CHEMISTRY (CODE - 043)

SAMPLE QUESTION PAPER*

CLASS XII (2025-26)

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

GENERAL INSTRUCTIONS:

Read the following instructions carefully.

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 questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

	Section-A Question 1 to 16 are multiple choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions.	
1	Which of the following reaction will lead to formation of ethyl methyl ketone: A. heating $CH_3CH(CH_3)CH_2OH$ with acidified $Na_2Cr_2O_7$ B. passing $CH_3C(OH)CH_3$ over heated copper C. ozonolysis of $CH_3CH_2C(CH_3)=CHCH_3$ D. acetylene on reaction with $HgSO_4/H_2SO_4$	1
2	Consider the reaction and identify B and C $CH_3CH_2CH_2CH_2Cl \xrightarrow{NaOH + Ethanol} A$ $A \xrightarrow{H_2O,\ H^+} B$ and $A \xrightarrow{(i)\ B_2H_6,\ (ii)H_2O_2,\ OH^-} C$ A. B=C= Butanol B. B= Butanol, C=Butene C. B= Butan-2-ol, C= Butanol D. B= Butene, C=Butan-2-ol	1
3	The counter ion in the coordination compound $[Co(NH_3)_5(NO_2)]Cl_2$ is A. Ammine B. Cobalt	1

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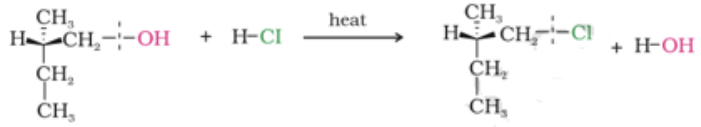
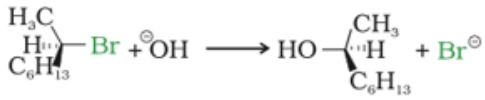
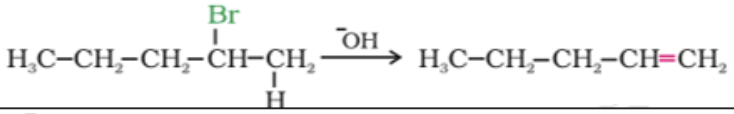
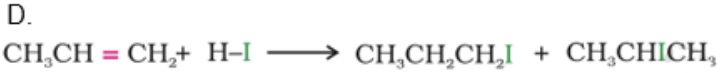
	C. Chloride D. Nitro	
4	The organic compounds A, B and C are amines having equivalent molecular weight. A and B on reaction with benzene sulphonyl chloride give white precipitate, however white precipitate obtained from compound B remains insoluble in NaOH. The variation in the boiling point of A, B and C can be seen as : A. A> B>C B. B>A>C C. A=B > C D. C>B>A	1
5	70 gm solute is dissolved in 700 gm solvent to prepare a solution having density 1.5 g/ml. The ratio of its molality and molarity will be: A. 0.77 B. 1.4 C. 0.73 D. 1.3	1
6	Match the column I and column II: Column I / Column II A.  (i) Addition reaction B.  (ii) Elimination reaction C.  (iii) S_N^2 reaction D.  (iv) S_N^1 reaction A. A-(i), B-(ii), C-(iii), D-(iv) B. A-(iv), B-(ii), C-(iii), D-(i) C. A-(i), B-(iii), C-(ii), D-(iv) D. A-(iv), B-(iii), C-(ii), D-(i)	1

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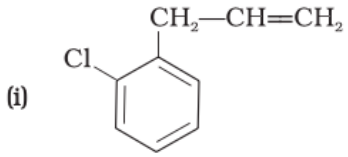
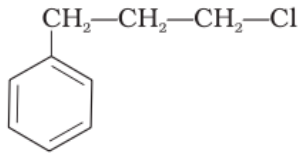
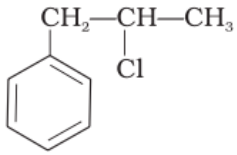
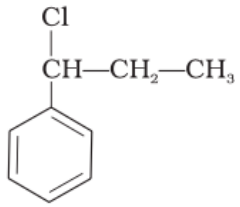
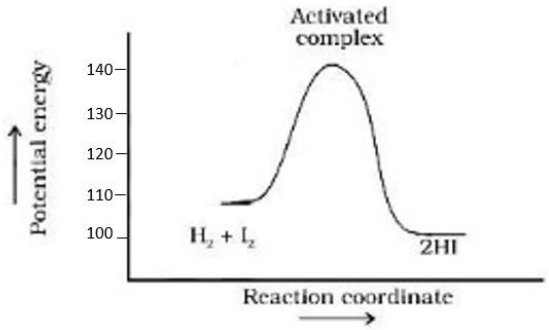
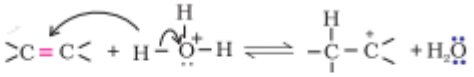
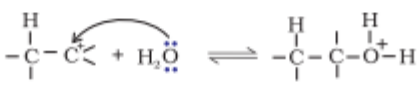
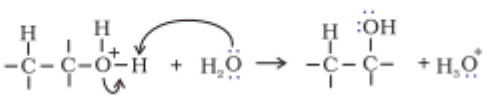
7	In o-cresol, the –OH group is attached to the carbon that is: A. sp^3 hybrid B. sp^2 hybrid C. sp hybrid D. dsp^2 hybrid	1
8	Which of the following is laevorotatory in nature : A. alpha D – glucose B. beta -D- glucose C. beta-D- fructose D. sucrose	1
9	The name inner transition metals is often used to refer to the A. lanthanoids B. actinoids C. both lanthanoids and actinoids D. d block elements	1
10	Λ_m^o CH_3COOH can be calculated if the values of the following are given: 1. Λ_m^oHCl, Λ_m^oKCl and Λ_m^o CH_3COOK 2. Λ_m^oNaCl, Λ_m^oKCl and Λ_m^o CH_3COONa 3. $\Lambda_m^o$$H_2SO_4$, $\Lambda_m^o$$Na_2SO_4$ and Λ_m^o CH_3COONa A. Only 1 B. Either 1 or 2 C. Either 1 or 3 D. Either 2 or 3	1
11	Which of the following will give a yellow or orange ppt. with 2,4 DNP? (i) Porpanal (ii) Propanone (iii) Propanoic acid A. (i) and (ii) B. (ii) and (iii) C. (i) and (iii) D. (i), (ii) and (iii)	1

