



INDIAN SCHOOL SOHAR
TERM- 1 EXAMINATION (2023-24)
CHEMISTRY THEORY (043)

CLASS : XII
 DATE : 17/09/23

MAX. MARK : 70
 TIME : 3Hours

General instructions:

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 question carrying **4** marks.
6. **SECTION E-** consists of 3 long answer questions carrying **5** marks with internal choice.
7. **All questions are compulsory.**
8. **Use of log tables and 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 **Equimolar solutions in the same solvent will have:**
 - a) Different boiling and different freezing points
 - b) Same boiling and Same freezing points
 - c) Same boiling and different freezing points
 - d) Different boiling and different freezing points
- 2 **The role of a catalyst is to change _____.**
 - a) Gibbs energy of reaction.
 - b) Enthalpy of reaction.
 - c) Activation energy of reaction.
 - d)Equilibrium constant
- 3 **The limiting molar conductivity for NaCl, KBr and KCl are 126,152 and150 Scm²mol⁻¹ , the limiting molar Conductivity of NaBr is:**
 - a)278 Scm²mol⁻¹
 - b)176 Scm²mol⁻¹
 - c) 128 Scm²mol⁻¹
 - d) 302 Scm²mol⁻¹
- 4 **Chlorination of toluene in presence of sunlight and heat and followed by treatment with aqueous NaOH gives**
 - a) o-cresol
 - b) p-cresol
 - c) 2,4-dihydroxytoluene
 - d) Benzoic acid
- 5 **The most suitable reagent for the conversion of primary alcohol to aldehyde is :**
 - a) PCC
 - b) K₂Cr₂O₇
 - c) KMnO₄
 - d) CrO₃
- 6 **Molal depression constant for water 1.86°C/m. The freezing point of a 0.05molal solution of a non-electrolyte in water is:**
 - a) -1.86°C
 - b) -0.93°C
 - c) -0.093°C
 - d) 0.93°C

- 7 **HVZ reaction is used to prepare :**
- β -haloacid
 - α -haloacid
 - α, β -unsaturated add
 - None of these
- 8 **According to Maxwell Boltzmann distribution of energy,**
- The fraction of molecules with most probable kinetic energy does not change at higher temperatures.
 - The fraction of molecules with most probable kinetic energy increases at higher temperatures.
 - Most probable kinetic energy increases at higher temperatures.
 - Most probable kinetic energy decreases at higher temperatures.
- 9 **Identify the set of reagent reaction conditions 'X' and 'Y' in the following set of transformation:**
- $$\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} \xrightarrow{\text{X}} \text{Product} \xrightarrow{\text{Y}} \text{CH}_3\text{CH}(\text{Br})\text{CH}_3$$
- X = dil. aq. NaOH, 20°C ; Y = HBr / acetic acid, 20°C
 - X = Conc. alc. NaOH, 80°C ; Y = HBr / acetic acid, 20°C
 - X = dil. aq. NaOH, 20°C ; Y = Br₂ / CHCl₃, 0°C
 - X = Conc. alc. NaOH, 80°C ; Y = Br₂ / CHCl₃, 0°C
- 10 **When compound X is oxidized by acidified potassium dichromate, compound Y is formed. Compound Y on reduction with LiAlH₄ gives X. (X) and (y) respectively are:**
- C₂H₅OH, CH₃COOH
 - CH₃COCH₃, CH₃COOH
 - C₂H₅OH, CH₃COCH₃
 - CH₃CHO, CH₃COCH₃
- 11 **Which of the following compound will undergo self-aldol condensation in the presence of cold dilute alkali?**
- CH \equiv C-CHO
 - CH₂ = C(CH₃)CHO
 - C₆H₅CHO
 - CH₃CH₂CHO
- 12 **Which of the following 0.1 M aqueous solutions will have the lowest freezing point?**
- potassium sulphate
 - sodium chloride
 - urea
 - glucose
- In the following questions, statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices:**
- Assertion and Reason both are correct statements and Reason is the correct explanation for assertion.
 - Assertion and Reason both are correct statements but reason is **not** the correct explanation for assertion.
 - Assertion is correct statement, but Reason is wrong statement.
 - Assertion is wrong statement, but Reason is correct statement
- 13 **Assertion (A) :** Aldehyde and ketone have higher boiling point than alcohols.
Reason(R) : Alcohols are associated by intermolecular hydrogen bonding while aldehyde and Ketone lack hydrogen bonding.
- 14 **Assertion (A) :** *p*- Nitro phenol is more acidic than phenol.
Reason (R) : *m*- & *p*- Nitro phenols exist as associated molecules.

