KARNATAKA SCHOOL EXAMINATION & ASSESSMENT BOARD

II PUC EXAMINATION - 1 MARCH – 2024

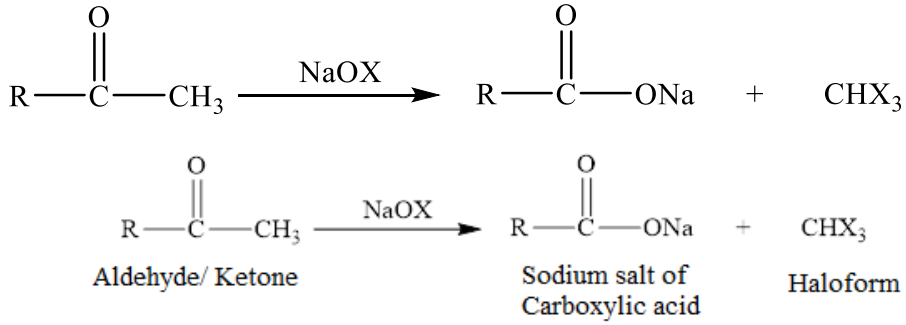
SUBJECT: CHEMISTRY MODEL ANSWERS SUBJECT CODE: 34

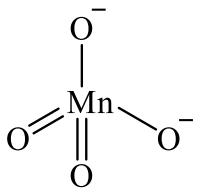
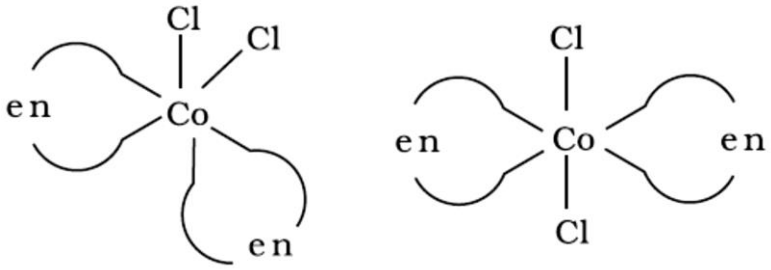
	PART-A	
I.	**Select the correct option from the given choices:**	**15 × 1=15**
1)	If the process of dissolution of a solid in liquid is an endothermic, its solubility; a) decrease with increase in temperature b) remains same at all temperature c) increase with increase in temperature d) increase with decrease in temperature	
Ans:	**c) increase with increase in temperature OR c) OR increase with increase in temperature**	**1**
2)	When the concentration of electrolytic solution approaches zero, the resulting molar conductivity is known as; a) specific conductance b) resistivity c) conductivity d) limiting molar conductivity	
Ans:	**d) limiting molar conductivity OR d) OR limiting molar conductivity**	**1**
3)	During discharging of lead storage battery, the correct half-cell reaction is; a) At anode, Pb is converted into PbO b) At anode, Pb is converted into $PbSO_4$ c) At anode, PbO is converted into $PbSO_4$ d) At cathode, Pb is converted into $PbSO_4$	
Ans:	**b) At anode, Pb is converted into $PbSO_4$ OR b) OR At anode, Pb is converted into $PbSO_4$**	**1**
4)	The catalyst in a chemical reaction provides an alternate pathway or reaction mechanism by decreasing: a) Activation energy b) Kinetic energy c) Normal energy of reacting species d) Potential energy	
Ans:	**a) Activation energy OR a) OR Activation energy**	**1**
5)	Which of the following pair of metal oxides are amphoteric? a) V_2O_5, Cr_2O_3 b) Mn_2O_7, CrO_3 c) V_2O_5, V_2O_4 d) CrO, V_2O_5	
Ans:	**a) V_2O_5, Cr_2O_3 OR a) OR V_2O_5, Cr_2O_3**	**1**
6)	The correct IUPAC name of $[Pt(NH_3)_2Cl_2]$ is; a) Diamminedichloridoplatinum (II) b) Dichloridodiammineplatinum (0) c) Dichloridodiammineplatinate (II) d) Diamminedichloridoplatinate (0)	
Ans:	**a) Diamminedichloridoplatinum (II) OR a) OR Diamminedichloridoplatinum (II)**	**1**