12	Identify the secondary benzylic halide and primary alkyl halide from the following:  (i)  (ii)  (iii)  (iv) A. (i) and (iii) B. (iv) and (ii) C. (iii) and (iv) D. (i) and (ii)	1
13	**Assertion (A):** Secondary aliphatic amines react with nitrous acid to form aliphatic diazonium salts which being unstable, liberate nitrogen gas quantitatively. **Reason**: Nitrogen gas evolved on reaction with nitrous acid can be used for the estimation of proteins and amino acids. 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, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true	1
14	**Assertion (A):** Care should always be taken to ensure that solutions that flow in the blood stream are of the same osmotic pressure as that of the blood. **Reason(R):** Sodium ion and potassium ions are responsible for maintaining proper osmotic pressure balance inside and outside of the cells of organism. 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, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true	1

15	**Assertion (A)**: Starch forms colloidal solution with water. **Reason (R)**: Starch contains 80-85% of amylopectin which is insoluble in water. 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, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true	1
16	**Assertion (A):** Secondary cells are used in invertors. **Reason (R):** A primary cell can be recharged by passing current through it in the opposite direction after it has been used. 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, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true	1
	Section-B Question No. 17 to 21 are very short answer questions carrying 2 marks each.	
17	**Attempt either option A or B** A. Answer the following: I. When 50 mL of phenol and 50 mL of aniline are mixed, predict whether the volume of the solution is equal to, greater than or less than 100 mL. Give reason to support your answer. II. Ritesh suggested adding salt to the box containing ice. He said this would keep the cold drink bottles cold for a longer time. How will Ritesh justify his suggestion? **OR** B. Answer the following: I. $BaCl_2$ on reaction with Na_2SO_4 in aqueous solution gives white precipitate. If the two solutions are separated by a semi-permeable membrane, will there be appearance of a white precipitate due to osmosis? II. Why does water stops boiling when sugar is added to boiling water.	2x1 2x1

18	Consider the graph for the reaction $H_2 + I_2 \rightleftharpoons 2HI$  I. Calculate enthalpy of reaction and activation energy for the backward reaction. II. How will the catalyst affect the rate of this reaction? Explain. ***(for visually challenged learners)*** I. Define activation energy. What will happen to activation energy if we increase the temperature? II. How will the catalyst affect the rate of an endothermic reaction?	2x1 2x1
19	Carry out following conversions : I. Nitrobenzene to 4- bromobenzenamine II. Chlorophenylmethane to 2-phenyl-ethanamine	2x1
20	Write the formula of the following coordination complex: I. diaquasilver(I) dichloridoargentate(I) II. dihydroxidobis(triphenylphosphine)nickel(II)	2x1
21	The mechanism of formation of alcohols from alkenes is given below. Rectify the errors in the mechanism and rewrite the corrected steps STEP 1  STEP 2  STEP 3 	2

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	Section-C Question No. 22 to 28 are short answer questions, carrying 3 marks each.	
22	What will be the vapour pressure of a 1 molal aqueous solution of $MgCl_2$, assuming dissociation of $MgCl_2$ to be 70 mole percent? (Vapor pressure of pure water at 25 ^oC is 23.8 mmHg)	3
23	Write the Nernst equation for the following: I. Ni (s) + Cu^{2+} (aq) → Ni^{2+} (aq) + Cu (s) II. Al (s) + $FeSO_4$ (aq) → $Al_2(SO_4)_3$ (aq) + Fe (s) III. Mg (s)/Mg^{2+} (aq)//Ag^+ (aq)/Ag(s)	3x1
24	Explain the following: I. Toluene on treatment with Cl_2 in sunlight gives benzyl chloride whereas when treated with Cl_2 in dark gives o-chlorobenzene and p-chlorobenzene. II. Finkelstein reaction is carried out in the presence of dry acetone. III. neo pentylchloride has lower boiling point than isopentylchloride.	3x1
25	Which of the following elements will: I. exhibit similar magnetic behaviour and why? Magnesium (Atomic No. 12), Chromium (Atomic No. 24), Iron (Atomic No. 26) and Molybdenum (Atomic No. 42). II. form white salts and why? Zinc (Atomic No. 30), Scandium (Atomic No. 21), Nickel (Atomic No. 28) and Vanadium (Atomic No. 23)	2x1.5
26	Arrange the products obtained in the following cases in the increasing order of their pKa values: A. Oxidation of ethanol in presence of acidified potassium dichromate B. Reaction of propanoic acid with Br_2 in the presence of red Phosphorus C. Reaction of isopropyl magnesium bromide with carbon dioxide, followed by hydrolysis. D. Reaction of propanoic acid with Cl_2 in the presence of red Phosphorous.	3

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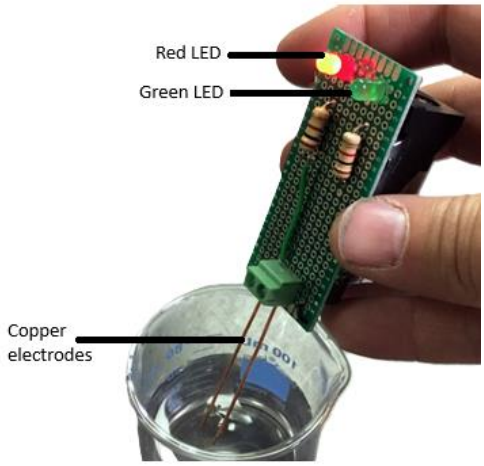
27	Carry out the following conversions. (**Attempt any 3)** I. Butan-2-one to 3-Methylpentan-3-ol II. Anisole to 4-Methoxytoluene III. Phenol to Benzene IV. Chloroethane to Ethoxy ethane	3x1
28	Answer the following questions: I. Are the enthalpies of atomisation of Zinc and Copper matched correctly? Justify your answer. Element | Enthalpy of atomisation/ $kJmol^{-1}$ Zinc | 339 Copper | 130 II. Out of sulphuric acid and hydrochloric acid, which acid will you prefer for permanganate titrations and why? III. $5NO_2^- + 2MnO_4^- + 6H^+ \rightarrow$	3x1

Section D

Question No. 29 & 30 are case-based/data -based questions carrying 4 marks each.