- 15 Assertion (A) :** In monohaloarenes , further electrophilic substitution occurs at *ortho* and *para* positions.
Reason (R) : Halogen atom is a ring deactivator.
- 16 Assertion (A) :** All natural and artificial radioactive decay of unstable nuclei take place by first order kinetics.
Reason (R) : In a first order reaction half-life is independent of initial concentration.

SECTION B

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

- 17** Why is freezing point depression 0.1M sodium chloride solution nearly twice then that of 0.1M glucose solution?
- 18** During nuclear explosion, one of the products is ^{90}Sr with half-life of 28.1 years. If $1\mu\text{g}$ of ^{90}Sr was absorbed in the bones of a newly born baby instead of calcium, how much of it will remain after 10 years and 60 years if it is not lost metabolically.
- 19** Explain why:
 (a) The dipole moment of chlorobenzene is lower than that of cyclohexyl chloride.
 (b) Alkyl halides, though polar, are immiscible with water.
- OR

What happens when

- (i) Chlorobenzene is treated with $\text{Cl}_2/\text{FeCl}_3$.
 (ii) Ethyl chloride is treated with AgNO_2 .
- 20** The boiling point elevation of 0.6 g acetic acid in 100g benzene is 0.1265k. What conclusion can you draw about the state of solute in solution? Molar elevation constant for benzene is 2.53 Kkg/mol?
- 21** a) Predict the order of reactivity of the following compounds in $\text{S}_\text{N}1$ reaction :
 $\text{C}_6\text{H}_5\text{CH}_2\text{Br}$, $\text{C}_6\text{H}_5\text{C}(\text{CH}_3)(\text{C}_6\text{H}_5)\text{Br}$, $\text{C}_6\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{Br}$, $\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{Br}$
 b) Give reason:
 The product formed during $\text{S}_\text{N}1$ reaction is a racemic mixture.

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** i) Write the chemistry of recharging the lead storage battery, highlighting all the materials that are involved during recharging.
 ii) At 298 K, the molar conductivities at infinite dilution of NH_4Cl , NaOH and NaCl are 129.8, 217.4 and 108.9 $\text{SCm}^2\text{mol}^{-1}$ respectively. The molar conductivity of 0.01M NH_4OH solution is 9.33 $\text{SCm}^2\text{mol}^{-1}$, Calculate the degree of dissociation of NH_4OH at this dilution? What is the percentage of NH_4OH at this dilution?
- 23** a) Write the mechanism of hydration of ethene to yield ethanol.
 b) Explain how does the -OH group attached to a carbon of benzene ring activate it towards electrophilic substitution?
- 24** a) Why is sulphuric acid not used during the reaction of alcohols with KI?
 b) How the following conversions can be carried out?
 i) Benzyl alcohol to phenyl ethanoic acid
 ii) 2-Chlorobutane to 3, 4-dimethylhexane

- 25 Show that the time required for 99% completion of a first order reaction is twice the time required for the completion of 90% of reaction.

OR

- a) Rate constant k for a first order reaction has been found to be $2.54 \times 10^{-3} \text{ sec}^{-1}$. Calculate its $\frac{3}{4}$ th life.
- b) A reaction is found to be zero order. Will its molecularity be zero?
- c) In which order of reaction, rate of reaction becomes equal to specific reaction rate?
- 26 A) Give simple chemical tests to distinguish between the following pairs of compounds.
- (i) Propanal and Propanone
- (ii) Ethanal and Propanal
- B) What is the function of BaSO_4 in Rosenmund reaction?
- 27 a) Henry's law constant for the molality of methane in benzene at 298 K is $4.27 \times 10^5 \text{ mmHg}$. Calculate the solubility of methane in benzene at 298 K under 760 mm Hg.
- b) How is boiling point changed when mass of solvent is doubled?
- 28 A) Write the structures of the following compounds.
- i) α -Methoxypropionaldehyde
- ii) 2-Hydroxycyclopentanecarbaldehyde
- B) What is the aldol condensation reaction? Illustrate with propan-3-one.

