FIRST TERM EXAMINATION, 2024-25

CLASS XII

SUBJECT - CHEMISTRY THEORY (043)

Max. Marks:70 **Time: 3 hours**

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 type questions. Each question carries 1 mark.

(iv)Sections B - questions number 17 to 21 are very short answer type questions. Each question carries 2 marks.

(v)Sections C - questions number 22 to 28 are short answer type questions. Each question carries 3 marks

(vi) Section D- questions number 29 and 30 are case-based questions. Each question carries 4 marks.

(vii)Sections E - questions number 31 to 33 are long answer type questions. Each question carries 5 marks.

(viii) Use of calculators is not allowed.

SECTION A

1.The Gabriel phthalimide synthesis is used for the preparation of:

(a) primary aromatic amines

(b) primary aliphatic amines

(c) secondary amines

(d) tertiary amines

2. Which one of the following pairs will not form an ideal solution?

(a)Benzene and Toluene

(b)Nitric acid and Water

(c)Hexane and Heptane

(d)Ethyl chloride and Ethyl bromide

3. Scurvy is caused by the deficiency of vitamin:

(a) E (b) A (c) C (d) D

4. Phenol dimerises in benzene having van't Hoff factor 0.54. Its degree of association is:

(a) 0.54 (b) 0.46 (c) 0.92 (d) 0.27

5.A alpha helix is a structural feature of

(a) Sucrose (b) Nucleotides (c) Polypeptides (d) Starch

6.Racemisation occurs in

(a) SN^1 reaction
(b) SN^2 reaction
(c) Neither SN^1 nor SN^2 reaction
(d) SN^2 reaction as well as SN^1 reaction

7. Which of the following alcohols will not undergo oxidation?

(a) Butanol (b)2-Methylbutan-2-ol
(c) Butan-2-ol (d) 3-Methylbutan-2-ol

8.Out of the following alkenes, the one which will produce tertiary butyl alcohol on acid catalysed hydration is
(a) $CH_3CH_2CH = CH_2$
(b) $CH_3\text{-}CH{=}CH\text{-}CH_3$
(c) $CH_3CH{=}CH_2$
(d) $(CH_3)_2C = CH_2$

9.Which one of the following has lowest pKa value?
(a) $CH_3\text{-}COOH$
(b) $Cl\text{-}CH_2\text{-}COOH$
(c) $O_2N\text{-}CH_2\text{-}COOH$
(d) HCOOH

10.Acetyl chloride is treated with H_2 in the presence of $Pd\text{-}BaSO_4$. The product form
(a) CH_3CH_2OH
(b) CH_3CHO
(c) CH_3COOH
(d) CH_3COCH_3

11. Which of the following would not be a good choice for reducing nitrobenzene to
(a) $LiAlH_4$ (b)Fe and HCl (c) H_2/Ni (d) Sn and HCl

12. Kohlrausch gave the following relation for strong electrolyte:

$$\Lambda = \Lambda_o - A\sqrt{C}$$

Which of the following equality holds true?

(a) $\Lambda = \Lambda_o$ as $C \longrightarrow \sqrt{A}$
(b) $\Lambda = \Lambda_o$ as $C \longrightarrow 0$
(c) $\Lambda = \Lambda_o$ as $C \longrightarrow \infty$
(d) $\Lambda = \Lambda_o$ as $C \longrightarrow 1$

Given below are two statements labelled as Assertion (A) and Reason (R)

3.Assertion (A): tert-Butyl bromide undergoes Wurtz reaction to give 2, 2, 3, 3-tetramethylbutane.
Reason (R): In Wurtz reaction, alkyl halides react with sodium in dry ether to give hydrocarbon containing double the number of carbon atoms present in the halide. (A)

Select the most appropriate answer from the options given below:
) Both A and R are true and R is the correct explanation of A
) Both A and R are true but R is not the correct explanation of A.
) A is true but R is false.
) A is false but R is true.

(C)

. Assertion (A): Electrolysis of aqueous solution of NaCl gives chlorine gas at anode instead oxygen gas.
eason (R): Formation of oxygen gas at anode requires overpotential.

elect the most appropriate answer from the options given below:

) Both A and R are true and R is the correct explanation of A
) Both A and R are true but R is not the correct explanation of A.
) A is true but R is false.
) A is false but R is true

5. Assertion (A): Nucleophilic substitution of iodoethane is easier than chloro ethane.
eason (R): Bond energy of C - Cl bond is less than C - I bond. (C)

elect the most appropriate answer from the options given below:

) Both A and R are true and R is the correct explanation of A
) Both A and R are true but R is not the correct explanation of A.
) A is true but R is false.
) A is false but R is true

. Assertion (A): When NaCl is added to water, a depression in freezing point is observed.
eason (R): The lowering of vapour pressure of a solution causes depression in the Freezing point. (A)

lect the most appropriate answer from the options given below:
Both A and R are true and R is the correct explanation of A
Both A and R are true but R is not the correct explanation of A.
A is true but R is false.
A is false but R is true

SECTION -B

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

7. What happens when D-glucose is treated with the following reagents?

a) Br_2 water (b) HCN

18. Define azeotrope. Give an example of minimum boiling azeotrope.

OR

What is Henry's law? Give one application of it.

