Half Yearly Exam: 2025-26
Subject: Chemistry(043)
Date: 11 /08 / 25
Time: 3 Hours
Max Marks:70

Name:_____
Class: 12 Division:_____
Roll No:_____
Invigilator's Sign _____

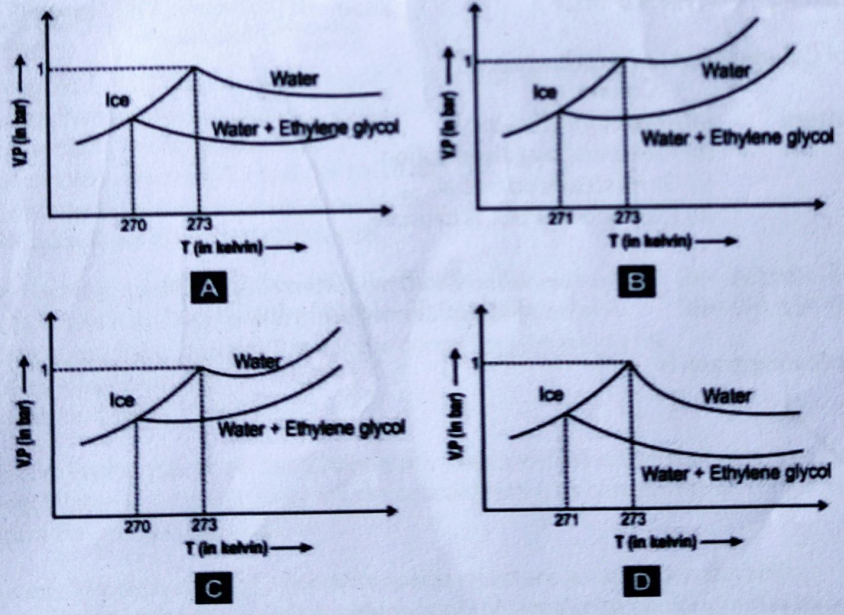
General Instructions:
Read the following instructions carefully.
(a) There are 33 questions in this question paper with internal choice.
(b) SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
(c) SECTION B consists of 5 short answer questions carrying 2 marks each.
(d) SECTION C 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.
(h) Use of log tables and calculators is not allowed.

SECTION A

16

Directions (Q. No. 1-16) : 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 93 g of ethylene glycol is added to 1 kg of water to change the freezing point of the solution. If the freezing point of water is 273 K at 1 bar, and the Kf of water is 2 K kg/mol, which of the following graphs represents the depression in the freezing point of the water-ethylene glycol solution? (molar mass of ethylene glycol is 62 g/mol) 1



a. A b. B c. C d. D

2 How much electricity in Faraday is required for the complete reduction of MnO_4^- ions present in 500 ml of 0.5 M solution to Mn^{2+}? 1

a. 5F b. 2.5 F c. 2.25 F d. 1.25 F

3 The major organic compound formed when 2-Bromobutane is heated with alcoholic KOH is 1

a. Butan-2-ol b. 2-Bromopropane c. But-2-ene d. But-1-ene

4 Compound 'A' of molecular formula $C_4H_{10}O$ on treatment with Lucas reagent at room temperature gives a compound 'B'. When compound 'B' is heated with alcoholic KOH, it gives isobutene. Compounds 'A' and 'B' are respectively 1

a. 2-methyl-2propanol and 2-chloro-2-mehtyl-propane
b. 2-methyl-1-propanol and 1-chloro-2methyl-propane
c. 2-methyl-1-propanol and 2-chloro-2methyl-propane
d. Butan-2-ol and 2-chlorobutane

5 Which of the following statements is/are correct? 1

(i) A catalyst lowers the activation energy of a reaction.
(ii) A catalyst allows the same rate of reaction to be achieved at a lower temperature.
(iii) A catalyst mixes with the reactants and increases the overall concentration of reactants in the rate equation.

a. i only b. i and ii only c. ii and iii only d. All- i, ii, and iii

6 Ortho-nitrophenol is less soluble in water than p- and m-nitrophenols because 1

a. o-nitrophenol shows intramolecular H-bonding
b. o-nitrophenol shows intermolecular H-bonding
c. The melting point of o-nitrophenol is lower than that of m- and p-nitrophenols
d. o-Nitrophenols are more volatile in steam than those of m- and p-isomers.

