

ROLL NUMBER				
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SET	A
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**INDIAN SCHOOL MUSCAT  
HALF YEARLY EXAMINATION 2023  
CHEMISTRY(043)**



CLASS : XII  
DATE: 24-09-2023

TIME ALLOTTED : 3 HRS.  
MAXIMUM MARKS:70

**GENERAL INSTRUCTIONS:**

- a) There are 33 questions in this question paper with internal choice.
- b) SECTION A consists of 16 multiple -choice questions carrying 1 mark each.
- c) SECTION B consists of 5 short answer questions carrying 2 marks each.
- d) SECTION C consists of 7 short answer questions carrying 3 marks each.
- e) SECTION D consists of 2 case - based questions carrying 4 marks each.
- f) SECTION E consists of 3 long answer questions carrying 5 marks each.
- g) All questions are compulsory.

**SECTION A**

The following questions are multiple -choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. Identify the specific pairs of bases that can form H-bonds between them in a dinucleotide chain :- 1  
 (a) A-T, G-C                      (b) A-C, G-T                      (c) A-A, T-T                      (d) G-C, C-T
  
2. Match the following: 1  

(i) Glycine	(j) Dipeptide
(ii) Valine	(k) Globular protein
(iii) Glycylalanine	(l) Optically inactive
(iv) Albumin	(m) Essential amino acid

Which one of the following represent the true match between the pairs ?

  - (a) i-l, ii-m, iii-k, iv-j
  - (b) i-m, ii-l, iii-j, iv-k
  - (c) i-l, ii-m, iii-j, iv-k
  - (d) i-k, ii-m, iii-j, iv-l
  
3. Which of the following reagents would one choose to transform  $\text{CH}_3\text{COCl}$  into acetone ? 1  
 (a)  $(\text{CH}_3)_2\text{Cd}$       (b)  $\text{CH}_3\text{MgBr}$       (c)  $\text{CH}_3\text{Cl}$       (d)  $(\text{CH}_3\text{O})_2\text{Mg}$
  
4.  $\text{X} \xrightarrow{\text{Cl}_2} \text{Benzalchloride} \xrightarrow{\text{Hydrolysis}} \text{Y}$  1  
 X and Y respectively are

- (a) Benzene, Benzaldehyde  
 (b) Toluene, Benzaldehyde  
 (c) Toluene, Benzoic acid  
 (d) Benzene, Benzoic acid
5. The compound  $\text{CH}_3\text{COCH}_2\text{COOH}$  when treated with  $\text{NaBH}_4$  will give, 1  
 (a)  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_2\text{OH}$   
 (b)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{O}$   
 (c)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$   
 (d)  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{COOH}$
6. Which one of the following alcohols is expected to have the lowest  $\text{pK}_a$  value ? 1  
 (a) Ethanol (b) tert-butyl alcohol (c) Isopropyl alcohol (d) Methanol
7. Which of the following cannot be made by using Williamson Synthesis: 1  
 (a) Methyl phenylether (b) Benzylethylether (c) tert.-butyl methyl ether (d) Ditert-butyl ether
8. The conversion of an alkyl halide into an alcohol by aqueous  $\text{NaOH}$  is classified as 1  
 (a) A dehydrohalogenation reaction (b) A nucleophilic substitution reaction  
 (c) An addition reaction (d) A dehydration reaction
9. The osmotic pressure of equimolar solutions of glucose, sodium chloride and barium chloride will be in the order: 1  
 (a)  $\text{BaCl}_2 > \text{NaCl} > \text{glucose}$  (b)  $\text{BaCl}_2 > \text{glucose} > \text{NaCl}$   
 (c)  $\text{glucose} > \text{BaCl}_2 > \text{NaCl}$  (d)  $\text{NaCl} > \text{BaCl}_2 > \text{glucose}$
10. The amount of solute (molecular mass 60 g/mol) that must be added to 180 g water so that vapour pressure of water is lowered by 10% is 1  
 (a) 30 g (b) 60g (c) 120g (d) 12g
11. If molality of a dilute solution is doubled, the value of the molal elevation constant ( $K_b$ ) will be 1  
 (a) halved (b) doubled (c) tripled (d) unchanged
12. 1 mole of liquid A and 2 moles of liquid B make a solution having a total vapour pressure 40 torr. The vapour pressure of pure A and pure B are 45 torr and 30 torr respectively. The above solution 1  
 (a) is an ideal solution.  
 (b) shows positive deviation.  
 (c) shows negative deviation.  
 (d) is a maximum boiling azeotrope.

Given below (Q: nos 13-16) are two statements labelled as Assertion (A) and Reason (R)

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.
- (e) Both A and R are false

13. Assertion (A): Reactivity of alkyl halide in  $S_N2$  substitution is governed by steric factors. 1  
Reason (R): The bulkier the group, that less reactive it will be.
14. Assertion (A): Two liquids nitric acid and water form a maximum boiling azeotrope when mixed in the ratio of 68% and 32% respectively. 1  
Reason (R): Interaction between nitric acid and water are weaker than nitric acid – nitric acid interactions and water-water interactions.
15. Assertion (A): Strong oxidising agents oxidise toluene and its derivatives to benzoic acids. 1  
Reason (R): It is possible to stop the oxidation of toluene at the aldehyde stage with suitable reagents.
16. Assertion (A): Alcohols react both as nucleophiles and electrophiles. 1  
Reason (R): The bond between C–O is broken when alcohols react as nucleophiles.