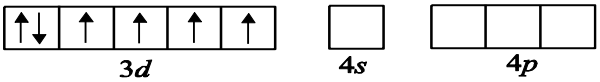
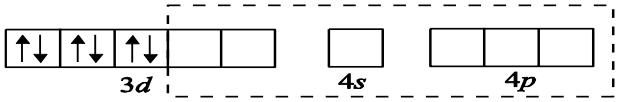
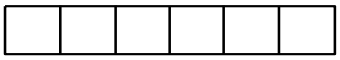
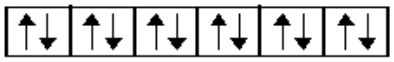
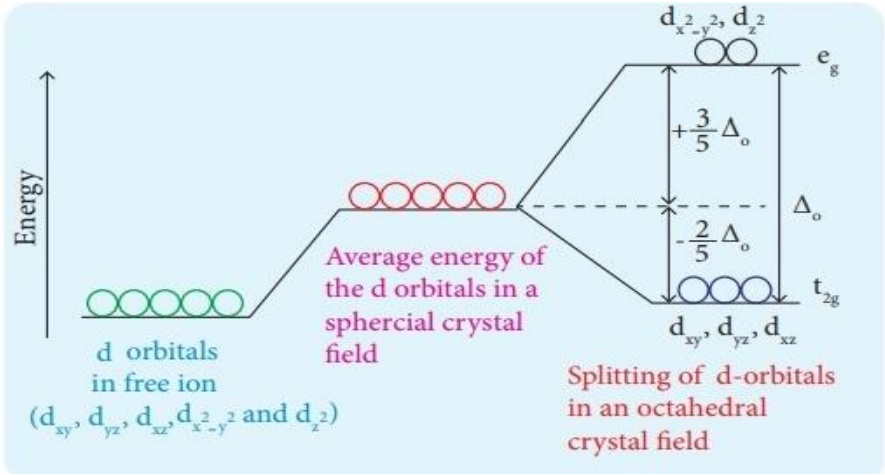
7)	The stereoisomers related to each other as non-superimposable mirror images are called; a) Enantiomers b) Diastereomers c) Anomers d) Racemic mixture	
Ans:	**a) Enantiomers OR a) OR Enantiomers**	
8)	Anisole on treatment with CH_3Cl in the presence of anhydrous $AlCl_3$ gives; a) Toluene b) o-chloroanisole c) Ortho and para-methylanisoles d) p-chloroanisole	
Ans:	**c) Ortho and para-methylanisoles OR c) OR Ortho and para-methylanisoles**	**1**
9)	The enzyme which can catalyse the conversion of glucose to ethanol is; a) Invertase b) Maltase c) Zymase d) Sucrase	
Ans:	**c) Zymase OR c) OR Zymase**	**1**
10)	Nucleophilic attack on carbonyl carbon atom changes its hybridization from; a) sp to sp^2 b) sp^2 to sp^3 c) sp^3 to sp^2 d) sp to sp^3	
Ans:	**b) sp^2 to sp^3 OR b) OR sp^2 to sp^3**	**1**
11)	Decarboxylating reagent is a mixture of; a) Alc. KOH + H_2O_2 b) NaOH + CO_2 c) NaOH + CaO d) Conc. HCl + $ZnCl_2$	
Ans:	**c) NaOH + CaO OR c) OR NaOH + CaO**	**1**
12)	To prepare p-Nitroaniline as a major product from aniline, the amino group is protected by; a) Acetylation b) Alkylation c) Saponification d) Sulphonation	
Ans:	**a) Acetylation OR a) OR Acetylation**	**1**
13)	The reagents used to separate the mixture of methylamine and dimethylamine are; a) $CHCl_3$ and HCl b) $C_6H_5SO_2Cl$ and KOH c) $C_6H_5SO_2Cl$ and HCl d) $CHCl_3$ and KOH	
Ans:	**b) $C_6H_5SO_2Cl$ and KOH OR b) OR $C_6H_5SO_2Cl$ and KOH**	**1**
14)	The carbohydrate which is also known as animal starch and stored in animal body is; a) Starch b) Sucrose c) Glycogen d) Cellulose	
Ans:	**c) Glycogen OR c) OR Glycogen**	**1**
15)	Which vitamin deficiency causes the disease cheilosis? a) Vitamin B_1 b) Vitamin B_2 c) Vitamin B_6 d) Vitamin B_{12}	
Ans:	**b) Vitamin B_2 OR b) OR Vitamin B_2**	**1**