7 What type of linkage holds together the monomers of DNA and RNA? 1.

a. Ether Bond b. Van der waal's Bond c. Phosphodiester linkage d.H-Bond

8 Name the vitamin responsible for the coagulation of blood. 1

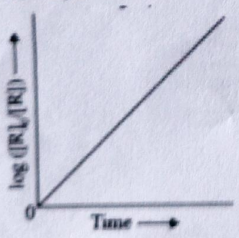
a. Vitamin B12 b.Vitamin C c.Vitamin K d. Vitamin E

9 Match the terms of Column I and Column II. 1

Column I	Column II
(i) Lead storage battery	(a) Maximum efficiency
(ii) Mercury cell	(b) Prevented by galvanization
(iii) Fuel cell	(c) Gives steady potential
(iv) Rusting	(d) Pb is anode, PbO_2 is cathode

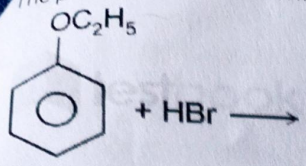
a.(i)→(a);(ii)→(c);(iii)→(b);(iv)→(d) b.(i)→(b);(ii)→(c);(iii)→(d);(iv)→(a)
c.(i)→(d);(ii)→(c);(iii)→(a);(iv)→(b) d.(i)→(c);(ii)→(d);(iii)→(b);(iv)→(a)

10 The slope of the following graph is

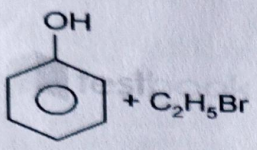


a. 2.303 /k b. k/ 2.303 c. k d. 1/ k

The product of the following reaction is: 1



a.



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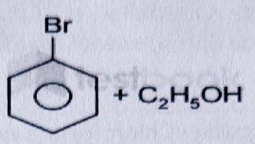

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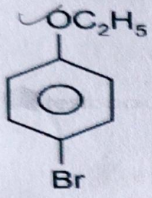
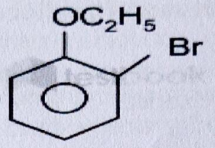
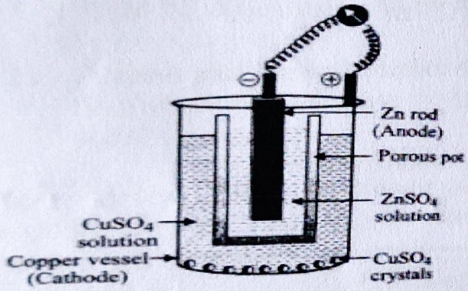


d.



12 The electrochemical cell made up of Zn and Cu half-cells is called the Daniell cell. The emf of a Daniell cell is 1.10V. 1



When an external voltage greater than 1.10 V is applied to this cell, which of the following changes will be observed in the cell?

a. Zn electrode will act as an anode.
b. Current will flow from Cu half cell to Zn half cell.
c. Electrochemical cell continues to work fast.
d. The cell will act as an electrolytic cell.

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.

13 Assertion: Hydrolysis of methyl ethanoate is a pseudo-first-order reaction. 1
Reason: Water is present in large excess, and therefore its concentration remained constant throughout the reaction.

14 Assertion: The disruption of a protein's native structure is called denaturation. 1
Reason: The change in color and appearance of the egg during cooking is due to denaturation.

15 Assertion: The reversible work done by a Galvanic cell is equal to the decrease in its Gibbs energy. 1
Reason: Gibbs free energy change is given by $\Delta G = \Delta H - T\Delta U$

16 Assertion: SN_2 mechanism leads to the inversion of configuration.
Reason: As in this mechanism, optical activity is lost. 2

SECTION B

17 What happens when
a. Methyl chloride is treated with KCN.
b. n-butyl chloride is treated with alc.KOH.(Write a reaction in support of it.)

OR

a. What happens when Chloroform is exposed to air and sunlight? Write a reaction in support of it.
b. Write the structure of DDT and its IUPAC name. 1

18 a. Aquatic species are more comfortable in cold waters than in warm waters. Give reasons. 1
b. What happens when blood cells are placed in a solution containing more than 0.9% (mass/volume) Sodium chloride? 2

19 When a certain conductivity cell was filled with 0.1 M KCl, it had a resistance of 85 ohms at 25°C. When the same cell was filled with an aqueous solution of 0.052 M unknown electrolyte, the resistance was 96 ohms. Calculate the molar conductivity of the electrolyte at this concentration. (Conductivity of 0.1 M KCl = $1.29 \times 10^{-2} \Omega^{-1} cm^{-1}$) 2

20 a. Give simple chemical tests to distinguish between the following pairs of compounds: 2
(i) Ethanol and Phenol
(ii) Propanol and 2-methylpropan-2-ol
b. Illustrate the following reactions giving a chemical equation for each:
(i) Kolbe's reaction
(ii)Reimer–Tiemann reaction

21 a. How can propan-2-one be converted into tert-butyl alcohol? 2
b.Name the starting material used in the industrial preparation of phenol and write chemical reaction.