#### SECTION B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Write short note on 2  
(i) Anoxia  
(ii) Cryoscopic constant
18. Explain the mechanism of acid catalysed hydration of an alkene to form corresponding alcohol. 2
19. (a) Write a chemical test to distinguish between phenol and ethanol. 2  
(b) What happens when propanal is treated with ethyl magnesium bromide followed by hydrolysis.
20. (a) An aldehyde was produced on hydration of an alkyne P in the presence of  $H_2SO_4$  and  $HgSO_4$ . 2  
Identify the alkyne P.  
(b) Draw the structure of Propiophenone.

**OR**

What happens when

- (a) Benzoyl chloride is treated with hydrogen in presence of palladium on barium sulphate.
- (b) Benzene is treated with ethanoyl chloride in presence of anhydrous aluminium chloride.

21. Write equations for the following: 2  
 (a) Ethyl chloride is treated with NaI in the presence of acetone .  
 (b) Chlorobenzene is treated with Na metal in the presence of dry ether.

### SECTION C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. Write the name of the reaction, structure and IUPAC name of the product formed when 3  
 (i) Phenol reacts with  $\text{CHCl}_3$  in the presence of NaOH followed by hydrolysis.  
 (ii)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{ONa}$  reacts with  $\text{C}_2\text{H}_5\text{Br}$  .
23. Write the equations involved in the following reactions: 3  
 (i) Stephen reaction  
 (ii) Gattermann –Koch reaction  
 (iii) Etard's Reaction .
24. How do you convert the following: 3  
 (i) Propene to propanal  
 (ii) Aniline to phenol  
 (iii) Methanal to ethanol
25. Calculate Van't Hoff factor for an aqueous solution of  $\text{K}_3[\text{Fe}(\text{CN})_6]$  if the degree of dissociation is 3  
 0.852. What will be boiling point of this solution if its concentration is 1 molal? ( $K_b = 0.52 \text{ K kg/mol}$ ).

OR

- (a) What will happen when a pressure greater than osmotic pressure is applied on the solution separated by a semipermeable membrane from the solvent? Explain.  
 (b) The osmotic pressure of blood is 8.21 atm at  $37^\circ\text{C}$ . How much glucose should be added per litre for an intravenous injection that is isotonic with blood? ( $R = 0.082 \text{ L atm mol}^{-1}\text{K}^{-1}$ , Molar mass of Glucose =  $180 \text{ g mol}^{-1}$ ).
26. (a) Predict the state of the solute in the following situations : 3  
 (i) Experimentally determined molar mass is more than the true value.  
 (ii) 'i' value is 0.4.  
 (b) Gas (A) is more soluble in water than Gas (B) at the same temperature. Which one of the two gases will have the higher value of  $K_H$  (Henry's constant) and why?
27. Give reasons: 3  
 (i) n-Butyl bromide has higher boiling point than t-butyl bromide.  
 (ii) Racemic mixture is optically inactive.  
 (iii) The presence of nitro group ( $-\text{NO}_2$ ) at o/p positions increases the reactivity of haloarenes towards nucleophilic substitution reactions.

28. Write chemical reactions to show that open structure of D-glucose contains the following : 3
- (i) Straight chain                      (ii) primary alcoholic group                      (iii) a carbonyl group

#### SECTION D

The following questions are case -based questions. Each question has an internal choice and carries 4 (1+1+2) marks each. Read the passage carefully and answer the questions that follow.

29. A nucleophilic substitution reaction that occurs by  $S_N1$  mechanism proceeds in two steps. In the first 4  
step, the bond between the carbon atom and the leaving group breaks to produce a carbocation and most commonly, an anionic leaving group. In the second step, the carbocation reacts with the nucleophile to form the substitution product. The formation of a carbocation is the slow or rate determining step. The rate of  $S_N1$  reactions decrease in the order  $3^\circ > 2^\circ > 1^\circ$ , which is the reverse order observed in  $S_N2$  reactions. In contrast to  $S_N2$  reactions at stereogenic centers, which occur with inversion of configuration,  $S_N1$  reaction gives a racemic mixture of enantiomers that has no optical rotation. The polarity of carbon-halogen bond of alkyl halides is responsible for their nucleophilic substitution, elimination and their reaction with metal atoms to form organometallic compounds. When haloalkanes with  $\beta$  -hydrogen atom are boiled with alcoholic solution of KOH, they undergo elimination of hydrogen halide resulting in the formation of alkenes. These reactions are called  $\beta$  -elimination reactions or dehydrohalogenation reactions. These reactions follow Saytzeff's rule. Substitution and elimination reactions often compete with each other. Mostly bases behave as nucleophiles and therefore can engage in substitution or elimination reactions depending upon the alkyl halide and the reaction conditions.

Answer the following questions :

- (a) Write the IUPAC name of  $\text{CH}_3\text{CH}_2\text{C}(\text{Br})=\text{CH}-\text{Cl}$ .  
(b) What happens when isopropyl chloride is treated with Na in dry ether.  
(c) (i) Predict the major product formed when 2-Bromopentane reacts with alcoholic KOH.  
(ii) Write the name of the product when benzene diazonium chloride is treated with  $\text{Cu}_2\text{Cl}_2$ .

OR

- (i) Which one of the compounds in the following pairs is chiral?



- (ii) Out of  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$  and  $\text{CH}_2=\text{CH}-\text{CH}_2-\text{Cl}$ , which one is more reactive towards  $S_N1$  reaction?