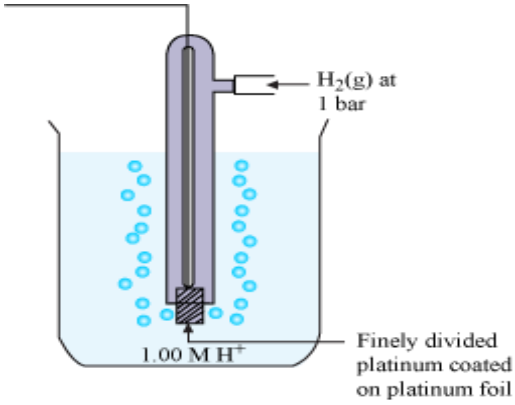
II.	**Fill in the blanks by choosing the appropriate word from those given in the brackets: [ionic charge, Grignard reagent, $C_6H_5N_2^+Cl^-$, Collision frequency, Molality, Molarity]**	**5 × 1 = 5**
16)	The number of moles of solute present in one kilogram of the solvent is called _____.	
Ans:	**Molality**	**1**
17)	The number of collisions per second per unit volume of the reaction mixture is known as _____.	
Ans:	**Collision frequency**	**1**
18)	Transition metals form large number of complex compounds due to high _____.	
Ans:	**ionic charge**	**1**
19)	The common name of alkyl magnesium halide is _____.	
Ans:	**Grignard reagent**	**1**
20)	The formula of benzenediazonium chloride is _____.	
Ans:	**$C_6H_5N_2^+Cl^-$**	**1**
	PART - B	
III.	**Answer any three of the following. Each question carries 2 marks.**	**3 × 2 = 6**
21)	**What type of deviation from Raoult's law is observed, when equal volume of ethanol and acetone are mixed together? Mention the reason for it.**	
Ans:	Positive deviation from Raoult's law **OR** $+^{ve}$ deviation. In pure ethanol molecules are hydrogen bonded. On adding acetone, its molecules get in between the ethanol molecules and break hydrogen bonds between them. **OR** The ethanol - acetone shows weaker interaction than pure ethanol-ethanol interaction. **OR** Due to weaker interaction between solute and solvent. **OR** $F_{A-B} < F_{A-A}$ & F_{B-B}	**1** **1**
22)	**Mention any two differences between order and molecularity of a reaction.**	

Ans:	Order of a reaction	Molecularity of a reaction	
	The sum of the powers concentration terms of reactants in the experimentally determined rate equation.	It is the number of reacting species involved in elementary or simplest reaction.	
	It is experimentally determined.	It is theoretically calculated.	
	It can be zero and even a fraction.	It cannot be zero or a non-integer.	**1 + 1**
	Order is applicable to elementary as well as complex reactions	Molecularity is applicable only for elementary reactions.	
	For complex reaction, order is given by the slowest step.	Molecularity of the slowest step is same as the order of the overall reaction.	
	Any two correct answer; ONE MARK EACH		

23) a) b)	**What is spectrochemical series?** **Between $[Co(en)_3]^{3+}$ and $[Co(NH_3)_6]^{3+}$ complex ions, which is more stable?**	
Ans: a)	Ligands can be arranged in a series in the order of increasing field strength is termed as spectrochemical series. **OR** Arrangement of ligands in increasing or decreasing order in their field strength is termed as spectrochemical series.	**1**
b)	$[Co(en)_3]^{3+}$ is more stable.	**1**
24)	**Write the IUPAC name of product obtained when ethyl bromide reacts with sodium iodide in dry acetone. Name the reaction.**	
Ans:	IUPAC Name: iodoethane. Reaction name: Finkelstein reaction.	**1** **1**
25)	**Explain Haloform reaction with chemical equation.**	
Ans:	Aldehydes and ketones having at least one methyl group (α – methyl group) linked to the carbonyl carbon atom (methyl ketones) are oxidised (oxidative degradation) by sodium hypohalite to sodium salts of corresponding carboxylic acids and haloform. This reaction is called Haloform reaction.  **OR** **Any Suitable example OR Self-explanatory equation: 2M**	**1** **1** **OR** **2**
26)	**Name two hormones which regulate the glucose level in the blood.**	
Ans:	Insulin Glucagon	**1** **1**
	PART - C	
IV.	**Answer any three of the following. Each question carries 3 marks.**	**3 × 3 = 9**
27)	**Write the balanced chemical equations in the manufacture of potassium dichromate from chromite ore.**	
Ans:	Step 1: $4\ FeCr_2O_4 + 8\ Na_2CO_3 + 7\ O_2 \rightarrow 8\ Na_2CrO_4 + 2\ Fe_2O_3 + 8\ CO_2$ Step 2: $2Na_2CrO_4 + H_2SO_4 \rightarrow Na_2Cr_2O_7 + Na_2SO_4 + H_2O$ or $2Na_2CrO_4 + 2H^+ \rightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$ Step 3: $Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$ **One mark for each step**	**1** **1** **1**

28) a) i) **ii)** **b)**	**Give a reason for each of the following:** **The spin only magnetic moment of Sc^{3+} is zero.** **Alloys are readily formed by transition metals.** **Write the structure of manganate ion (MnO_4^{2-}).**	
Ans:a) i) ii) b)	Due to absence of unpaired electrons. Very small difference in atomic size. **OR** Similar radii and other characteristics of transition metals, alloys are readily formed by transition metals.  manganate ion	**1** **1** **1**
29)	**What is Lanthanoid Contraction? Mention two consequences of it.**	
Ans:	The overall decrease in atomic radii and ionic radii from lanthanum to lutetium (across lanthanoids) is called Lanthanoid contraction. Consequences: 1. The separation of lanthanoids in pure state becomes difficult. **OR** Difficulty in separation of lanthanoids due to similar chemical properties. 2. The atomic radii of 3rd row transition series elements are almost similar to that of 2nd row transition series elements. **OR** The identical radii of Zirconium (Zr) and Hafnium (Hf). **Any correct consequences: 1 mark for each**	
30) a) **b)**	**Draw the geometrical isomers of $[CoCl_2(en)_2]$.** **Give an example for ambidentate ligand.**	
Ans: a) b)	 nitrite ion (NO_2^-) ion, SCN^- ion, CN^- ion, etc (any one correct answer)	**1** **+** **1** **1**
31)	**On the basis of Valence Bond Theory [VBT], explain geometry, hybridisation and magnetic property of $[Co(NH_3)_6]^{3+}$ ion. [Atomic number of cobalt is 27)**	