SECTION C

22 a.Write the structural formula of A, B, C and D in the following sequence of reaction : 3

$$CH_3 - \overset{\overset{Cl}{|}}{CH} - CH_3 \xrightarrow[KOH]{alc} A \xrightarrow[\text{Peroxide}]{HBr} B \xrightarrow[\text{dry ether}]{NaI} C \xrightarrow[\text{dry ether}]{Mg} D$$

b. How is chlorobenzene prepared by (a) direct chlorination (b) diazotization method?

23 Write the Nernst equation for the cell in which the following reaction takes place 3
$Mg(s) + 2Ag^+(0.0001M) \rightarrow Mg^{2+}(0.130M) + 2Ag(s)$
Calculate its E_{Cell} if $E_{Mg2+/Mg}{}^{O} = -2.36$ V and $E_{Ag1+/Ag}{}^{O} = 0.81$ V (log 13=1.114)

24 An organic compound 'A', having molecular formula C_6H_6O gives a characteristic colour with a neutral ferric chloride solution. 'A' on treatment with CO_2 and NaOH at 400K under pressure gives B, which on acidification gives a compound C. The compound C reacts with acetyl chloride to give D, which is a popular painkiller. Deduce the structure of A, B, C, and D, and write the reactions involved. 3

a. A first-order reaction takes 77.78 minutes for 50% completion. Calculate the time required for 30% completion of the reaction. (log 10= 1, log 7=0.8450) 2+1

b. Differentiate between order and molecularity of reaction.

OR

a. The decomposition of N_2O_5 in CCl_4 solution follows the first-order rate law. The concentrations of N_2O_5 measured at different time intervals are given below:

Time in second(t)	0	80	160	410	600	1130	1740
[N2O5] mol/L	5.5	5.0	4.8	4	3.4	2.4	1.6

Calculate its rate constant at t = 410 s and t = 1130 s. What do these results show?

b. Mention the factors that affect the rate of a chemical reaction. 1

26 a. State two main differences between globular and fibrous proteins. 2

b. The two strands in DNA are not identical but complementary. Explain

27 a. 0.6 mL of acetic acid, CH_3COOH, having a density of 1.06 g/mL, is dissolved in 1 litre of water. The depression in the freezing point observed for this strength of acid was 0.0205°C. Calculate the van't Hoff factor and the dissociation constant of an acid. Kf = 1.86 K kg /mol. 2+1

b. The mole fraction of helium in a saturated solution at 20°C is 1.2×10^{-6}. Find the pressure of helium above the solution. Given Henry's constant at 20°C is 144.97 kbar.

28 Observe the table in which azeotropic mixtures are given along with their boiling points of pure Components and azeotropes, and answer the questions that follow. 3

Some Azeotropic Mixtures					
A	B	Minimum Boiling Azeotropes	Boiling Points		
			A	B	Mixture Azeotropes
H_2O	C_2H_5OH	95.37%	373K	351.3K	351.15
H_2O	C_3H_7OH	71.69%	373K	370.19K	350.72
CH_3COCH_3	CS_2	67%	329.25K	319.25K	312.30
A	B	Maximum Boiling Azeotropes	A	B	Mixture Azeotropes
H_2O	HCl	20.3%	373K	188K	383K
H_2O	HNO_3	68.0%	373K	359K	393.5K
H_2O	$HClO_4$	71.6%	373K	383K	476K

a. What type of deviation is shown by minimum boiling azeotropes?

b. Why do H_2O and HCl mixtures form maximum boiling azeotropes?

c. Give one example of an ideal solution. What type of liquids form ideal solutions?

SECTION D

29 Ethers are compounds with the general formula R–O–R'. A common method of preparing ethers is the Williamson Synthesis, where an alkoxide ion reacts with a primary alkyl halide. Anisole (methoxybenzene) is an ether used in perfumes and organic synthesis. Due to the electron-donating methoxy group, anisole undergoes electrophilic substitution at ortho and para positions.

a. Explain why aryl halides cannot be used effectively in Williamson synthesis. 1

b. The boiling point of ethyl alcohol is much higher than that of dimethyl ether, though both have the same molecular weight. Why? 1

2

OR

c. Write equations of the following reactions:
i) Friedel-Crafts reaction – alkylation of anisole.
ii)Bromination of anisole in ethanoic acid medium