30. Biomolecule is a term used for molecules present in organisms that are essential to one or more typical 4  
biological processes such as cell division, morphogenesis or development. Biomolecules include large macromolecules such as proteins, carbohydrates, lipids and nucleic acids as well as small molecules such as primary metabolites, secondary metabolites and natural products. A more familiar

name for this class of material is biological materials. Biomolecules are usually endogenous produced within the organism but organisms usually need exogenous biomolecules. Synthetic analogs are defined as the artificial compounds differing from the natural compounds in their structure, resemblance and function. Synthetic refers to any material made from non-natural sources. This means that a product such as cloth is made from a chemical source rather than the fibers produced by nature. Biomolecules and their synthetic analogs play vital role in medicine, drug delivery or antiviral agents etc

Answer the following Questions:

- (a) What are the products of hydrolysis of lactose.
- (b) Draw the structure of  $\beta$ -D (-) fructofuranose.
- (c) (i) What do you understand by the term anomers?  
(ii) Which among the following is/are reducing sugars: Maltose, Sucrose, Cellulose, Starch ?

OR

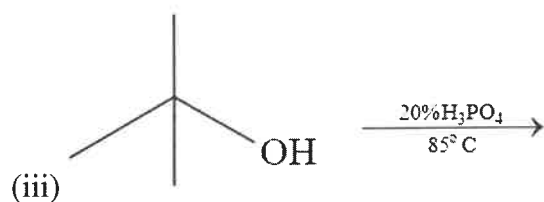
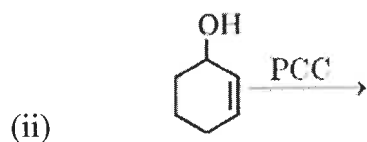
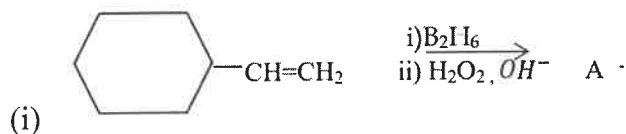
- (i) Name the type of linkage present in nucleotide.
- (ii) Give one functional difference between DNA and RNA.

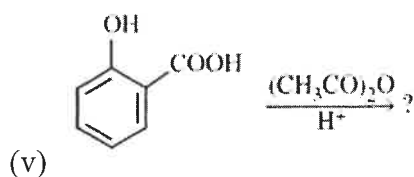
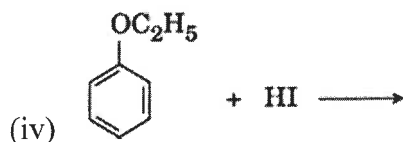
### SECTION E

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

31. (a) Complete the following:

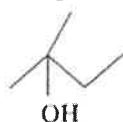
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OR

- (a) Write the structure of the major product obtained from dinitration of 3-methylphenol.  
 (b) How will you synthesis the following alcohol from appropriate alkene :



- (c) Arrange the following compounds in the increasing order of their acid strength :  
 p-cresol, p-nitrophenol, phenol, ethanol
- (d) What happens when (Write equations)  
 (i)  $(\text{CH}_3)_3\text{C} - \text{OH}$  is treated with Cu at 573 K,  
 (ii) Phenol is treated with Zn dust.

32. Attempt any five of the following:

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- What does the primary structure of proteins represent?
- Why is leucine an essential amino acid?
- Give one characteristic feature of myosin, based on its tertiary structure.
- Why do amino acids show amphoteric behavior?
- What structural change will occur when a native protein is subjected to change in pH?
- What is the basic structural difference between starch and cellulose ?
- Write two examples for peptide hormone.

33. (a) Give reasons :

5

- A decrease in temperature is observed on mixing ethanol and acetone.
- An aqueous solutions of potassium chloride freezes at a lower temperature than water.

(b) Calculate the solubility of  $\text{CO}_2$  in water at 298 K under 760 mm Hg. ( $K_H$  for  $\text{CO}_2$  in water at 298 K is  $1.25 \times 10^6$  mm Hg)

(c) 100 g of liquid A (molar mass  $140 \text{ g mol}^{-1}$ ) was dissolved in 1000 g of liquid B (molar mass  $180 \text{ g mol}^{-1}$ ). The vapour pressure of pure liquid B was found to be 500 torr. Calculate the vapour pressure of pure liquid A and its vapour pressure in the solution if the total vapour pressure of the solution is 475 Torr.

**OR**

- (a) What are colligative properties? Write the colligative property which is used to find the molecular mass of macromolecules.
- (b) Scuba divers carry oxygen cylinders diluted with helium. Give reason.
- (c) 0.3 g of acetic acid ( $M = 60 \text{ g mol}^{-1}$ ) dissolved in 30 g of benzene shows a depression in freezing point equal to  $0.45^\circ \text{C}$ . Calculate the percentage association of acid if it forms a dimer in the solution. (Given :  $K_f$  for benzene =  $5.12 \text{ K kg mol}^{-1}$ )

**\*\*\*\*END OF THE QUESTION PAPER\*\*\*\***



ROLL NUMBER				
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SET	B
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HALF YEARLY EXAMINATION 2023  
CHEMISTRY(043)**



CLASS : XII  
DATE: 24-09-2023

TIME ALLOTTED : 3 HRS.  
MAXIMUM MARKS:70

**GENERAL INSTRUCTIONS:**

- a) There are 33 questions in this question paper with internal choice.
- b) SECTION A consists of 16 multiple -choice questions carrying 1 mark each.
- c) SECTION B consists of 5 short answer questions carrying 2 marks each.
- d) SECTION C consists of 7 short answer questions carrying 3 marks each.
- e) SECTION D consists of 2 case - based questions carrying 4 marks each.
- f) SECTION E consists of 3 long answer questions carrying 5 marks each.
- g) All questions are compulsory.