29	**Conductivity of Aqueous Solutions** Electrical conductivity is based on the flow of ions. Slightly ionized substances are *weak electrolytes*. Weak acids and bases would be categorized as weak electrolytes because they do not completely dissociate in solution. Highly ionized substances are *strong electrolytes*. Strong acids and salts are strong electrolytes because they completely ionize in solution. The ions carry the electric charge through the solution thus creating an electric current. The current, if sufficient enough, will light one or both LEDs on a *conductivity meter*, shown at right.  The meter has a 9V battery, two parallel copper electrodes and	

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two LED's – one green and one red. The conductivity of a solution can be tested by switching the meter on and dipping the copper electrodes in the solution to be tested.

Substances that do not conduct an electric current are called *non-electrolytes*. Non-electrolytes do not ionize; they do not contain moveable ions. The LEDs of a conductivity meter will not light because there are no ions to carry the electric current.

The table given below is a guide to the possible conductivity measurements

Scale	Red LED	Green LED	Conductivity
0	off	off	low or none
1	dim	off	low
2	medium	off	medium
3	bright	dim	high
4	very bright	medium	very high

source: https://chem.libretexts.org

Based on the information provided above, answer the following questions: 1+1+2

I. Is it possible to identify whether the given solution is 1 M NaOH or 1 M HCl using the conductivity meter? Justify your answer.

II. What is the possible pH value of solution if the glow of green LED is medium and the red LED glows very brightly?

(i) 1 (ii) 13 (iii) 5 (iv) 8

(a) (i) and (ii)
(b) (i) and (iii)
(c) (ii) and (iv)
(d) (iii) and (iv)

OR

Write down the observations if the conductivity meter is dipped in distilled water.

III. Refer to the table given below and draw the molar conductivity vs. concentration curve for solution A and B.

Solution	Red LED	Green LED
A	bright	dim
B	dim	off

(For Visually Challenged students)

Conductivity of Aqueous Solutions

Conductivity meter is a device which is used to identify whether the given solution is a strong, weak or non-electrolyte. The meter has a 9V battery, and two parallel copper electrodes and a 5 point scale (0 to 4) to measure conductivity of a solution. The conductivity of a solution can be tested by switching the meter on and dipping the copper electrodes in the solution to be tested.

Electrical conductivity is based on the flow of ions. Highly ionized substances are *strong electrolytes*. Strong acids and salts are strong electrolytes because they completely ionize in solution. The ions carry the electric charge through the solution thus creating an electric current. The current, if sufficient enough, will show a value of 3 or 4 on the conductivity *meter*.

Slightly ionized substances are *weak electrolytes*. Weak acids and bases would be categorized as weak electrolytes because they do not completely dissociate in solution. The values for weak electrolytes are 1 or 2 on the conductivity scale.

Substances that do not conduct an electric current are called *non-electrolytes*. Non-electrolytes do not ionize; they do not contain moveable ions. The conductivity meter shows a value of 0 in such a case as there are no ions to carry the electric current.

The following table is a guide to the possible conductivity values:

Scale	Conductivity
0	low or none
1	low
2	medium
3	high
4	very high

Based on the information provided above, answer the following questions: 1+1+2

I. Is it possible to identify whether the given solution is 1 M NaOH or 1 M HCl using the conductivity meter? Justify your answer.

II. What is the possible pH value of solution if the scale shows the value "4"

(i) 1 (ii) 13 (iii) 5 (iv) 8

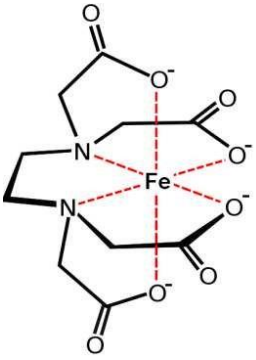
(a) (i) and (ii)
(b) (i) and (iii)
(c) (ii) and (iv)
(d) (iii) and (iv)

OR

What will be value on the scale if the conductivity meter is dipped in distilled water?

III. Predict the electrolyte is a strong or weak electrolyte on the basis of the following observation:

Solution	Scale
A	3
B	2

30	**Iron-EDTA complex in food fortification** Food fortification is defined as the practice of adding vitamins and minerals to commonly consumed foods during processing to increase their nutritional value. It is a proven, safe and cost-effective strategy for improving diets and for the prevention and control of micronutrient deficiencies. A food product (such as rice, wheat flour, edible oil) that is fortified through the addition of fortificants is called a "vehicle".  In African and south Asian countries 40% of the population suffers from anaemia. Average human needs nearly 10mg of iron daily. Iron fortification may be useful in fighting iron deficiencies in humans. Reduced iron and several iron salts have been used in the past as iron fortification, however, not all are suitable for this purpose, in terms of iron absorption. Recent studies have shown that beverages containing sugar fortified with either Ferrous sulphate or Fe(III)- EDTA complex have high rate of absorption of iron. Ferrous sulphate as well as Fe(III)- EDTA is suitable to enrich sugar, but while iron from ferrous sulphate is precipitated and poorly absorbed when fortified sugar is added to beverages such as tea, Fe(III)- EDTA reacts slowly with tea and iron is not precipitated for at least 24 hr. Fe(III)-EDTA as iron fortification, has demonstrated so far, more advantages than that observed from other iron salts, including ferrous sulphate. But, EDTA is a chelating agent and its use in food technology to prevent oxidative damage of food has been restricted. Excessive consumption of EDTA can cause abdominal cramps, nausea, low blood pressure and damage to kidneys. According to National Institute of Health, it is unsafe to consume more than 3 g of EDTA per day or continuously for more than 5 to 7 days. The amount of EDTA necessary for 10 mg of iron fortification, is about 60 mg. This is within the safe limits and is comparable to the usual amount added to the diet. (source: Layrisse, M., & MartInez-Torres, C. (1977). Fe (III)-EDTA complex as iron fortification. *The American Journal of Clinical Nutrition*, *30*(7), 1166-1174.) **Based on the information provided above, answer the following questions:** I. Why is Fe(III)-EDTA complex stable as compared to Ferrous sulphate? **OR**	1+1+2

