APEEJAY SCHOOL, SAKET
MID TERM EXAMINATION
SESSION: 2024-2025
SET A

SUB: CHEMISTRY (043)
TIME: 3 Hours **CLASS: XII**
GENERAL INSTRUCTIONS: **M. Marks:70**

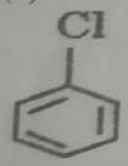
Read the following instructions carefully.
(1) This question paper contains **8** printed pages. There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study-based questions of four marks each and Section E contains three long answer questions of five marks each.
(5) There is no overall choice. However, an internal choice has been provided.
(6) Use of calculators is not allowed.

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. Which of the following is most reactive towards nucleophilic substitution reaction? 1

(a)



(b) CH_3-CH_2-CH_2-Cl
(c) $CH_2 = CH$-Cl
(d) $CH_2 = CH$-CH_2-Cl

2. Match the reagents required for the given reaction 1

Column I	Column II
I. Oxidation or primary alcohol to aldehyde	(p) $NaBH_4$
II. Butan-2-one to Butan-2-ol	(q) 85% Phosphoric acid at 440K
III. Bromination of Phenol to 2,4,6-Tribromophenol	(r) PCC
IV. Dehydration of Propan-2-ol to Propene	(s) Bromine water

(a) I-(r), II-(p), III-(s), IV-(q)
(b) I-(q), II-(r), III-(p), IV-(s)
(c) I-(s), II-(q), III-(p), IV-(r)
(d) I-(p), II-(s), III-(r), IV-(q)

3. Which of the following is the strongest acid? 1
(a) p-Cl C_6H_4COOH
(b) p-OH C_6H_4COOH
(c) C_6H_5COOH
(d) p-NO_2 C_6H_4COOH

4. Maltose is made up of : 1
(a) glucose and fructose
(b) glucose and galactose
(c) glucose and glucose
(d) glucose and ribose

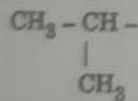
5. The system that forms maximum boiling azeotrope is: 1
(a) CS_2 and acetone
(b) Benzene and toluene
(c) Ethanol and acetone
(d) Chloroform and acetone

6. During electrolysis of aqueous solution of NaCl: 1
(a) H_2 (g) is liberated at cathode
(b) Na is formed at cathode
(c) O_2 (g) is liberated at anode
(d) Cl_2 (g) is liberated at cathode

7. A zero-order reaction is one whose rate is independent of: 1
(a) Presence of light
(b) Concentration of the reactant
(c) Temperature of the reaction
(d) Pressure of the reaction

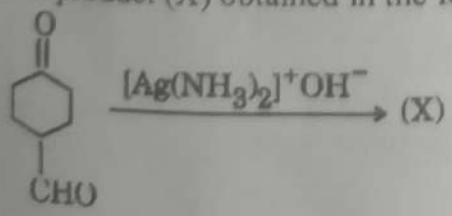
8. The reaction of an alkyl halide with sodium alkoxide forming ether is known as: 1
(a) Wurtz reaction
(b) Reimer-Tiemann reaction
(c) Williamson synthesis
(d) Kolbe reaction

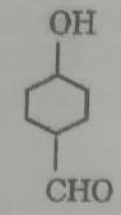
9. The suitable Grignard reagent used for the synthesis of 1

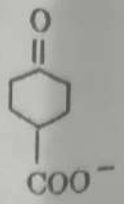


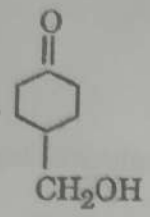
with methanal is:
(a) $(CH_3)_2CH\text{-}CH_2MgBr / H_2O$
(b) CH_3MgBr / H_2O
(c) $(CH_3)_2CHMgBr / H_2O$
(d) $CH_3CH_2CH_2MgBr / H_2O$

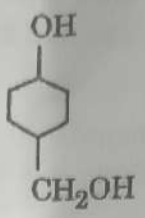
10. The product (X) obtained in the following reaction is: 1



(A) 

(B) 

(C) 

(D) 

11. All proteins on hydrolysis give: 1
(a) Enzymes (b) α-amino acids (c) Glucose (d) Polypeptides

12. The relative lowering of vapour pressure of an aqueous solution containing non-volatile solute is 0·0225. The mole fraction of the non-volatile solute is: 1
(a) 0·80 (b) 0·725
(c) 0·15 (d) 0·0225

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):** Activation complex for the forward reaction will have lower energy than that for the backward reaction in an exothermic reaction. 1
Reason (R): Reactants have greater energy than products for an exothermic reaction.

14. **Assertion (A):** Alternating current is used to measure resistance of an electrolytic solution. 1
Reason (R): Composition of the electrolyte does not change if AC is used, electrolysis is prevented and concentration of ions in solution remains unchanged.

15. **Assertion (A):** The unit of the rate constant is independent of the order of the reaction. 1
Reason (R): The power of concentration terms in the rate equation keeps changing with change in order.