**SECTION A**

The following questions are multiple -choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. The amount of solute (molecular mass 60 g/mol) that must be added to 180 g water so that vapour pressure of water is lowered by 10% is 1  
 (a) 30 g                      (b) 60g                      (c) 120g                      (d) 12g
2. The compound  $\text{CH}_3\text{COCH}_2\text{COOH}$  when treated with  $\text{NaBH}_4$  will give, 1  
 (a)  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_2\text{OH}$   
 (b)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{O}$   
 (c)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$   
 (d)  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{COOH}$
3. Which one of the following alcohols is expected to have the lowest  $\text{pK}_a$  value ? 1  
 (a) Ethanol                      (b) tert-butylalcohol                      (c) Isopropylalcohol                      (d) Methanol
4. The osmotic pressure of equimolar solutions of glucose, sodium chloride and barium chloride will be in the order: 1  
 (a)  $\text{BaCl}_2 > \text{NaCl} > \text{glucose}$                       (b)  $\text{BaCl}_2 > \text{glucose} > \text{NaCl}$   
 (c)  $\text{glucose} > \text{BaCl}_2 > \text{NaCl}$                       (d)  $\text{NaCl} > \text{BaCl}_2 > \text{glucose}$
5. The conversion of an alkyl halide into an alcohol by aqueous  $\text{NaOH}$  is classified as 1  
 (a) A dehydrohalogenation reaction                      (b) A nucleophilic substitution reaction  
 (c) An addition reaction                      (d) A dehydration reaction

6. Which of the following cannot be made by using Williamson Synthesis: 1  
 (a) Methyl phenylether (b) Benzylethylether (c) tert.-butyl methyl ether (d) Ditert-butyl ether
7. Which of the following reagents would one choose to transform  $\text{CH}_3\text{COCl}$  into acetone ? 1  
 (a)  $(\text{CH}_3)_2\text{Cd}$  (b)  $\text{CH}_3\text{MgBr}$  (c)  $\text{CH}_3\text{Cl}$  (d)  $(\text{CH}_3\text{O})_2\text{Mg}$
8. Identify the specific pairs of bases that can form H-bonds between them in a dinucleotide chain : 1  
 (a) A-T, G-C (b) A-C, G-T (c) A-A, T-T (d) G-C, C-T

9.  $\text{X} \xrightarrow{\text{Cl}_2} \text{Benzalchloride} \xrightarrow{\text{Hydrolysis}} \text{Y}$  1

X and Y respectively are

- (a) Benzene, Benzaldehyde  
 (b) Toluene, Benzaldehyde  
 (c) Toluene, Benzoic acid  
 (d) Benzene, Benzoic acid
10. Match the following: 1
- |                     |                          |
|---------------------|--------------------------|
| (i) Glycine         | (j) Dipeptide            |
| (ii) Valine         | (k) Globular protein     |
| (iii) Glycylalanine | (l) Optically inactive   |
| (iv) Albumin        | (m) Essential amino acid |

Which one of the following represent the true match between the pairs ?

- (a) i-l, ii-m, iii-k, iv-j  
 (b) i-m, ii-l, iii-j, iv-k  
 (c) i-l, ii-m, iii-j, iv-k  
 (d) i-k, ii-m, iii-j, iv-l
11. 1 mole of liquid A and 2 moles of liquid B make a solution having a total vapour pressure 40 torr. The vapour pressure of pure A and pure B are 45 torr and 30 torr respectively. The above solution 1
- (a) is an ideal solution.  
 (b) shows positive deviation.  
 (c) shows negative deviation.  
 (d) is a maximum boiling azeotrope
12. If molality of a dilute solution is doubled, the value of the molal elevation constant ( $K_b$ ) will be 1
- (a) halved (b) doubled (c) tripled (d) unchanged

Given below (Q: nos 13-16) are two statements labelled as Assertion (A) and Reason (R)

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.  
 (e) Both A and R are false
13. Assertion (A): Two liquids nitric acid and water form a maximum boiling azeotrope when mixed in the ratio of 68% and 32% respectively. 1  
 Reason (R): Interaction between nitric acid and water are weaker than nitric acid – nitric acid interactions and water-water interactions
14. Assertion (A): Strong oxidising agents oxidise toluene and its derivatives to benzoic acids. 1  
 Reason (R): It is possible to stop the oxidation of toluene at the aldehyde stage with suitable reagents
15. Assertion (A): Alcohols react both as nucleophiles and electrophiles. 1  
 Reason (R): The bond between C–O is broken when alcohols react as nucleophiles.
16. Assertion (A): Reactivity of alkyl halide in  $S_N2$  substitution is governed by steric factors. 1  
 Reason (R): The bulkier the group, that less reactive it will be.

### SECTION B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Suggest a mechanism for the dehydration of ethanol using conc.  $H_2SO_4$  at 413K. 2
18. (a) Write a chemical test to distinguish between phenol and ethanol. 2  
 (b) What happens when propanone is treated with ethyl magnesium bromide followed by hydrolysis.
19. Write equations for the following: 2  
 (a) Benzyl chloride is treated with magnesium in dry ether followed by hydrolysis.  
 (b) Bromoethane is heated with  $AgF$
20. (a) An aldehyde was produced on hydration of an alkyne P in the presence of  $H_2SO_4$  and  $HgSO_4$ . Identify the alkyne P. 2  
 (b) Draw the structure of  $\beta$ -Chloro valeraldehyde