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What happens when hard water is titrated against Na_2EDTA?

II. You are a doctor, working in Somalia. Will you recommend iron fortified food to your patients? Support your answer with references from the passage.

III. What is the denticity of the ligand in the Fe(III) EDTA complex. Name the atom(s) through which it can bind to the central metal ion.

Write the structure of EDTA. (Refer to figure 1)

For Visually challenged candidates

Iron-EDTA complex in food fortification

Food fortification is defined as the practice of adding vitamins and minerals to commonly consumed foods during processing to increase their nutritional value. It is a proven, safe and cost-effective strategy for improving diets and for the prevention and control of micronutrient deficiencies. A food product (such as rice, wheat flour, edible oil) that is fortified through the addition of fortificants is called a “vehicle”.

Reduced iron and several iron salts have been used in the past as iron fortification, however, not all are suitable for this purpose, in terms of iron absorption. Recent studies have shown that beverages containing sugar fortified with either Ferrous sulphate or Fe(III)- EDTA complex have high rate of absorption of iron.

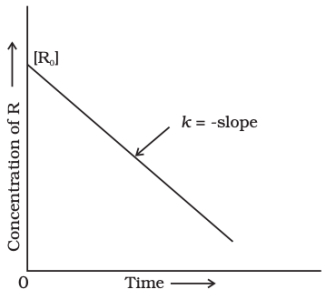
Ferrous sulphate as well as Fe(III)- EDTA is suitable to enrich sugar, but while iron from ferrous sulphate is precipitated and poorly absorbed when fortified sugar is added to beverages such as tea, Fe(III)- EDTA reacts slowly with tea and iron is not precipitated for at least 24 hr.

Fe(III)-EDTA as iron fortification, has demonstrated so far, more advantages than that observed from other iron salts, including ferrous sulphate. But, EDTA is a chelating agent and its use in food technology to prevent oxidative damage of food has been restricted. Excessive consumption of EDTA can cause abdominal cramps, nausea, low blood pressure and damage to kidneys. According to National Institute of Health, it is unsafe to consume more than 3 g of EDTA per day or continuously for more than 5 to 7 days.

The amount of EDTA necessary for 10 mg of iron fortification, is about 60 mg. This is within the safe limits and is comparable to the usual amount added to the diet.

(source: Layrisse, M., & MartInez-Torres, C. (1977). Fe (III)-EDTA complex as iron fortification. *The American Journal of Clinical Nutrition*, *30*(7), 1166-1174.)

	Based on the information provided above, answer the following questions: I. Why is Fe(III)-EDTA complex stable as compared to Ferrous sulphate? **OR** What happens when hard water is titrated against Na_2EDTA? II. You are a doctor, working in Somalia. Will you recommend iron fortified food to your patients? Support your answer with references from the passage. III. (a)What is the denticity of the ligand in the Fe(III) EDTA complex. Name the atom(s) through which it can bind to the central metal ion. (b) EDTA is an electron acceptor or an electron donor?	1+1+2
	Section-E Question No. 31 to 33 are long answer type questions carrying 5 marks each.	
31	**Attempt either A or B** A. Answer the following questions: I. Write the structure of expected product of Cannizarro reaction of 2-chlorobenzaldehyde. II. How would the presence of $-SO_3H$ group effect the basic strength of aniline. III. Convert acetic acid to ethanamine. IV. Write the steps to prepare Benzoic acid from Benzoyl chloride. V. Give a chemical test to distinguish between: propanal and propanone **OR** B. Answer the following questions: I. Write the structure of expected product of Wolf-Kishner reduction of 2 –methylbutanal. II. How would the presence of $-SO_3H$ group effect the acidic strength of benzoic acid III. Prepare acetic acid from ethanamine. IV. Convert Aniline to benzoic acid. V. Give a chemical test to distinguish between: propanal and ethanal.	5x1

32	**Attempt either A or B** A. Answer the following questions: I. Identify and give any one point of difference between the protein present in the hair and protein present in egg albumin. II. Both glucose and sucrose have aldehydic group, then why does only glucose reduces Fehling's Reagent.and not sucrose? III. Why do amino acids behave as salts? IV. What chemical change takes place during curdling of milk? V. Doctor advised a 50 year old woman enough exposure to sunlight and addition of fish and egg yolk to her diet. What is the possible disease diagnosed by the doctor? **OR** B. Answer the following questions: I. Identify and give any one point of difference between the carbohydrate present in cane sugar and carbohydrate present in milk. II. Glucose is an aldohexose and a monosaccharide. Which oxidising agent should be used to bring about oxidation of only the aldehydic group present in glucose? III. Amino acid $HOOC\text{-}CH_2CH(NH_2)CH_2COOH$.Predict whether the pH of this amino acid will be >7, 7 or <7. IV. Name the two major molecular shapes formed due to the folding of secondary structure of proteins. V. Ashish's gums bleed frequently. The doctor's prescription mentioned that Ashish is suffering from scurvy. Help him to identify two food sources to help him recover faster. .	5x1
33	**Attempt either A or B** A. I. The rate of a reaction triples when the temperature changes from 298 K to 318 K. Calculate the energy of activation of the reaction assuming that it does not change with temperature. (Given R = 8.314 $JK^{-1}mol^{-1}$, log 3 = 0.4771) II. Identify the order of reaction and write its integrated rate equation mentioning what each term in the equation represents.  **OR**	3+2