30 Read the passage given below and answer the following questions:
Molar conductivity for weak electrolytes can be obtained from the molar conductivities of strong electrolytes at infinite dilution by algebraic addition. For example, the molar conductivity of a weak electrolyte like CH_3COOH can be obtained from the molar conductivities at infinite dilution of strong electrolytes like CH_3COONa, HCl, and NaCl according to Kohlrauch's law $\Lambda°mCH3COOH = [\Lambda°mCH_3COO^- + \Lambda°mNa^+] + [\Lambda°mH^+ + \Lambda°mCl^-] - [\Lambda°mNa^+ + \Lambda°mCl^-]$

(i) What is the expression of $\Lambda°m$ for an electrolyte AmBn? 1
(ii) Define limiting molar conductivity. 1
(iii) Calculate $\Lambda°m$ for AgCl if $\Lambda°m\ (AgNO_3) = 133.4, \Lambda°m(KCl)=149.9, \Lambda°m(KNO_3)=144.9$ Scm^2mol^{-1} 2

OR

(iii) Calculate $\Lambda°m$ for HAc if $\Lambda°m\ (HCl) = 425.9, \Lambda°m(NaCl)=126.4, \Lambda°m(NaAc)=91.0$ Scm^2mol^{-1}

SECTION D

31 a. In a chemistry lab, Riya wants to find the difference between the theoretical molar mass and the observed molar mass of an unknown compound MN_2. For this, she prepares a solution by adding 0.2 moles of the unknown compound MN_2 in 4 liters of water. She finds that the compound ionized to: 3+2

$MN_2 \rightarrow M^{2+} + 2N^-$

If the molar mass of M is 48 and that of N is 64 and the observed osmotic pressure is 6 atm, then what is the value of the observed molar mass of the unknown compound?

b. The vapor pressure of compound A at 90°C is 526 mm Hg and that of compound B is 11250 mm of Hg.
(i) What will be the total concentration (in terms of mole fraction) of the boiling mixture of A and B at 90° C if the two liquids are completely miscible with each other?
(ii) Using i, calculate X_A and X_B. (Round off to two decimal places)
(Take P_{total} = 760 mm Hg)

OR

a. Two solutions A and B are prepared. Both solutions A and B contain an equal amount of organic compounds P and Q, respectively as solutes in 500 g of benzene (as a solvent). The boiling point of solution A is 0.4 °C higher than that of pure benzene, and the boiling point of solution B is 0.8 °C higher than that of pure benzene.
(i) Calculate the ratio of the molecular weight of P: Q
(ii) If the molecular weight of P is 200, what is the minimum value of the sum of the molecular weights of P and Q?

b. Write two differences between an ideal solution and a non-ideal solution.

The rate constant for a reaction of zero order in A is 0.0030 mol $L^{-1} s^{-1}$. How long will it take for the initial concentration of A to fall from 0.10 M to 0.075 M? 2+1

b. With the help of an example, explain what is meant by pseudo-first-order reaction. +2

c. A reaction is second order with respect to a reactant.
How is the rate of reaction affected if the concentration of the reactant is
(i) doubled (ii) reduced to half ?

OR

a. A first order gas phase reaction : $A_2B_2(g) \rightarrow 2A(g) + 2B(g)$ at the temperature 400°C has the rate constant $k = 2.0 \times 10^{-4}$ sec^{-1}. What percentage of A_2B_2 is decomposed on heating for 900 seconds? (Antilog 0.0781 = 1.197)

b. Define electrophoresis. State 2 functions of salt bridge

c. For a reaction: $2NH_3(g) \rightarrow Pt\ N_2(g) + 3H_2(g)$
Rate = k
(i) Write the order and molecularity of this reaction.
(ii) Write the unit of k.

33 Explain any five. 5

a. Give a reason: During the electrophilic substitution reaction of haloarenes, the para-substituted derivative is the major product.

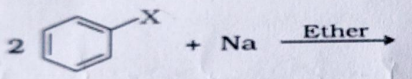
b. Why is the product formed during the SN1 reaction is a racemic mixture? Retention

c. Convert the following: Chlorobenzene to Phenol

d. Write the product formed when p-nitro chlorobenzene is heated with aqueous NaOH at 443 K, followed by acidification.

e. You want to prepare $CH_3 - CH_2 - CH_2 - Br$ from $CH_3 - CH = CH_2$. What are the reagents you require?

f. Identify the product and the name of the reaction:



g. Write the IUPAC name of the following compound.

$CH_3CH=CHC(Br)(CH_3)_2$