OR

What happens when

- (a) Ethanoyl chloride is treated with hydrogen in presence of palladium on barium sulphate.  
 (b) Ethane nitrile on reaction with methyl magnesium chloride followed by hydrolysis.
21. Write short note on 2  
 (i) Azeotropes  
 (ii) Ebullioscopic constant

### SECTION C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. Write chemical reactions to show that open structure of D-glucose contains the following : 3  
 (i) Straight chain (ii) primary alcoholic group (iii) a carbonyl group

23. Give reasons: 3
- n-Butyl bromide has higher boiling point than t-butyl bromide.
  - Racemic mixture is optically inactive.
  - The presence of nitro group ( $-\text{NO}_2$ ) at o/p positions increases the reactivity of haloarenes towards nucleophilic substitution reactions.
24. Calculate Van't Hoff factor for an aqueous solution of  $\text{K}_3[\text{Fe}(\text{CN})_6]$  if the degree of dissociation is 0.852. What will be boiling point of this solution if its concentration is 1 molal? ( $K_b = 0.52 \text{ K kg/mol}$ ) 3
- OR
- What will happen when a pressure greater than osmotic pressure is applied on the solution separated by a semipermeable membrane from the solvent? Explain.
  - The osmotic pressure of blood is 8.21 atm at  $37^\circ\text{C}$ . How much glucose should be added per litre for an intravenous injection that is isotonic with blood? ( $R = 0.082 \text{ L atm mol}^{-1}\text{K}^{-1}$ , Molar mass of Glucose =  $180 \text{ g mol}^{-1}$ ).
25. (a) Predict the state of the solute in the following situations : 3
- Experimentally determined molar mass is more than the true value.
  - 'i' value is 1.4.
- (b) Gas (A) is more soluble in water than Gas (B) at the same temperature. Which one of the two gases will have the higher value of  $K_H$  (Henry's constant) and why?
26. How do you convert the following: 3
- Propene to propanal
  - Aniline to phenol
  - Methanal to ethanol
27. Write the equations involved in the following reactions: 3
- Stephen reaction
  - Gattermann –Koch reaction
  - Etard's Reaction
28. Write the name of the reaction, structure and IUPAC name of the product formed when 3
- Phenol reacts with  $\text{CHCl}_3$  in the presence of  $\text{NaOH}$  followed by hydrolysis.
  - $\text{C}_6\text{H}_5\text{ONa}$  reacts with  $\text{C}_2\text{H}_5\text{Br}$ .

#### SECTION D

The following questions are case -based questions. Each question has an internal choice and carries 4 (1+1+2) marks each. Read the passage carefully and answer the questions that follow.

29. A nucleophilic substitution reaction that occurs by  $\text{S}_{\text{N}}1$  mechanism proceeds in two steps. In the first step, the bond between the carbon atom and the leaving group breaks to produce a carbocation and most commonly, an anionic leaving group. In the second step, the carbocation reacts with the nucleophile to form the substitution product. The formation of a carbocation is the slow or rate determining step. The rate of  $\text{S}_{\text{N}}1$  reactions decrease in the order  $3^\circ > 2^\circ > 1^\circ$ , which is the reverse 4

order observed in  $S_N2$  reactions. In contrast to  $S_N2$  reactions at stereogenic centers, which occur with inversion of configuration,  $S_N1$  reaction gives a racemic mixture of enantiomers that has no optical rotation. The polarity of carbon-halogen bond of alkyl halides is responsible for their nucleophilic substitution, elimination and their reaction with metal atoms to form organometallic compounds. When haloalkanes with  $\beta$ -hydrogen atom are boiled with alcoholic solution of KOH, they undergo elimination of hydrogen halide resulting in the formation of alkenes. These reactions are called  $\beta$ -elimination reactions or dehydrohalogenation reactions. These reactions follow Saytzeff's rule. Substitution and elimination reactions often compete with each other. Mostly bases behave as nucleophiles and therefore can engage in substitution or elimination reactions depending upon the alkyl halide and the reaction conditions.

Answer the following questions :

- (a) Write the IUPAC name of  $\text{CH}_3\text{CH}_2\text{C}(\text{Br})=\text{CH}-\text{Cl}$ .
- (b) What happens when isopropyl chloride is treated with Na in dry ether.
- (c) (i) Predict the major product formed when 2-Bromopentane reacts with alcoholic KOH.  
(ii) Write the name of the product when benzene diazonium chloride is treated with KI.

**OR**

- (i) Which one of the compounds in the following pairs is chiral?



- (ii) Out of  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$  and  $\text{CH}_2=\text{CH}-\text{CH}_2-\text{Cl}$ , which one is more reactive towards  $S_N1$  reaction?

30. Biomolecule is a term used for molecules present in organisms that are essential to one or more typical biological processes such as cell division, morphogenesis or development. Biomolecules include large macromolecules such as proteins, carbohydrates, lipids and nucleic acids as well as small molecules such as primary metabolites, secondary metabolites and natural products. A more familiar name for this class of material is biological materials. Biomolecules are usually endogenous produced within the organism but organisms usually need exogenous biomolecules. Synthetic analogs are defined as the artificial compounds differing from the natural compounds in their structure, resemblance and function. Synthetic refers to any material made from non-natural sources. This means that a product such as cloth is made from a chemical source rather than the fibers produced by nature. Biomolecules and their synthetic analogs play vital role in medicine, drug delivery or antiviral agents etc

Answer the following questions:

- (a) What are the products of hydrolysis of lactose.
- (b) Draw the structure of  $\alpha\text{-D (+)glucopyranose}$
- (c) (i) What do you understand by the term anomers?  
(ii) Which among the following is/are reducing sugars: Maltose, Sucrose, Cellulose, Starch ?