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	B. I. Consider the following first order thermal decomposition of SO_2Cl_2 at a constant volume SO_2Cl_2 (g) → SO_2(g) + Cl_2 (g) If the total pressure of the gases is found to be 200 torr after 10 seconds and 300 torr upon the complete decomposition of SO_2Cl_2. Calculate the rate constant. (Given log 3 = 0.4771, log 2= 0.3010) II. For a bimolecular elementary reaction A + B → Products. Write the expression for the rate of reaction relating temperature and activation energy for the reaction and also mention what each term represents in the equation.	3+2

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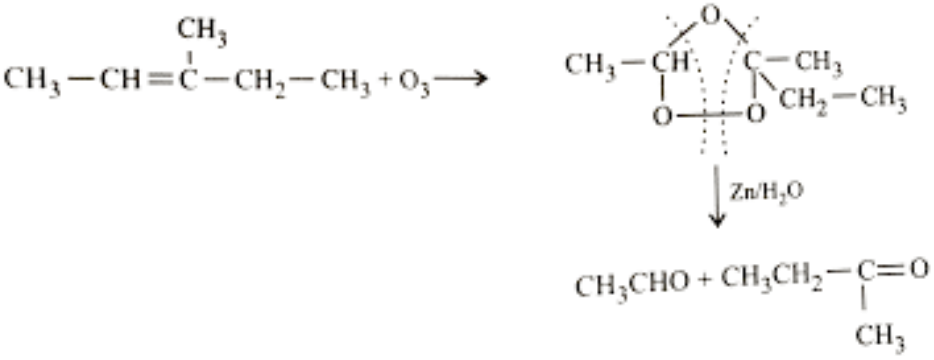
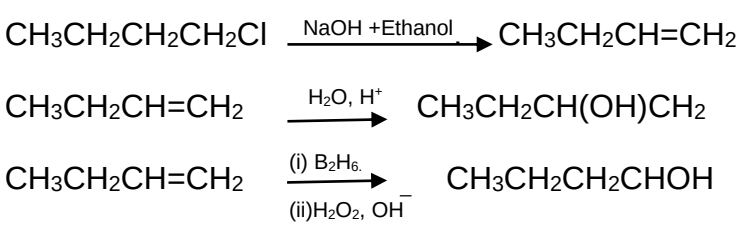
CHEMISTRY CODE - 043
MARKING SCHEME
CLASS XII (2025-26)

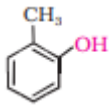
Time: 3 hours **Max. Marks: 70**

GENERAL INSTRUCTIONS:

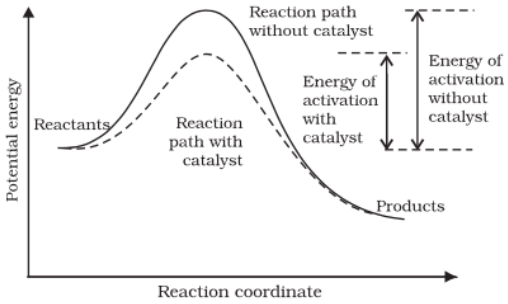
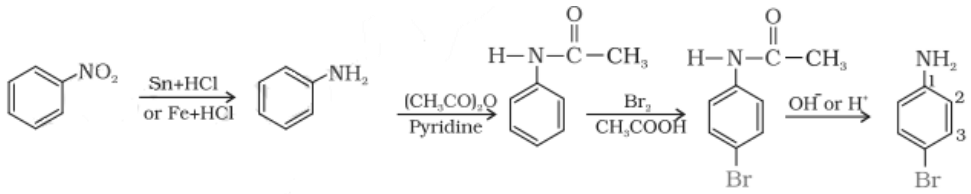
Read the following instructions carefully.

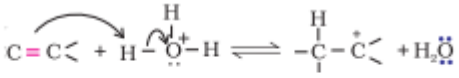
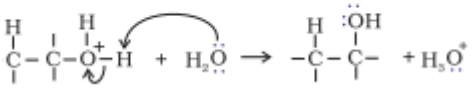
1. There are **33** questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case-based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

	Section-A	
1	C. Ozonolysis of $CH_3CH_2C(CH_3)=CHCH_3$ 	1
2	C. B= Butan-2-ol, C= Butanol 	1
3	C. chloride	1

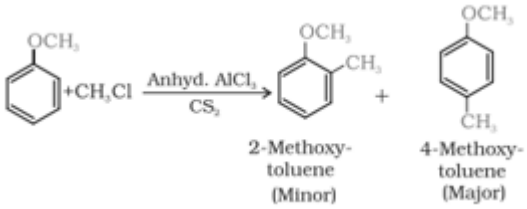
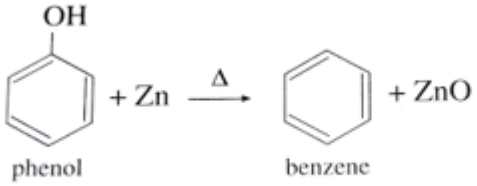
	The formula of coordination complex, the ions outside the square bracket are called counter ions.	
4	A. A> B>C A is primary, B is secondary amine, C is tertiary amine.Primary amines are having higher boiling point as compared to secondary and tertiary amines.	1
5	C. 0.73 m = $\frac{m_2}{MM_2}$ x $\frac{1000}{m_1}$ m = $\frac{70}{MM_2}$ x $\frac{1000}{700}$ M = $\frac{m_2}{MM_2}$ x $\frac{1000}{V}$ Here, V = $\frac{m_1+m_2}{d}$ = $\frac{770}{1.5}$ M = $\frac{70}{MM_2}$ x $\frac{1000\ x\ 1.5}{770}$ $\frac{m}{M}$ = $\frac{770}{700\ x\ 1.5}$ = 0.73	1
6	D. A-(iv), B-(iii), C-(ii), D-(i)	1
7	B. sp^2 hybrid. The –OH group has replaced –H of benzene ring. All carbons of benzene are sp^2 hybrid. 	1
8	C. Beta D – fructose	1
9	C. both lanthanoids and actinoids	1
10	C. Either 1 or 3 Λ_m^o CH_3COOH = $\Lambda_m^o HCl$ + Λ_m^o CH_3COOK - $\Lambda_m^o KCl$	1