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 Standard electrode potentials are used for various processes:
- It is used to measure relative strengths of various oxidants and reductants.
 - It is used to calculate standard cell potential.
 - It is used to predict possible reactions.
- A set of half-reactions (in acidic medium) along with their standard reduction potential, E° (in volt) values are given below:
- $\text{I}_2 + 2\text{e}^- \rightarrow 2\text{I}^-; E^\circ = 0.54 \text{ V}$
- $\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-; E^\circ = 1.36 \text{ V}$
- $\text{Mn}^{3+} + \text{e}^- \rightarrow \text{Mn}^{2+}; E^\circ = 1.50 \text{ V}$
- $\text{Fe}^{3+} + \text{e}^- \rightarrow \text{Fe}^{2+}; E^\circ = 0.77 \text{ V}$
- $\text{O}_2 + 4\text{H}^+ + 4\text{e}^- \rightarrow 2\text{H}_2\text{O}; E^\circ = 1.23 \text{ V}$

Answer the following:

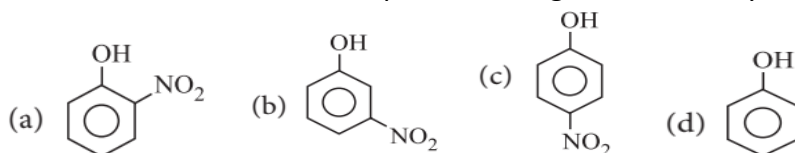
- a) 'Mn³⁺ is not stable in acidic medium, while Fe³⁺ is stable'. Why?
- b) Which of the following statements is correct? Why?
I⁻ is oxidised by chlorine or Fe²⁺ is oxidised by iodine.
- c) Find the emf for the following reaction
 $\text{I}_2 + 2\text{KI} \rightarrow 2\text{KI} + \text{Cl}_2$

OR

- c) Find from the emf of the reaction $\text{Fe}^{3+} + \text{Mn}^{2+} \rightarrow \text{Fe}^{2+} + \text{Mn}^{3+}$ whether this reaction occurs or not. Why?

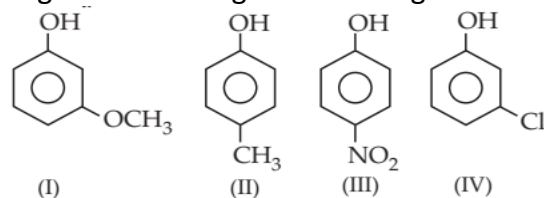
30 Both alcohols and phenols are acidic in nature, but phenols are more acidic than alcohols. Acidic strength of alcohols mainly depends upon the inductive effect. Acidic strength of phenols depends upon a combination of both inductive effect and resonance effects of the substituent and its position on the benzene ring. Electron withdrawing groups increases the acidic strength of phenols whereas electron donating groups decreases the acidic strength of phenols. Phenol is a weaker acid than carboxylic acid.

- a) Why Phenols are highly acidic as compare to alcohols?
 b) Arrange the following in decreasing order of acidic strength.
 (I) H_2O (II) $\text{CH}_3\text{CH}_2\text{OH}$ (III) $\text{C}_6\text{H}_5\text{OH}$ (IV) *p*-chloro phenol
 c) Which is the most acidic compound among these and why?



OR

Arrange the following in decreasing order of PKa value



SECTION E

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

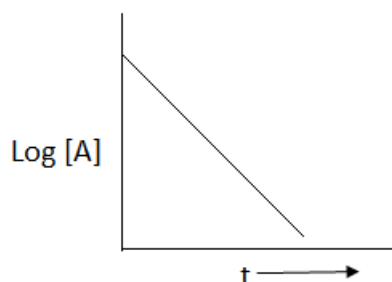
- 31** a) The rate of the chemical reaction doubles for an increase of 10 K in absolute temperature from 298 K. Calculate E_a . ($R = 8.314 \text{ JK}^{-1}\text{mol}^{-1}$).
 b) For a reaction $\text{A} + \text{B} \rightarrow \text{P}$, the rate law is given by

$$r = k [\text{A}^{1/2}] [\text{B}]^2$$

 What is the order of this reaction?
 c) A first order reaction is found to have a rate constant $k = 5.5 \times 10^{-14} \text{ s}^{-1}$. Find the half-life of the reaction.