OR

- (i) Name the type of linkage present in nucleotides.
- (ii) Give one functional difference between DNA and RNA.

### SECTION E

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

31. Attempt any **five** of the following:

5

- (a) What does the primary structure of proteins represent?
- (b) Why is leucine an essential amino acid?
- (c) Give one characteristic feature of myosin, based on its tertiary structure.
- (d) Why do amino acids show amphoteric behavior?
- (e) What structural change will occur when a native protein is subjected to change in pH?
- (f) What is the basic structural difference between starch and cellulose ?
- (g) Write two examples for peptide hormone.

32. (a) Give reasons :

5

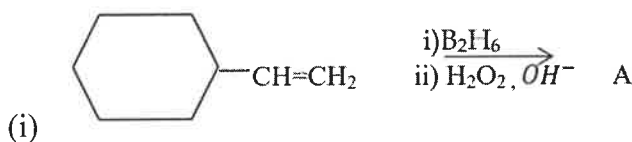
- (i) A decrease in temperature is observed on mixing ethanol and acetone.
- (ii) An aqueous solution of potassium chloride freezes at a lower temperature than water.
- (b) Calculate the solubility of CO<sub>2</sub> in water at 298 K under 760 mm Hg. ( $K_H$  for CO<sub>2</sub> in water at 298 K is  $1.25 \times 10^6$  mm Hg)
- (c) 100 g of liquid A (molar mass 140 g mol<sup>-1</sup>) was dissolved in 1000 g of liquid B (molar mass 180 g mol<sup>-1</sup>). The vapour pressure of pure liquid B was found to be 500 torr. Calculate the vapour pressure of pure liquid A and its vapour pressure in the solution if the total vapour pressure of the solution is 475 Torr.

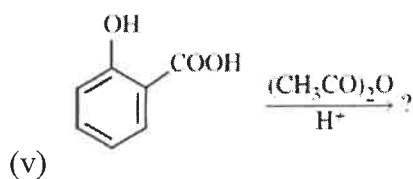
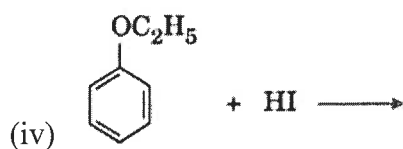
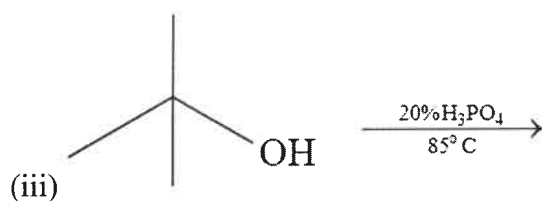
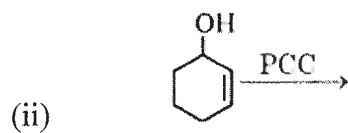
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- (a) What are colligative properties? Write the colligative property which is used to find the molecular mass of macromolecules.
- (b) Scuba divers carry oxygen cylinders diluted with helium. Give reason.
- (c) 0.3 g of acetic acid ( $M = 60$  g mol<sup>-1</sup>) dissolved in 30 g of benzene shows a depression in freezing point equal to 0.45° C. Calculate the percentage association of acid if it forms a dimer in the solution. (Given :  $K_f$  for benzene = 5.12 K kg mol<sup>-1</sup>)

33. (a) Complete the following:

5





OR

- (a) Write the structure of the major product obtained from dinitration of 3-methylphenol.  
 (b) How will you synthesis the following alcohol from appropriate alkene :



- (c) Arrange the following compounds in the increasing order of their acid strength :  
 p-cresol, p-nitrophenol, phenol, Ethanol
- (d) What happens when
- $(CH_3)_3C - OH$  is treated with Cu at 573 K
  - Phenol is treated with Zn dust.

\*\*\*\*END OF THE QUESTION PAPER\*\*\*\*





ROLL  
NUMBER

SET

C



INDIAN SCHOOL MUSCAT  
HALF YEARLY EXAMINATION 2023  
CHEMISTRY(043)



CLASS : XII  
DATE: 24-09-2023

TIME ALLOTTED : 3 HRS.  
MAXIMUM MARKS:70

**GENERAL INSTRUCTIONS:**

- There are 33 questions in this question paper with internal choice.
- SECTION A consists of 16 multiple -choice questions carrying 1 mark each.
- SECTION B consists of 5 short answer questions carrying 2 marks each.
- SECTION C consists of 7 short answer questions carrying 3 marks each.
- SECTION D consists of 2 case - based questions carrying 4 marks each.
- SECTION E consists of 3 long answer questions carrying 5 marks each.
- All questions are compulsory.

SECTION A

The following questions are multiple -choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

- The conversion of an alkyl halide into an alcohol by aqueous NaOH is classified as 1  
(a) A dehydrohalogenation reaction (b) A nucleophilic substitution reaction  
(c) An addition reaction (d) A dehydration reaction
- 1 mole of liquid A and 2 moles of liquid B make a solution having a total vapour pressure 40 torr. 1  
The vapour pressure of pure A and pure B are 45 torr and 30 torr respectively. The above solution  
(a) is an ideal solution.  
(b) shows positive deviation.  
(c) shows negative deviation.  
(d) is a maximum boiling azeotrope
- If molality of a dilute solution is doubled, the value of the molal elevation constant ( $K_b$ ) will be 1  
(a) halved (b) doubled (c) tripled (d) unchanged
- The amount of solute (molecular mass 60 g/mol) that must be added to 180 g water so that vapour 1  
pressure of water is lowered by 10% is  
(a) 30 g (b) 60g (c)120g (d)12g
- The osmotic pressure of equimolar solutions of glucose, sodium chloride and barium chloride will 1  
be in the order:  
(a)  $\text{BaCl}_2 > \text{NaCl} > \text{glucose}$  (b)  $\text{BaCl}_2 > \text{glucose} > \text{NaCl}$   
(c)  $\text{glucose} > \text{BaCl}_2 > \text{NaCl}$  (d)  $\text{NaCl} > \text{BaCl}_2 > \text{glucose}$