16. **Assertion (A):** On increasing dilution, the specific conductance keeps on increasing. 1
Reason (R): On increasing dilution, the degree of ionisation of weak electrolyte increases.

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. Give reasons for the following: 2
(a) Phenol is more acidic than methanol.
(b) The C—O—H bond angle in alcohols is slightly less than the tetrahedral angle (109°28′).

18. Give chemical tests to distinguish between the following pairs of compounds: 2
(a) Pentan-2-ol and Pentan-3-ol
(b) Ethanol and Phenol

19. Write the chemical equations when: 2
(a) Ethanal is treated with 2,4-dinitrophenylhydrazine?
(b) Propanone is treated with Zn(Hg) and conc. HCl ?

20. What happens when D-glucose is treated with the following reagents? 2
(a) H_2N-OH
(b) $(CH_3CO)_2O$

OR

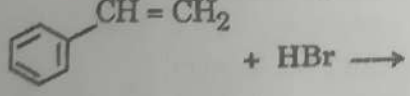
(a)The two strands of DNA are not identical but complementary. Comment.
(b) What are the different types of RNA?

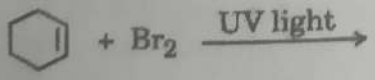
21. The vapour pressures of A and B at 25°C are 75 mm Hg and 25 mm Hg, respectively. If A and B are mixed such that the mole fraction of A in the mixture is 0·4, then calculate the mole fraction of B in the vapour phase. 2

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) Draw the structures of major monohalo products in each of the following reactions: 3

(i) 

(ii) 

(b) Grignard reagent should be prepared under anhydrous conditions. Give reason.

23. (a) Which of the following is an allylic halide? 3
(i) CH_3-CH = CH-Br
(ii)

$$CH_2 = CH - \underset{\displaystyle Br}{\underset{|}{CH}} - CH_3$$

(b) Out of chlorobenzene and 2,4,6-trinitrochlorobenzene, which is more reactive towards nucleophilic substitution and why?
(c) Which isomer of C_4H_9Cl has the lowest boiling point?

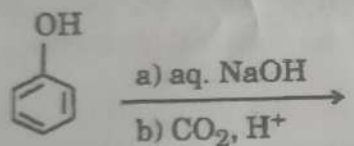
24. The following initial rate data were obtained for the reaction: 3
$2NO\ (g) + Br_2\ (g) \rightarrow 2NOBr\ (g)$

Expt. No.	[NO]/mol L^{-1}	[Br_2]/mol L^{-1}	Initial Rate (mol L^{-1} s^{-1})
1	0·05	0·05	$1·0 \times 10^{-3}$
2	0·05	0·15	$3·0 \times 10^{-3}$
3	0·15	0·05	$9·0 \times 10^{-3}$

(a) What is the order with respect to NO and Br_2 in the reaction?
(b) Calculate the rate constant (k).
(c) Determine the rate of reaction when concentration of NO and Br_2 are 0·4 M and 0·2 M, respectively.

25. Write the main product in each of the following reactions: 3

(i) $CH_3 - CH_2 - CH = CH_2 \xrightarrow[b)\ 3H_2O_2/OH^-]{a)\ B_2H_6}$

(ii) 

(iii) $CH_3-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CHO \xrightarrow{NaBH_4}$

26. Give the equations of reactions for the preparation of: (any three) 3
(a) Phenol from chlorobenzene
(b) Salicylaldehyde from phenol
(c) 2-Methoxyacetophenone from anisole
(d) Picric acid from phenol

27. (a) Name the starting material used in the industrial preparation of phenol. 3
(b) Write a complete reaction for the bromination of phenol in an aqueous and non-aqueous medium.
(c) Explain why Lewis acid is not required in the bromination of phenol?

28. Compound (A) ($C_6H_{12}O_2$) on reduction with $LiAlH_4$ gives two compounds (B) and (C). The compound (B) on oxidation with PCC gives compound (D) which upon treatment with dilute NaOH and subsequent heating gives compound (E). Compound (E) on catalytic hydrogenation gives compound (C). The compound (D) is oxidized further to give compound (F) which is 3

found to be a monobasic acid (Molecular weight = 60). Identify the compounds (A), (B), (C), (D), (E) and (F).

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. **Read the given passage and answer the questions:** 4

In a clinical setting, the understanding of osmotic pressure and solubility plays a critical role in patient care. When blood cells are placed in an aqueous solution, the concentration of solutes, such as sodium chloride (NaCl), must be carefully controlled. For example, intravenous solutions typically contain 0.9% NaCl to maintain isotonic conditions with blood plasma. Deviations from this concentration can cause osmotic imbalances, leading to cellular shrinkage or swelling. Additionally, the solubility of gases like carbon dioxide (CO_2) and oxygen (O_2) in water is crucial in respiratory functions. CO_2 is more soluble than O_2 at the same temperature, which influences its transport in the blood. Colligative properties, such as osmotic pressure, are essential in determining the molar mass of macromolecules, and osmotic pressure is often the property of choice due to its sensitivity to solute concentration. These principles are vital in both medical applications and in understanding fundamental chemical processes.