Ans:	In $[Co(NH_3)_6]^{3+}$; the cobalt ion is in +3 oxidation state. The electronic configuration of Co^{3+} = $[Ar]3d^6 4s^0$. Orbitals of Co^{3+} ion are represented as  When six strong NH_3 ligand is approaching central metal ion, rearrangement of electrons takes place.  Two d-orbitals, one s-orbital and three p-orbitals undergo hybridization to form six d^2sp^3 hybrid orbitals of cobalt.  six d^2sp^3 hybrid orbitals These six hybridised orbitals of Co^{3+} overlaps with orbitals of six ammonia ligands form six coordinate bonds.  six d^2sp^3 hybrid orbitals six pairs of electrons on NH_3 ligand The complex has octahedral geometry. diamagnetic because of the absence of unpaired electron. **OR** **Hybridisation: d^2sp^3** **Geometry: octahedral** **Magnetic property: diamagnetic**	**Geometry:** one-mark, **Magnetic property:** one mark; **Explanation:** one mark
32) a) b)	**Draw the energy level diagram for the splitting of d-orbitals in an octahedral crystal field.** **If Δ_O < P, on the basis of crystal field theory [CFT]. Write the electronic configuration of d^4- ion in octahedral complexes.**	
Ans : a)	 	**2**
b)	The electronic configuration of d^4 - ion in octahedral complexes is **t_{2g}^3 e_g^1.**	**1**

V	**Answer any two of the folowing. Each question carries 3 marks:**	**2 × 3 = 6**
33) a) **b)**	**What is reverse osmosis? Mention one of its application.** **State Henry's Law.**	
Ans: a)	The phenomenon of the flow of solvent molecules from solution to the pure solvent through semi permeable membrane by applying more pressure than osmotic pressure (in opposite direction or on solution side). Desalination of Sea water.	**1** **1**
b)	"The partial pressure of the gas in vapour phase (p) is proportional to the mole fraction of the gas (x) in the solution". **OR** "At a constant temperature, the solubility of a gas in a liquid is directly proportional to the partial pressure of the gas present above the surface of liquid or solution". **OR** "The solubility of a gas at a given temperature is directly proportional to the pressure at which it is dissolved".	**1**
34)	**Draw a neat labelled diagram of Standard Hydrogen Electrode (SHE). Write its half-cell reaction.**	
Ans:	 The half-cell reaction: $H^+_{(aq)} + e^- \longrightarrow \frac{1}{2} H_{2(g)}$ **Labelled diagram =2 mark** **Diagram without labelling = 1M;** **Reaction = 1 M**	**2** **1**
35)	**Write the anodic, cathodic and overall reactions of corrosion of iron occurs in the presence of water and air.**	
Ans:	At anode: $Fe(s) \longrightarrow Fe^{2+}(aq) + 2e^-$ **OR** $2\ Fe_{(S)} \rightarrow 2\ Fe^{2+}_{(aq)} + 4e^-$ At cathode: $4H^+(aq) + O_2(g) + 4e^- \longrightarrow 2H_2O(l)$ The overall reaction: $2\ Fe\ (s) + O_2\ (g) + 4\ H^+\ (aq) \longrightarrow 2\ Fe^{2+}\ (aq) + 2\ H_2O$	**1** **1** **1**
36)	**Derive Integrated rate equation for rate constant of a zero-order reaction.**	
Ans:	Consider a zero-order reaction, R → P $[R]_0$ = Initial concentration of the reactant. [R] = Concentration of the reactant at any time.	

$$\text{Rate} = \frac{-d[R]}{dt} = k[R]^0$$ **1**

Where k is rate constant of a zero order reaction

$$\text{Rate} = \frac{-d[R]}{dt} = k \times 1$$

$$d[R] = -k\ dt$$

Integrating both sides: $[R] = -kt + I$ … (i) (I = Integration constant)