6. Which of the following cannot be made by using Williamson Synthesis: 1  
 (a) Methyl phenylether (b) Benzylethylether (c) tert.-butyl methyl ether (d) Ditert-butyl ether
7. Which one of the following alcohols is expected to have the lowest pKa value ? 1  
 (a) Ethanol (b) tert-butylalcohol (c) Isopropylalcohol (d) Methanol
8. The compound  $\text{CH}_3\text{COCH}_2\text{COOH}$  when treated with  $\text{NaBH}_4$  will give, 1  
 (a)  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_2\text{OH}$   
 (b)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{O}$   
 (c)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$   
 (d)  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{COOH}$
9.  $\text{X} \xrightarrow{\text{Cl}_2} \text{Benzalchloride} \xrightarrow{\text{Hydrolysis}} \text{Y}$  1

X and Y respectively are

- (a) Benzene, Benzaldehyde  
 (b) Toluene, Benzaldehyde  
 (c) Toluene, Benzoic acid  
 (d) Benzene, Benzoic acid
10. Which of the following reagents would one choose to transform  $\text{CH}_3\text{COCl}$  into acetone ? 1  
 (a)  $(\text{CH}_3)_2\text{Cd}$  (b)  $\text{CH}_3\text{MgBr}$  (c)  $\text{CH}_3\text{Cl}$  (d)  $(\text{CH}_3\text{O})_2\text{Mg}$
11. Match the following: 1
- |                     |                          |
|---------------------|--------------------------|
| (i) Glycine         | (j) Dipeptide            |
| (ii) Valine         | (k) Globular protein     |
| (iii) Glycylalanine | (l) Optically inactive   |
| (iv) Albumin        | (m) Essential amino acid |

Which one of the following represent the true match between the pairs ?

- (a) i-l, ii-m, iii-k, iv-j  
 (b) i-m, ii-l, iii-j, iv-k  
 (c) i-l, ii-m, iii-j, iv-k  
 (d) i-k, ii-m, iii-j, iv-l
12. Identify the specific pairs of bases that can form H-bonds between them in a dinucleotide chain : 1  
 (a) A-T, G-C (b) A-C, G-T (c) A-A, T-T (d) G-C, C-T
- Given below (Q: nos 13-16) are two statements labelled as Assertion (A) and Reason (R)

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.  
 (e) Both A and R are false

13. Assertion (A): Strong oxidising agents oxidise toluene and its derivatives to benzoic acids. 1  
Reason (R): It is possible to stop the oxidation of toluene at the aldehyde stage with suitable reagents
14. Assertion (A): Reactivity of alkyl halide in  $S_N2$  substitution is governed by steric factors. 1  
Reason (R): The bulkier the group, the less reactive it will be
15. Assertion (A): Alcohols react both as nucleophiles and electrophiles. 1  
Reason (R): The bond between C–O is broken when alcohols react as nucleophiles.
16. Assertion (A): Two liquids nitric acid and water form a maximum boiling azeotrope when mixed in the ratio of 68% and 32% respectively. 1  
Reason (R): Interaction between nitric acid and water are weaker than nitric acid – nitric acid interactions and water-water interactions

### SECTION B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Write short note on 2  
(i) Henry's law  
(ii) Cryoscopic constant
18. Suggest a mechanism for the dehydration of ethanol using conc.  $H_2SO_4$  at 443K. 2
19. (a) Write a chemical test to distinguish between phenol and ethanol. 2  
(b) What happens when propanal is treated with methyl magnesium bromide followed by hydrolysis.
20. (a) An aldehyde was produced on hydration of an alkyne P in the presence of  $H_2SO_4$  and  $HgSO_4$ . 2  
Identify the alkyne P.  
(b) Draw the structure of  $\alpha$ -HydroxyButyraldehyde

OR

What happens when

- (a) Benzoyl chloride is treated with hydrogen in presence of palladium on barium sulphate.  
(b) Benzene is treated with ethanoyl chloride in presence of anhydrous aluminium chloride.
21. Write equations for the following: 2  
(a) Chlorobenzene is treated with Na metal in the presence of dry ether  
(b) Benzyl chloride is treated with magnesium in dry ether followed by hydrolysis.

### SECTION C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. (a) Predict the state of the solute in the following situations : 3  
(i) Experimentally determined molar mass is less than the true value.  
(ii) 'i' value is 0.4.  
(b) Gas (A) is more soluble in water than Gas (B) at the same temperature. Which one of the two gases will have the higher value of  $K_H$  (Henry's constant) and why?