19. Calculate the potential of Iron electrode in which the concentration of Fe^{2+} is 0.01 M.

($E^{\circ}_{Fe^{2+}/Fe} = -0{\cdot}45$ V at 298 K)

[Given : log 10 = 1]

20. Write the chemical equations when :

(a)Pentan-3-one is treated with $H_2N\text{-}NH_2$ followed by heating with KOH in high boiling solvent such as ethylene glycol.

(b)Two molecules of $(CH_3)_3C$ -CHO are treated with conc. NaOH.

21.(a) Arrange the following in the increasing order of their pK_b values in aqueous solution:

$C_2H_5NH_2$, $(C_2H_5)_2NH$, $(C_2H_5)_3N$

(b) Aniline on nitration gives a substantial amount of m-nitroaniline, though amino group is o/p directing. Why?

SECTION -C

22. a)Define Osmotic pressure.

b) A 3% solution of glucose (molar mass = 180 g mol^{-1}) is isotonic with 2.5% solution of an unknown organic substance. Calculate the molecular weight of the unknown organic substance.

23. (a) What is the other name of vitamin B_6 ?

(b) Name the vitamin whose deficiency causes increased blood clotting time.

(c) Xerophthalmia is caused by the deficiency of which vitamin? Give two sources of this vitamin.

24. (a)Which of the following is an allylic halide?

(i) $CH_3\text{-}CH{=}CH\text{-}Br$

(ii) $CH_2{=}CH\text{-}CH(Br)\text{-}CH_3$

(b) Which one of the following has the highest dipole moment and Why?

(i)CH_2Cl_2 (ii) $CHCl_3$ (iii) CCl_4

(c)Which isomer of C_4H_9Cl has the lowest boiling point?

OR

Account for the following:

(a)Haloalkanes react with KCN to form alkyl cyanides as main product while AgCN form isocyanides as the chief product.

(b)Dipole moment of chlorobenzene is lower than cyclohexyl chloride.

(c)Grignard reagents should

25.Write the mechanism for
product is expected if the

26.Write the structures of A

(a) CH_3-C

(b) NO_2

27. How will you bring abo
(a)Benzoic acid to Benzal
(b) Ethanal to Propanone
(c)Acetophenone to Benz
(d)Bromobenzene to 1-Ph

28. Complete the followir

(i) $CH_3CH_2CH_2CHO \xrightarrow{Pd/H_2}$

(ii) $CH_3CH=CHCH_2OH \xrightarrow{}$

(iii) $CH_3CH=CH_2 \xrightarrow[(2)\ 3H_2O_2]{(1)\ B_2H}$

The following question choice and carries 4 (1 questions that follow.

29. In a galvanic cell, c
energy, whereas in an e
simplest galvanic cell i
placed in a solution of
voltmeter. The two solu
electrode potentials of
electrolysis, the decom
One mole of electric c
divalent metal ion such
electrolysis.

Answer the following
(a) What is the functi
(b) When does galvani
(c) Can copper sulphat
value of E° cell. (E° C

(c)Grignard reagents should be prepared under anhydrous conditions.

25.Write the mechanism for reaction of ethanol with acid at 443 K to give ethene.What product is expected if the temperature of reaction mixture is maintained at 413K?

26.Write the structures of A, B and C in the following reactions

(a) $CH_3-CH_2-Br \xrightarrow{KCN} A \xrightarrow[\text{Partial hydrolysis}]{OH^-} B \xrightarrow{NaOH + Br_2} C$

(b)  $\xrightarrow{Fe + HCl} A \xrightarrow[273-278\ K]{NaNO_2 + HCl} B \xrightarrow{C_2H_5OH} C$

27. How will you bring about the following conversions? (any three)
(a)Benzoic acid to Benzaldehyde
(b) Ethanal to Propanone
(c)Acetophenone to Benzoic acid
(d)Bromobenzene to 1-Phenylethanol

28. Complete the following reactions:

(i) $CH_3CH_2CH_2CHO \xrightarrow{Pd/H_2/Ni}$

(ii) $CH_3CH=CHCH_2OH \xrightarrow{PCC}$

(iii) $CH_3CH=CH_2 \xrightarrow[(2)\ 3H_2O_2/OH^-]{(1)\ B_2H_6}$

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. In a galvanic cell, chemical energy of a redox reaction is converted into electrical energy, whereas in an electrolytic cell the redox reaction occurs on passing electricity. The simplest galvanic cell is in which Zn rod is placed in a solution of $ZnSO_4$ and Cu rod is placed in a solution of $CuSO_4$. The two rods are connected by a metallic wire through a voltmeter. The two solutions are joined by a salt bridge. The difference between the two electrode potentials of the two electrodes is known as electromotive force. In the process of electrolysis, the decomposition of a substance takes place by passing an electric current. One mole of electric charge when passed through a cell will discharge half a mole of a divalent metal ion such as Cu^{2+}. This was first formulated by Faraday in the form of laws of electrolysis.