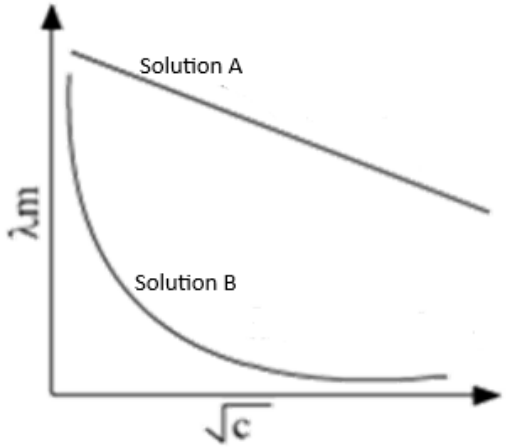
	Λ_m^o CH_3COOH = 1/2 $\Lambda_m^o H_2SO_4$ + Λ_m^o CH_3COONa – 1/2 $\Lambda_m^o Na_2SO_4$	
11	A. (i) and (ii) Aldehydes and ketones react with 2,4 dinitrophenylhydrazine to give a yellow/orange ppt of 2,4 dintirophenylhydrazone	1
12	B. (iv) and (ii)	1
13	D. A is false but R is true Primary aliphatic amines react with nitrous acid to form aliphatic diazonium salts which being unstable, liberate nitrogen gas	1
14	B. Both A and R are true, and R is not the correct explanation of A. If osmotic pressure of the solutions that flow in the blood stream is not same as that of the blood, exosmosis or endosmosis will take place.	1
15	A. Both A and R are true, and R is the correct explanation of A. In starch, the major component is 80-85% of amylopectin is insoluble in water. Hence starch is not completely soluble in water and form colloidal solution.	1
16	C. A is true but R is false. A primary cell becomes dead after use, it cannot be recharged.	1
17	**Option A** I. The volume will be less than 100 ml. The intermolecular forces between phenol and aniline is stronger than phenol-phenol and aniline-aniline which results in decrease in volume. II. Salt lowers the freezing point of water ie. it leads to depression in freezing point. This will delay the melting of ice. **OR** **Option B** I. Precipitate of $BaSO_4$ will not appear as osmosis involves movement of solvent molecules and not solute.	1 1 1

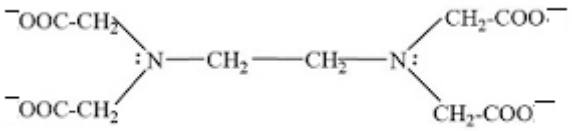
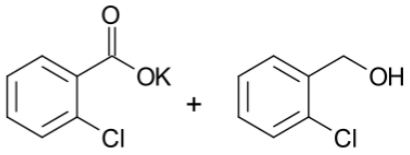
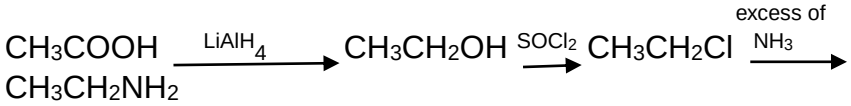
	II. Sugar being non-volatile solute, lowers the vapour pressure above the solution. This leads to elevation in boiling point.	1
18	I. Ea for backward reaction = 40 kJ/mol, ΔH= 10 kJ/mol II. Catalyst will increase the rate of reaction as the activation energy required to form intermediate activated complex between reactant and catalyst is lower than the activation energy required for forming complex without catalyst.  ***(for visually challenged learners)*** I. The minimum energy required to form the intermediate activated complex, is known as activation energy (Ea). Activation energy is the least possible energy required to start a chemical reaction. The activation energy doesn't change with change in temperature. II. Catalyst will increase the rate of reaction as the activation energy required to form intermediate activated complex between reactant and catalyst is lower than the activation energy required for forming complex without catalyst.	1 1 1 1
19	I  II. $C_6H_5CH_2Cl + KCN \longrightarrow C_6H_5CH_2CN \xrightarrow{LiAlH_4} C_6H_5CH_2CH_2NH_2$	1 1
20	I. $[Ag(H_2O)_2][Ag(Cl)_2]$ II. $[Ni(OH)_2(PPh_3)_2]$	1 1

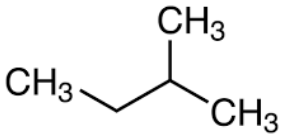
21	STEP 1  STEP 2 No error STEP 3 	1 1
22	P_A^o = 23.8 mm of Hg m = 1molal ,1mol of solute in1000g of water $n_B = 1$ mol $n_A = \frac{1000}{18} = 55.5$mol $MgCl_2 \rightarrow Mg^{2+} + 2Cl^-$ 1 0 0 $1-0.7$ 0.7 1.4 $\alpha = (i-1)/(n-1)$ n=3 $i = 0.7(2)+1$ $= 1.4 + 1 = 2.4$ $\frac{P_A^o - P_s}{P_A^o} = i\frac{n_B}{n_A + n_B}$ $\frac{23.8 - Ps}{23.8} = 2.4\ \frac{1}{56.5}$ $23.8\left(1-\frac{2.4}{56.5}\right) = Ps$ 22.9mm of Hg $= Ps$	½ ½ ½ ½ ½
23	I. $E_{cell} = E^o_{cell} - \frac{2.303\ RT}{2F}$ log $\frac{[Ni^{2+}]}{[Cu^{2+}]}$	1