When $t = 0$, $[R] = [R]_0$; Substituting in equation (i),

$$[R]_0 = -k \times 0 + I$$

$$[R]_0 = I$$ **1**

Substituting value of 'I' in equation (i),

$$[R] = -kt + [R]_0$$

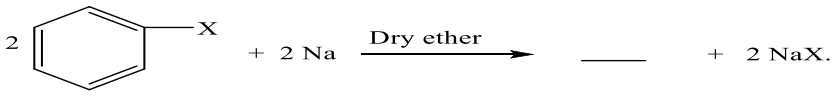
$$k = \frac{[R]_0 - [R]}{t}$$ **1**

PART - D

IV. **Answer any four of the following. Each question carries 5 marks.** **4 × 5 = 20**

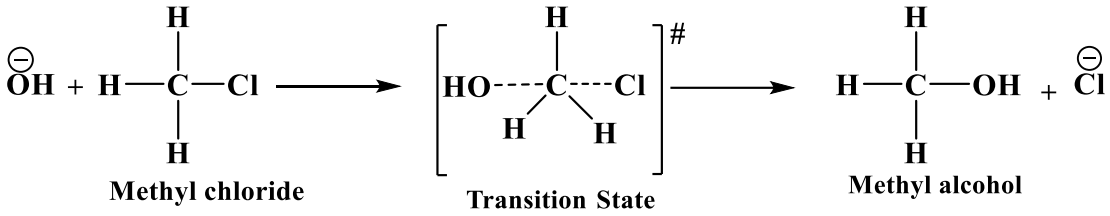
37)a) **Write the mechanism for the conversion of methyl chloride to methyl alcohol. Mention the order.**

b) **Complete the following equation:**

i) 

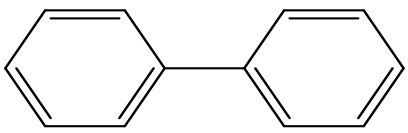
ii) $H_2C{=}CH_2 + Br_2 \xrightarrow{CCl_4}$ ____

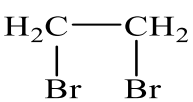
Ans:

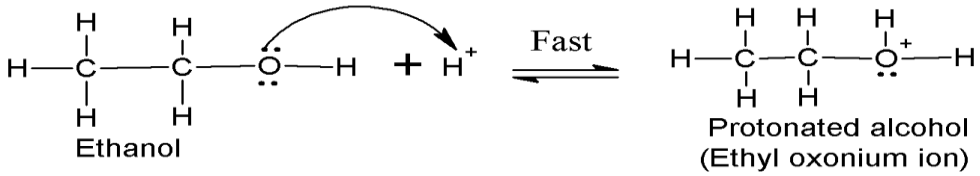
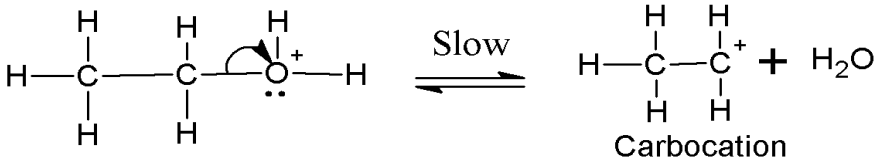
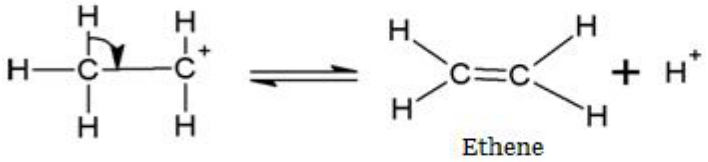
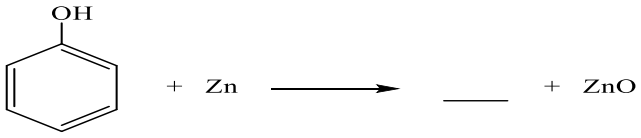
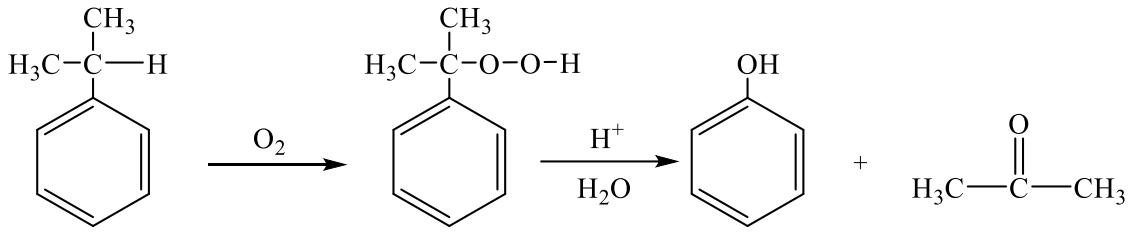
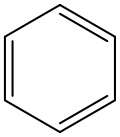
a) 