23. Give reasons: 3
- (i) n-Butyl bromide has higher boiling point than t-butyl bromide.
  - (ii) Racemic mixture is optically inactive.
  - (iii) The presence of nitro group ( $-\text{NO}_2$ ) at o/p positions increases the reactivity of haloarenes towards nucleophilic substitution reactions.
24. Write chemical reactions to show that open structure of D-glucose contains the following : 3
- (i) Straight chain
  - (ii) primary alcoholic group
  - (iii) a carbonyl group
25. Write the name of the reaction, structure and IUPAC name of the product formed when 3
- (i) Phenol reacts with  $\text{CHCl}_3$  in the presence of  $\text{NaOH}$  followed by hydrolysis.
  - (ii)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{ONa}$  reacts with  $\text{C}_2\text{H}_5\text{Br}$
26. Write the equations involved in the following reactions: 3
- (i) Stephen reaction
  - (ii) Gattermann –Koch reaction
  - (iii) Etard's Reaction
27. How do you convert the following: 3
- (i) Propene to propanal
  - (ii) Aniline to phenol
  - (iii) Methanal to ethanol
28. Calculate Van't Hoff factor for an aqueous solution of  $\text{K}_3[\text{Fe}(\text{CN})_6]$  if the degree of dissociation is 0.852. What will be boiling point of this solution if its concentration is 1 molal? ( $K_b = 0.52 \text{ K kg/mol}$ ) 3

OR

- (a) What will happen when a pressure greater than osmotic pressure is applied on the solution separated by a semipermeable membrane from the solvent? Explain.
- (b) The osmotic pressure of blood is 8.21 atm at  $37^\circ\text{C}$ . How much glucose should be added per litre for an intravenous injection that is isotonic with blood? ( $R = 0.082 \text{ L atm mol}^{-1}\text{K}^{-1}$ , Molar mass of Glucose =  $180 \text{ g mol}^{-1}$ ).

#### SECTION D

The following questions are case -based questions. Each question has an internal choice and carries 4 (1+1+2) marks each. Read the passage carefully and answer the questions that follow.

29. A nucleophilic substitution reaction that occurs by  $\text{S}_{\text{N}}1$  mechanism proceeds in two steps. In the first step, the bond between the carbon atom and the leaving group breaks to produce a carbocation and most commonly, an anionic leaving group. In the second step, the carbocation reacts with the nucleophile to form the substitution product. The formation of a carbocation is the slow or rate determining step. The rate of  $\text{S}_{\text{N}}1$  reactions decrease in the order  $3^\circ > 2^\circ > 1^\circ$ , which is the reverse order observed in  $\text{S}_{\text{N}}2$  reactions. In contrast to  $\text{S}_{\text{N}}2$  reactions at stereogenic centers, which occur with inversion of configuration,  $\text{S}_{\text{N}}1$  reaction gives a racemic mixture of enantiomers that has no optical rotation. The polarity of carbon-halogen bond of alkyl halides is responsible for their nucleophilic substitution, elimination and their reaction with metal atoms to form organometallic compounds. When haloalkanes with  $\beta$  -hydrogen atom are boiled with alcoholic solution of  $\text{KOH}$ , they undergo 4

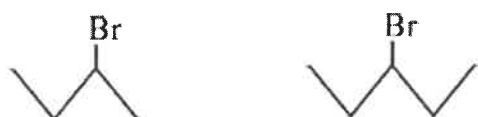
elimination of hydrogen halide resulting in the formation of alkenes. These reactions are called  $\beta$ -elimination reactions or dehydrohalogenation reactions. These reactions follow Saytzeff's rule. Substitution and elimination reactions often compete with each other. Mostly bases behave as nucleophiles and therefore can engage in substitution or elimination reactions depending upon the alkyl halide and the reaction conditions.

Answer the following questions :

- (a) Write the IUPAC name of  $\text{CH}_3\text{CH}_2\text{C}(\text{Br})=\text{CH}-\text{Cl}$ .
- (b) What happens when isopropyl chloride is treated with Na in dry ether.
- (c) (i) Predict the major product formed when 2-Bromopentane reacts with alcoholic KOH.  
(ii) Write the name of the product when benzene diazonium chloride is treated with KI.

**OR**

- (i) Which one of the compounds in the following pairs is chiral?



- (ii) Out of  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$  and  $\text{CH}_2=\text{CH}-\text{CH}_2-\text{Cl}$ , which one is more reactive towards  $\text{S}_{\text{N}}1$  reaction?

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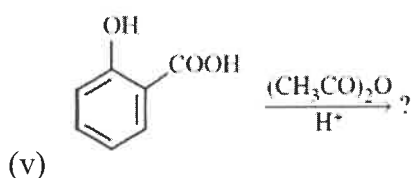
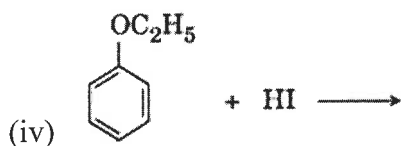
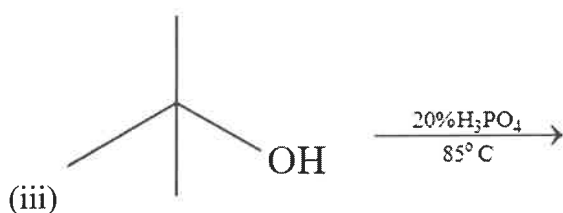
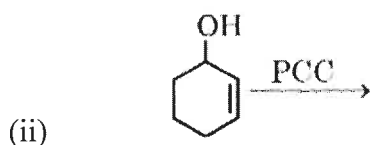
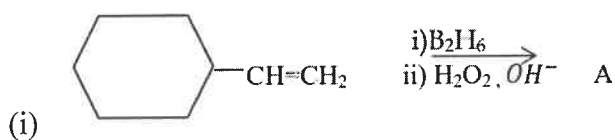
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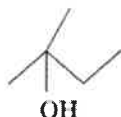
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**\*\*\*\*END OF THE QUESTION PAPER\*\*\*\***

Shri Singh