	II. $E_{cell} = E^{o}_{cell} - \frac{2.303\ RT}{6F} \log \frac{[Al^{3+}]^2}{[Fe^{2+}]^3}$ III. $E_{cell} = E^{o}_{cell} - \frac{2.303\ RT}{2F} \log \frac{[Mg^{2+}]}{[Ag^{+}]^2}$	1 1
24	I. Cl_2 in presence of sunlight forms free radical as an intermediate and hence toluene undergoes free radical substitution of the alky group to form benzyl alcohol whereas Cl_2 in dark forms Cl^+, an electrophile as an intermediate, making toluene undergo electrophilic substitution and form o-chlorobenzene and p-chlororbenzene. II. NaI is soluble in dry acetone but NaCl is insoluble. NaCl precipitates out of the reaction mixture and shifts the equilibrium towards the right accoding to Le Chatelier's principle. III. The branching of the chain in neo pentylchloride is more than iso pentylchloride, which makes the molecule more compact and decreases its surface area. This decrease the magnitude of the Van der Waal's forces of attraction existing between the two molecules of neopentyl chloride. and consequently the boiling point decreases and is less than isopentyl chloride	1 1 1
25	I. Chromium and Molybdenum Cr – $[Ar]3d^5 4s^1$ Mo- $[Kr]4d^5 5s^1$ have similar electronic configuration and same number of unpaired electrons (6). Therefore, both show similar magnetic behaviour. II. Zinc and Scandium Zinc shows +2 oxidation state in its salts and Zn^{2+} – $[Ar]3d^{10}$ has no unpaired electrons as it has completely filled d subshell, so it forms white salts and Sc shows +3 oxidation state in its salts and Sc^{3+} [Ar] and no unpaired electron, so it forms white salts. Nickel and Vanadium salts are coloured as their ions have unpaired electrons.	½ 1 ½ 1
26	A. $CH_3CH_2OH \xrightarrow{\text{Acidified } K_2Cr_2O_7} CH_3COOH$ B. $CH_3CH_2COOH \xrightarrow{Br_2/\text{ Red P}} CH_3CHBrCOOH$ C. $(CH_3)_2CHMgCl \xrightarrow{(i)CO_2\ (ii)H^+,H_2O} (CH_3)_2CHCOOH$ D. $CH_3CH_2COOH \xrightarrow{Cl_2/\text{ Red P}} CH_3CHClCOOH$ Order of acidity : $CH_3CHClCOOH > CH_3CHBrCOOH > CH_3COOH > (CH_3)_2CHCOOH$	½ ½ ½ ½

	Order of pKa values: $CH_3CHClCOOH < CH_3CHBrCOOH < CH_3COOH < (CH_3)_2CHCOOH$	1
27	**Attempt any 3** I. $CH_3CH_2COCH_3 + CH_3CH_2MgCl \xrightarrow{\text{dry ether}} (CH_3CH_2)_2C(OMgCl)CH_3 \xrightarrow{H_2O} (CH_3CH_2)_2C(OH)CH_3$ II.  2-Methoxy-toluene (Minor) 4-Methoxy-toluene (Major) III.  phenol benzene IV. $CH_3CH_2Cl + CH_3CH_2ONa \longrightarrow CH_3CH_2OCH_2CH_3 + NaCl$	1 1 1
28	I. No. Enthapy of atomisation of Zinc is 130kJ/mol because it has no unpaired electrons in d subshell so the interatomic interaction is weaker than Cu. II. Sulphuric acid because hydrochloric acid is oxidised to chlorine. III. $5NO_2^- + 2MnO_4^- + 6H^+ \rightarrow 2Mn^{2+} + 5NO_3^- + 3H_2O$	1 1 1
29	I. No. Both are strong electrolytes so both the LEDs will glow. Red will be very bright and green will be medium in both cases. II. (a) (i) and (ii) **OR** **Scale** | **Red LED** | **Green LED** | **Conductivity** 0 | off | off | low or none	1 1

	III. A is strong electrolyte while B is a weak electrolyte. (marks allotted for correct curve)  **For Visually challenged** I. No. Both are strong electrolytes so both will have value of 3 or 4 on the scale II. (a) (i) and (ii) **OR** The value will be 0. III. A is a strong electrolyte and B is a weak electrolyte	1 + 1 1 1 1+1
30	I. EDTA is a chelating agent, it forms ringed complex with the central metal ion and makes the complex stable. **OR** Hardness of water is estimated by simple titration with Na_2EDTA. The Ca^{2+} and Mg^{2+} ions form stable complexes with EDTA. II. Yes, 40% of the population in Africa suffers from anaemia. Most of the patients in Somalia are likely to be anaemic. Iron fortified food will have increased the nutritional value. In the same amount of food product the patient will get higher amount of the micronutrient than present in natural product. This will help reduce cases of iron deficiency in Somalia. However, patients will be advised to consume the food product according to the recommended safe limits of the fortificant. **OR** No, though 40% of the population suffers from anaemia, iron fortified food will be recommended to patients whose reports	1 1

	suggest iron deficiency. Iron fortified food will have increased the nutritional value. In the same amount of food product the patient will get higher amount of the micronutrient than present in natural product. This fortificant can cause other ill effects to the non- anaemic population as well as could lead to higher levels of iron in the body than required. **III.** (a)6 2 Nitrogen and 4 oxygen are electron donors (b)  **For Visually challenged** I. Same as above II. Same as above III. (a) 6 2 Nitrogen and 4 oxygen are electron donors. (b) EDTA is an electron donor.	½ ½ 1
31	**Option A** I. The structures of expected products of Cannizarro reaction of 2-chloro -benzaldehyde  II. $-SO_3H$ is electron withdrawing in nature, hence it decreases the availability of lone pair for donation, hence basic nature of aniline decrease due to the presence of sulphonic group. III. Following are the steps to convert acetic acid to ethanamine.  IV. Benzoic acid from Benzoyl chloride: 	1 1 1 1

