a steady current of 2A was passed through two electrolytic cells A and B containing electrolytes ZnSO_4 and CuSO_4 connected in series, 2 g of Cu were deposited at the cathode of cell B. How long did the current flow?

What mass of Zn was deposited at cathode of cell A?

[Atomic mass : Cu = 63.5 g mol⁻¹, Zn = 65 g mol⁻¹; 1F = 96500 C mol⁻¹]

33 Answer any FIVE of the following:

5

- (a) The relative lowering of vapour pressure of an aqueous solution containing non-volatile solute is 0.0225. Find the mole fraction of the non-volatile solute in the solution.
- (b) An azeotropic mixture of two liquids has a boiling point higher than either of the two liquids. Which type of deviation from Raoult's law it will show?
- (c) Which colligative property will prefer to find the molar mass of proteins and why?
- (d) Sprinkling of salt helps in clearing the snow-covered roads in hilly areas. Why?
- (e) Aquatic animals are more comfortable in cold water in comparison to warm water. Why?
- (f) A compound undergoes complete tetramerization in a given organic solvent, What will be the value of Van't Hoff factor 'i'?
- (g) What causes the low concentration of oxygen in the blood and tissues of people living at high altitude?