Answer the following questions:

(a) How does the size of blood cells change when placed in an aqueous solution containing more than 0·9% (mass/volume) sodium chloride?

OR

(a) Why are equimolar solutions of sodium chloride and glucose not isotonic?

(b) At the same temperature, CO_2 gas is more soluble in water than O_2 gas. Which one of them will have higher value of K_H and why?

(c) Define colligative property. Which colligative property is preferred for the molar mass determination of macromolecules?

30. **Read the given passage and answer the questions:** 4

In chemical processes, various factors influence how quickly reactions proceed and products form. Temperature changes often impact these reactions, as does the number of molecules interacting at any given time. Understanding these interactions requires considering how reactant concentrations influence the reaction rate, especially in cases where multiple substances combine to form a product.

In some reactions, the rate depends on how the concentration of one or more reactants changes over time. These changes can be observed through a graph of concentration versus time, where the slope of the curve provides valuable information about the reaction's progress. Additionally, analyzing the relationship between the reactants' concentrations can help predict

how the reaction will respond to changes in these concentrations.

Answer the following questions:

(a) Why does the rate of a reaction increase with a rise in temperature?

(b) Why is the probability of reaction with molecularity higher than three very rare?

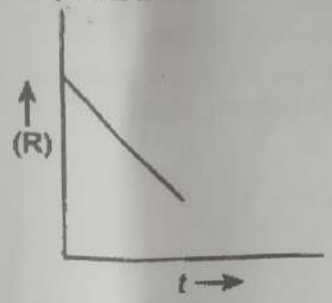
(c) For a reaction $A + B \rightarrow P$, the rate is given by Rate = $k[A]^2[B]$

(i) How is the rate of reaction affected if the concentration of A is doubled?

(ii) What is the overall order of reaction if B is present in large excess?

OR

For a chemical reaction $R \rightarrow P$, the variation in the concentration (R) vs. time (t)



(i) Predict the order of the reaction.

(ii) What is the slope of the curve?

SECTION E

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

34. Attempt any **five** of the following: 5

(a) Describe the linkage that is present between the molecules of amino acids in a polypeptide.

(b) What type of bonds hold a DNA double helix together?

(c) Which one of the following is a polysaccharide?
Sucrose, Ribose, Galactose, Starch, Fructose

(d) Give one example each for water-soluble vitamins and fat-soluble vitamins.

(e) Name the isomers of glucose which in the cyclic form differ only in the configuration of the -OH group at C-1.

(f) What are reducing sugars?

(g)What is the significance of vitamin K in the coagulation of blood?

35. (a) The cell potential of Mercury cell is 1·35 V, and remains constant during its life. Give reason. 5

(b) Write two advantages of fuel cells over other galvanic cells.

(c) When a certain conductivity cell was filled with 0·1 M KCl solution, it has a resistance of 85 ohm at 25°C. When the same cell was filled with 0·052 M $AgNO_3$ solution, the resistance was 96 ohm. Calculate the conductivity and molar conductivity of $AgNO_3$ solution.
(Given: Conductivity of 0·1 M KCl solution = $1{\cdot}29 \times 10^{-2}$ ohm^{-1} cm^{-1})

OR

(a) State the relationship amongst cell constant for a cell, resistance of the solution in the cell

and conductivity of the solution. How is molar conductivity of a solution related to conductivity of its solution?

(b) A voltaic cell is set up at 25°C with the following half-cell;

Al/Al^{3+} (0.001 M) and Ni/Ni^{2+}(0.50 M)

Calculate the cell voltage.

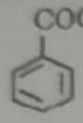
[Given: $E^{\circ}_{Ni^{2+}/Ni} = -0.25$ V, $E^{\circ}_{Al^{3+}/Al} = -1.66$ V]

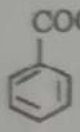
33. (a)(i) Account for the following: 5

(1) Oxidation of aldehydes is easier as compared to ketones.

(2) The alpha (α) hydrogen atoms of aldehydes are acidic in nature.

(ii) Write the products in the following reactions:

(1)  $\xrightarrow{NaOH / I_2}$? + ?

(2)  + $(CH_3)_2Cd \longrightarrow$? + $CdCl_2$

(iii) Give a simple chemical test to distinguish between ethanoic acid and ethanal.

OR

(b) (i) Draw structure of the 2,4-dinitrophenylhydrazone of benzaldehyde.

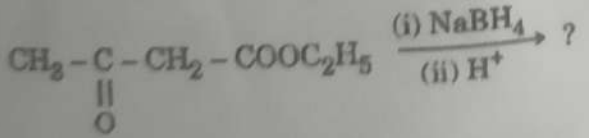
(ii) Arrange the following in increasing order of their reactivity towards HCN:

CH_3COCH_3 , $(CH_3)_3C\text{-}COCH_3$, CH_3CHO

(iii) How can you convert phenyl magnesium bromide to benzoic acid?

(iv) Give a simple chemical test to distinguish between benzaldehyde and ethanal.

(v) Write the main product in the following reaction:



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