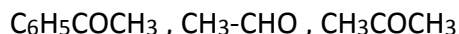
OR

- a) The rate of a reaction quadruples when the temperature changes from 293 K to 313 K. Calculate the energy of activation of the reaction assuming that it does not change with temperature.
 ($R=8.314\text{Jk}^{-1}\text{mol}^{-1}$, $\text{Log } 4= 0.6020$)
 b) For a chemical reaction $\text{A} \rightarrow \text{P}$, the variation in the concentration of log A vs time.

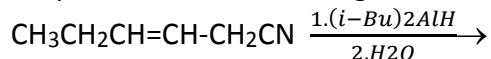


- (i) Predict the order of the reaction.
 (ii) What is the slope of the curve?
 c) In some cases, it is found that a large number of colliding molecules have energy more than threshold energy but yet the reaction is slow. Why?

- 32 (a) Write the chemical reaction involved in Wolf-Kishner reduction.
 (b) Arrange the following in the increasing order of their reactivity towards nucleophilic addition reaction:



- (c) Why carboxylic acid does not give reactions of carbonyl group.
 (d) Write the product in the following reaction :



- (e) **A** and **B** are two functional isomers of compound $\text{C}_6\text{H}_6\text{O}$. On heating with NaOH and I_2 , isomer **B** forms yellow precipitate of iodoform whereas isomer **A** does not form any precipitate. Write the formulae of **A** and **B**.

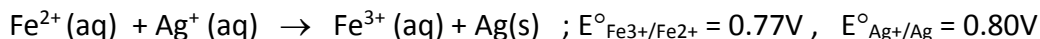
OR

- A) An organic compound (A) (molecular formula $\text{C}_8\text{H}_{16}\text{O}_2$) was hydrolysed with dilute sulphuric acid to give a carboxylic acid (B) and an alcohol (C). Oxidation of (C) with chromic acid also produced (B). On dehydration (C) gives but-1-ene. Write the equations for the reactions involved.
- B) How to obtain:
 i) Benzaldehyde from Toluene
 ii) Acetic acid from Methanol

- 33 A) The molar conductivity of 0.025 mol L^{-1} methanoic acid is $46.1 \text{ S cm}^2 \text{ mol}^{-1}$. Calculate its degree of dissociation and dissociation constant.

$$\text{Given } \lambda^\circ \text{H}^+ = 349.6 \text{ S cm}^2 \text{ mol}^{-1} \text{ and } \lambda^\circ(\text{HCOO}^-) = 54.6 \text{ S cm}^2 \text{ mol}^{-1}$$

- B) Calculate the standard cell potentials of galvanic cells in which the following reactions take place:



Calculate the $\Delta_f G^\circ$, and equilibrium constant of the reactions.

$$F = 964500 \text{ C mol}^{-1}, R = 8.314 \text{ JK}^{-1}\text{mol}^{-1}$$

OR

- A) Calculate ΔG° for the reaction 25°C , $\text{Zn}(\text{s})/\text{Zn}^{2+}(0.0004\text{m}) \parallel \text{Cd}^{2+}(0.2\text{m})/\text{Cd}(\text{s})$.
 $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.763\text{V}$, $E^\circ_{\text{Cd}^{2+}/\text{Cd}} = -0.403\text{V}$. Calculate the E_{cell} of reaction at 25°C
 ($F = 96500 \text{ C mol}^{-1}$, $R = 8.314 \text{ J/Kmol}$.)

- B) What is the half cell potential for Fe^{3+}/Fe electrode in which $[\text{Fe}^{3+}] = 0.1\text{m}$.
 Given ($E^\circ_{\text{Fe}^{3+}/\text{Fe}^{2+}} = 0.77\text{V}$)