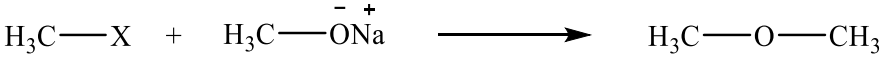
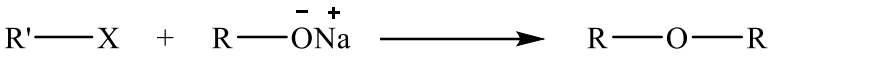
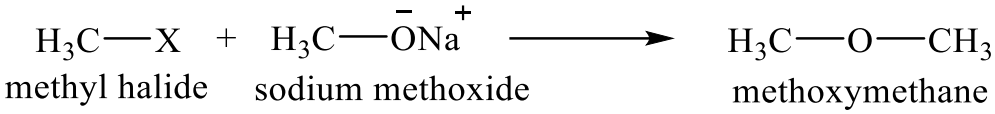
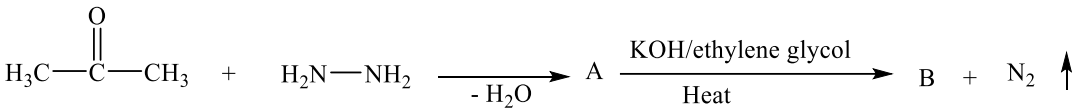
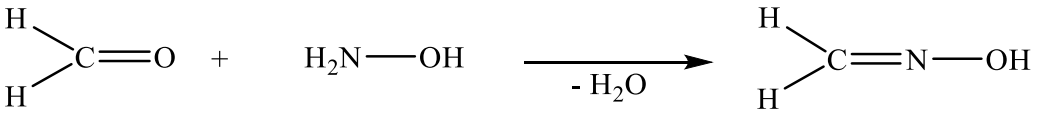
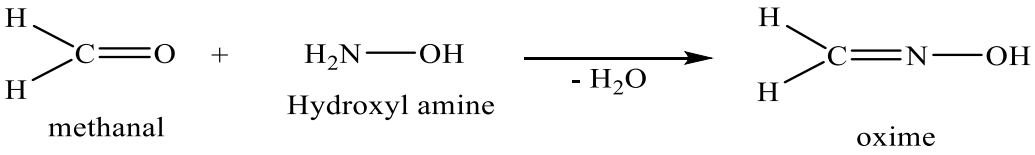
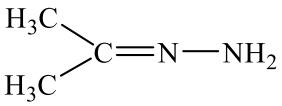
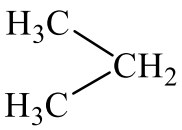
1 + 1

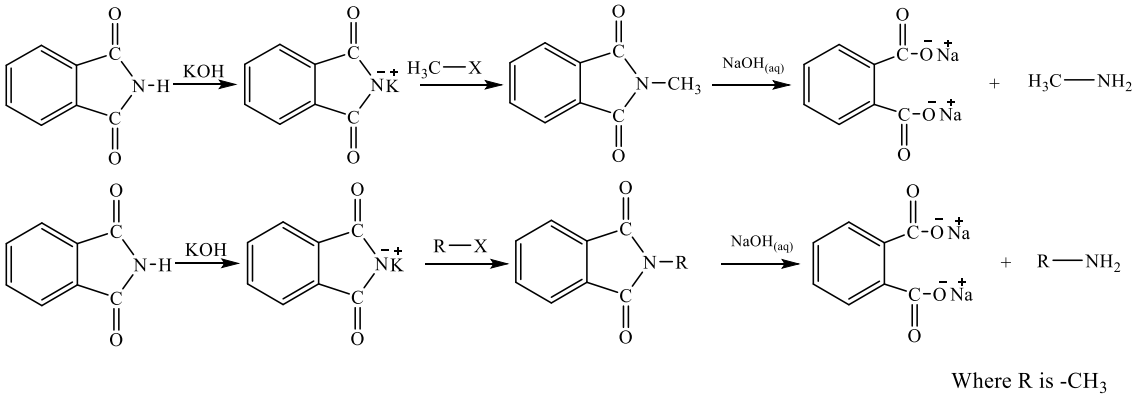
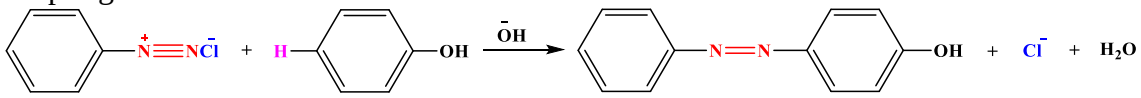
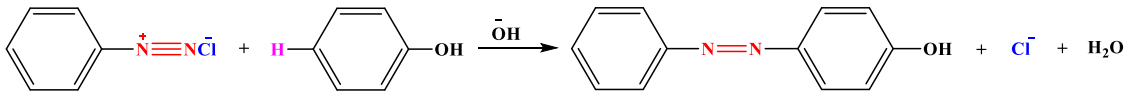
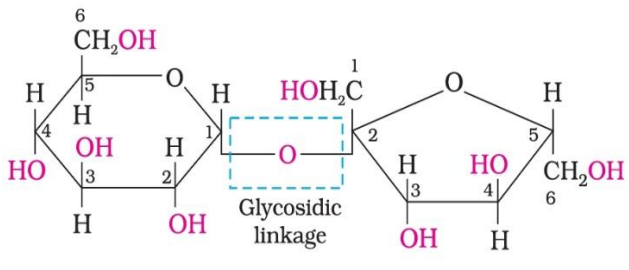
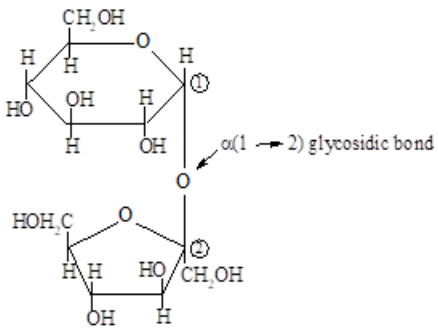
Order: 2 **One mark for each step** **1**