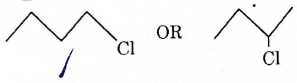
Answer the following questions :
(a) What is the function of a salt bridge in a galvanic cell?
(b) When does galvanic cell behave like an electrolytic cell?
(c) Can copper sulphate solution be stored in a pot made of zinc? Explain with the help of the value of E° cell. ($E°\ Cu^{2+}/Cu = 0.34$ V) , ($E°\ Zn^{2+}/Zn = -0.76$ V)

OR

(c)How much charge in terms of Faraday is required for the following:
(i) 1 mol of MnO_4^- to Mn^{2+} (ii) 1 mol of H_2O to O_2

30. Read the passage given below and answer the Questions:
The substitution reaction of alkyl halide mainly occurs by SN^1 or SN^2 mechanism. Whatever mechanism alkyl halides follow for the substitution reaction to occur, the polarity of the carbon halogen bond is responsible for these substitution reactions. The rate of SN^1 reactions are governed by the stability of carbocation whereas for SN^2 reactions steric factor is the deciding factor. If the starting material is a chiral compound, we may end up with an inverted product or racemic mixture depending upon the type of mechanism followed by alkyl halide. Cleavage of ethers with HI is also governed by steric factor and stability of carbocation, which indicates that in organic chemistry, these two major factors help us in deciding the kind of product formed.

1. (a) Which halogen compound in the following pair will react faster in SN2 reaction and why?



(b) Why does the presence of nitro groups at ortho- and para- positions in haloarenes increase their reactivity towards nucleophilic substitution reaction?

(c) Predict the major product formed when 2-Bromopentane reacts with alcoholic KOH. State the rule which decide the major product.

OR

Out of $CH_3CH_2CH_2Cl$ and $CH_2{=}CH{-}CH_2{-}Cl$, which one is more reactive towards SN^1 reaction and why?

SECTION- E

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

31.An organic compound with the molecular formula $C_9H_{10}O$ forms 2,4-DNP derivative, reduces Tollen's reagent and undergoes Cannizzaro reaction. On vigorous oxidation, it gives 1,2-benzenedicarboxylic acid.

(I)(a) Identify the compound A and write its IUPAC name.
(b) Write the reaction of compound (A) with
(1) 2, 4 Di nitro phenyl hydrazine and
(2) Fehling's solution.
(c) Write the equation of compound (A) when it undergoes Cannizzaro reaction.
(1+2+2)

OR

I) (a) Account for the following:
1) The alpha hydrogen of aldehydes and ketones are acidic in nature.
2) Oxidation of aldehydes is easier than ketones.

(b) Arrange the following in –

1) decreasing reactivity towards nucleophilic addition reaction – propanal, acetone, benzaldehyde

2) Increasing order of boiling point- Propane, ethanol, Dimethyl ether, Propanal

(c) Give simple test to distinguish between benzoic acid and benzaldehyde.

(2+2+1)

32(a) Consider the reaction: $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$ What is the quantity of electricity in coulombs needed to reduce 1 mol of $Cr_2O_7^{2-}$?

(b) What is the effect of catalyst on: (i) Gibbs energy (ΔG) and (ii) activation energy of a reaction?

(c) Calculate emf of the following cell:Zn (s) | Zn^{2+} (0.1 M) || Sn^{2+} (0·001 M) | Sn (s)

Given: $E^0Zn^{2+}/Zn = -0.76$ V, $E^0 Sn^{2+}/Sn = -0.14$ V [log 10 = 1]

OR

(c) Calculate the emf of the following cell :

Ni^{2+} (0.1 M) + 2Ag(s) → Ni(s) + $2Ag^+$(0.01 M)

(Given that E^0cell = 1.05 V, log 10 = 1)

(1+1+3)

33. (i) Ishan's automobile radiator is filled with 1.0 kg of water. How many grams of ethylene glycol (molar mass=62gmol^{-1}) must Ishan add to get freezing point of the solution lowered to – 2.8^{0}C . K_f for water is 1.86 Kkg mol^{-1}.

(ii) What type of deviation from Raoult's law is shown by ethanol and acetone mixture? Give reason.

(3+2)

OR

(i) 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?

(ii) How does the size of blood cells change when placed in aqueous solution containing more than 0.9% (mass/ volume) sodium chloride?

(iii) 1 molal aqueous solution of an electrolyte A_2B_3 is 60% ionized. Calculate the boiling point of the solution. (Given- K_b for H_2O = 0.52 K kg mol^{-1})

(1+1+3)