	V. The chemical test to distinguish between propanal and propanone is Tollen test (Silver Mirror) Propanal on heating in a water bath with ammonical silver nitrate (Tollen's reagent) forms a silver mirror on the sides of the test tube. Propanone on heating in a water bath with Tollen's reagent does not show any reaction. **OR** **Option B** I. Product formed on Wolf-Kishner reduction of 2 –methylbutanal is  II. The strength of benzoic acid depends on its ability to donate the proton and stability of the conjugate base formed .Sulphonic acid is an electron withdrawing group , it presence increases the ability to release proton . Hence the acidic strength will be increased . III. To convert acetic acid from ethanamine following are the steps involved : $CH_3CH_2NH_2 \xrightarrow{HNO_2} CH_3CH_2OH \xrightarrow{\text{acidified } KMnO_4} CH_3COOH$ IV. Aniline to benzoic acid: $C_6H_5NH_2 \xrightarrow{NaNO_2/\ HCl} C_6H_5N_2^+Cl^- \xrightarrow{KCN} C_6H_5CN \xrightarrow{\text{complete hydrolysis}} C_6H_5COOH$ V. a chemical test to distinguish between: propanal and ethanal Ethanal gives yellow precipitate on heating with iodine in the presence of sodium hydroxide (positive Iodoform test) Propanal will not give any reaction on heating with iodine in the presence of sodium hydroxide (negative Iodoform test)	1 1 1 1 1 1 1
32	**Option A** I. Protein present in the hair are fibrous while in egg are globular.	1

	Fibrous proteins are long fibre like and usually insoluble in water whereas globular proteins are globular and usually soluble in water.	
	II. Glucose reduces Fehling's Reagent however sucrose cannot though both have aldehydic group because glucose contains free aldehydic group whereas sucrose is a disaccharide and does not have free aldehydic group.	1
	III. Alpha -Amino acids behave as salts. This behaviour is due to the presence of both acidic (carboxyl group) and basic (amino group) groups in the same molecule.	1
	IV. The chemical change takes place during curdling of milk caused due to the formation of lactic acid from the lactose sugar by the bacteria present in milk.	1
	V. The possible disease is Osteoporosis, which can be cured by taking Vitamin D rich diet.	1
	OR	
	Option B	
	I. Carbohydrate present in cane sugar is sucrose which is a disaccharide composed of glucose and fructose while the carbohydrate present in milk is lactose which is a disaccharide composed of glucose and galactose	1
	II. Glucose is an aldohexose and a monosaccharide. Bromine water is a mild oxidising agent which can be used to bring about oxidation of only the aldehydic group present in glucose.	1
	III. Amino acid P is with structural formula given as – $HOOC\text{-}CH_2CH(NH_2)CH_2COOH$ The presence of two carboxylic acids shows that it is an acidic amino acid The pH will be less than 7	1
	IV. The two major molecular shapes formed due to the folding of secondary structure of proteins are alpha helix and beta pleated sheets	1
	V. Ashish is suffering from scurvy, which occurs due to deficiency of Vitamin C The sources of food are – Citrus fruits, amla and green leafy vegetables	1
33	**Option A**	
	I. Here, $T_1 = 298\,K, T_2 = 318\,K$	
	$\frac{K_2}{K_1} = 3$	
	$\log \frac{K_2}{K_1} = \frac{E_\alpha}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$	½
	$\log 3 = \frac{E_\alpha}{2.303 \times 8.314}\left[\frac{1}{298} - \frac{1}{318}\right]$	½

$$0.4771 = \frac{E_\alpha}{2.303 \times 8.314}\left[\frac{10}{298 \times 318}\right]$$ ½

$$E_\alpha = \frac{0.4771 \times 2.303 \times 8.314 \times 298 \times 318}{10}$$ ½

$$= 86567.87 \text{ J mol}^{-1}$$ 1

E_a =86.567 KJ mol^{-1} (½ mark for anwer anmd ½ for correct unit)

II. It is zero order reaction. ½

$$k = \frac{[R] - [R]_0}{t}$$ 1

Here, k is rate constant, [R] – concentration of reactant at time t, [Ro] initial concentration of reactant. ½

OR

Option B

I. $SO_2Cl_2(g) \rightarrow SO_2(g) + Cl_2(g)$

$t = 0$	P_i	0	0
on completion	0	P_i	P_i
$t = 10$ sec	$P_i - x$	x	x

½

On completion

$P_T = P_i + P_i$

$P_T = 2P_i$

$P_i = \frac{300}{2}$

$= 150$ torr

After 10 seconds

$P_T = P_i - x + x + x$

$x = P_T - P_i$

$x = 200 - 150$

$x = 50$ torr ½

First order integrated rate equation

$$k = \frac{2.303}{t} \log \frac{P_i}{P_i - x}$$ ½

$$k = \frac{2.303}{10} \log \frac{150}{150 - 50}$$

	$k = \frac{2.303}{10} \log \frac{150}{100}$ $k = \frac{2.303}{10} \log \frac{3}{2}$ $k = \frac{2.303}{10} (\log 3 - \log 2)$ $k = \frac{2.303}{10} \times (0.4771 - 0.3010)$ $k = \frac{2.303}{10} \times 0.1761$ $k = 0.040\ s^{-1}$	1 ½
	II. Rate of reaction can be expressed as Rate = $Z_{AB}e^{-Ea/RT}$	1
	where Z_{AB} represents the collision frequency of reactants, A and B and $e^{-Ea/RT}$ represents the fraction of molecules with energies equal to or greater than Ea.	1