b) i)  **OR** Diphenyl **1**

ii)  **OR** 1,2-dibromoethane **OR** ethylene dibromide **1**

38) a)	**Write the three reactions involved in the mechanism of acid catalysed dehydration of ethanol to ethene.**	
b)	**What is Lucas reagent? Which class of alcohols does not readily form turbidity with Lucas reagent?**	
Ans: a)	Step1: 	**1**
	Step2: 	**1**
	Step3: 	**1**
	One mark for each step	
b)	Lucas reagent: conc. HCl and $ZnCl_2$ (anhydrous zinc chloride)	**1**
	Primary Alcohol **OR** 1^0 - alcohols	**1**
39) a)	**Write the chemical equations in the manufacture of phenol by Cumene process.**	
b)	**Complete the equation.** 	
c)	**Explain Williamson's reaction for the preparation of methoxymethane.**	
Ans: a)		**1 + 1**
	One mark for each step	
b)	 **OR** Benzene	**1**

c)	When methyl halide (halomethane) reacts with sodium methoxide (in alcoholic medium) gives methoxymethane. This reaction is called Williamson's reaction.  **OR**  Where R and R' are $-CH_3$ **OR**  **Self-explanatory equation = 2 mark**	**1** **1** **OR** **2**
40) a)	**How does methanal react with hydroxylamine? Explain with equation.**	
b)	**Identify A and B in the following reaction.** 	
c)	**Write any one reagent used to distinguish between aldehyde and ketone.**	
Ans: a)	When methanal reacts with hydroxyl amine gives oxime.  **OR**  **Self-explanatory equation = 2 mark**	**1** **1** **OR** **2**
b)	A = 	**1**
	B =  or propane	**1**
c)	Tollens' reagent **OR** Fehling's reagent **any one correct answer**	**1**
41) a) i)	**When methyl magnesium iodide reacts with dry ice forms an intermediate, which on acidification gives compound 'A'.**	
ii)	**Write the equation for the above chemical reaction.** **Write the IUPAC name of compound 'A'.**	
b)	**Between acetic acid and monochloroacetic acid, which is more acidic? Give reason.**	

Ans: a) i)	$H_3C—MgI + O=C=O \longrightarrow H_3C—C(=O)—O^-Mg^+I \xrightarrow{H_3O^+} H_3C—COOH$ **One mark for each step**	**2**
ii)	A = Ethanoic acid	**1**
b)	Monochloroacetic acid is stronger acid than acetic acid.	**1**
	Because – Cl group shows -I effect **OR** negative inductive effect **OR** – Cl group is electron withdrawing group	**1**
42) a) **b)**	**Write the chemical equations involved in the Gabriel phthalimide synthesis of methanamine.** **Explain the coupling reaction of Benzene diazonium chloride with phenol using chemical equation.**	
Ans: a)	 **OR** Where R is $-CH_3$ **One mark for each step**	**3**
b)	Benzene diazonium chloride reacts with phenol to give azo dyes. These reactions are called coupling reactions.	**1**
	 **OR**  Benzene diazonium chloride Phenol *p*-Hydroxyazobenzene **Self-explanatory equation = 2 mark**	**1** **Or** **2**
43) a) **b) i)** **ii)** **c)**	**Write the Haworth structure of sucrose.** **What are essential amino acids?** **Give an example for fibrous proteins.** **Name the nitrogenous base present in DNA but not in RNA.**	
Ans: a)	 Glycosidic linkage α– D – Glucose β– D – Fructose **Sucrose** **OR**  $\alpha(1 \rightarrow 2)$ glycosidic bond	**2**

b) i)	The amino acids which are not synthesized in the body but provided in the diet are called essential amino acids.	**1**
ii)	Keratine (protein present in hair, wool or silk), myosin (protein present in musles) **any one correct answer**	**1**
c)	Thymine **OR** T	**1**

PART - E

V. **Answer any three of the following. Each question carries 3 marks.** **3 × 3 = 9**

44) **Calculate the mole fraction of benzene in a solution containing 30% by mass in carbon tetrachloride. (Molar mass of benzene = 78 g/mol, molar mass of carbon tetrachloride = 154 g/mol)**

Ans: 30% by mass benzene in carbon tetrachloride solution means 30 g benzene present in 70 g of carbon tetrachloride.

$$\text{Number of moles} = \frac{\text{mass of the compound}}{\text{molar mass of the compound}}$$

$$\text{Number of moles of } C_6H_6 = n_a = \frac{30}{78} = 0.38 \qquad \text{Number of moles of } CCl_4 = n_b = \frac{70}{154} = 0.45 \quad \textbf{1}$$

$$\therefore \text{mole fraction of benzene} = \frac{n_a}{n_a + n_b} \quad \textbf{1}$$

$$\text{mole fraction of benzene} = \frac{0.38}{0.38 + 0.45} = 0.46 \quad \textbf{OR} \quad 0.458 \quad \textbf{1}$$

45) **1.00g of a non-electrolyte solute dissolved in 50 g of benzene lowered the freezing point of benzene by 0.40 K. the freezing point depression constant of benzene is 5.12 K kg mol^{-1}. Find the molar mass of the solute.**

Ans:

$$M_2 = \frac{1000 \times k_f \times W_2}{\Delta T_f \times W_1} \quad \textbf{OR} \quad M_B = \frac{K_f \times w_B \times 1000}{\Delta T_f \times w_A} \quad \textbf{1}$$

$$M_2 = \frac{5 \cdot 12 \times 1 \times 1000}{0 \cdot 4 \times 50} \quad \textbf{1}$$

$$\mathbf{M_2} = 256 \text{ g mol}^{-1} \quad \textbf{1}$$

46) **Calculate the emf of the cell in which the following reactions takes place:**
$Ni_{(s)} + 2Ag^+_{(0.002M)} \rightarrow Ni^{2+}_{(0.160M)} + 2Ag_{(s)}$. Given E^o cell = 1.05 V at 298 K.

Ans:

$$E_{cell} = E^o_{cell} - \frac{0 \cdot 0591}{n} \log \frac{[Ni^{2+}]}{[Ag^+]^2} \quad \textbf{OR} \quad E_{cell} = E^0_{cell} - \frac{2.303RT}{nF} \log \frac{\left[Ni^{2+}\right]}{\left[Ag^+\right]^2} \quad \textbf{1}$$

$$E_{cell} = 1.05 - \frac{0.059}{2} \log \frac{0.16}{(0.002)^2} \quad \textbf{OR} \quad E_{cell} = 1.05 \text{ V} - \frac{2.303 \times 8.314 \times 298}{2 \times 96487} \log \frac{[0.16]}{[0.002]^2} \quad \textbf{1}$$

$$E_{cell} = 1.05 - 0.1358$$

$$E_{cell} = 0.914 \text{ V} \quad \textbf{1}$$

47)	**A solution of $CuSO_4$ is electrolysed for 10 minutes with a current of 1.5 amperes. What is the mass of copper deposited at the cathode? [Molar mass of copper = 63 g/mol. 1F = 96487C]**	
Ans:	$Q = It = 1.5 \times 10 \times 60 \quad = 900C$	**1**
	Charge required to deposit one mole of Copper from Cu^{+2} ion is $2F = 2 \times 96487$ C	**1**
	$\therefore$ Mass of copper deposited $= \frac{63 \times 900}{2 \times 96487} = 0.29$ g	**1**
	OR	**OR**
	$W = ZIt$	
	Z = Electrochemical Equivalent of copper	
	$\text{Equivalent mass of Cu} = \frac{\text{Molecular mass}}{\text{Valency}} = \frac{63}{2} = 31.5$	**1**
	$Z = \frac{\text{Equivalent Mass}}{96487}$	**1**
	$\therefore W = ZIt = \frac{31.5 \times 1.5 \times 10 \times 60}{96487} = 0.29\,g$	**1**
48)	**A first order reaction has a rate constant 1.15×10^{-3} s^{-1}. How long will 5 g of this reactant take to reduce to 3 g?**	
Ans:	$t = \frac{2.303}{k} \log \frac{[R]_0}{[R]}$	**1**
	$t = \frac{2.303}{1.5 \times 10^{-3}} \times \log \frac{5}{3}$	**1**
	$t = 443.8$ Seconds. OR $t = 444$ s	**1**
49)	**The rate of chemical reaction quadruples for an increase of temperature from 293K to 313K. Calculate energy of activation of the reaction assuming that it does not change with temperature.**	
Ans:	Given: $K_2 = 4K_1$; $T_1 = 293K$; $T_2 = 313K$ & $R = 8.314 JK^{-1}mol^{-1}$	
	$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$	**1**
	$\because k_2 = 4k_1$	
	$\log 4 = \frac{E_a}{2.303 \times 8.314}\left[\frac{313 - 293}{293 \times 313}\right]$ **OR** $E_a = \frac{\log 4 \times 2.303 \times 8.314 \times 293 \times 313}{20}$	**1**
	$E_a = 52864$ J **OR** 52.864 kJ	**1**