GOVERNMENT OF KARNATAKA

KARNATAKA SCHOOL EXAMINATION & ASSESSMENT BOARD

II Year PUC Supplementary Exam -2 August – 2023

SCHEME OF EVALUATION

SUBJECT: CHEMISTRY SUBJECT CODE: 34

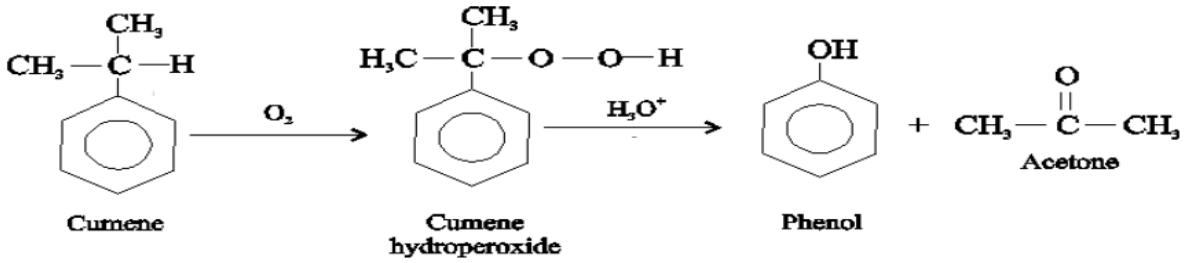
	PART-A	**15X 1 =15**
I.	**Select the correct option from the given choices:**	
1)	**One of the general characteristics of crystalline solids is** **a) isotropy b) Anisotropy** **c) No definite enthalpy of fusion d) They soften over of temperature**	
Ans:	b) Anisotropy OR b) OR Anisotropy	**1**
2)	**The ratio of number of moles of the solute per kilogram of the solvent is** **a) molarity b) mole fraction c) parts per million d) molality**	
Ans:	d) molality OR d) OR molality	**1**
3)	**The liquid solution in which solute is liquid is** **a) ethanol dissolved in water b) Oxygen dissolved in water** **c) CO_2 dissolved in water d) Glucose dissolved in water**	
Ans:	a) ethanol dissolved in water OR a) OR ethanol dissolved in water	**1**
4)	**During the Electrolysis of aqueous sodium chloride, the gas liberated at anode is a) H_2 b) O_2 c) Cl_2 d) N_2**	
Ans:	c) Cl_2 OR c) OR Cl_2	**1**
5)	**The order of a reaction with rate constant, K=3.2 X$10^{-4}$$mol^{-1}$ LS^{-1} is** **a) 0 b) 1 c) 2 d) 3**	
Ans:	c) 2 OR c) OR 2	**1**
6)	**The movement of colloidal particles under an applied electric potential is** **a) Brownian movement b) Dialysis c) Osmosis d) Electrophoresis**	
Ans:	d) Electrophoresis OR d) OR Electrophoresis	**1**
7)	**7) Sulphide ores are concentrated by** **a) Hydraulic washing b) Froth floatation method** **c) Magnetic separation d) Leaching**	
Ans:	b) Froth floatation method OR b) OR Froth floatation method	**1**
8)	**8) Natural gas is the commercial source of** **a) Helium b) Neon c) Argon d) Xenon**	
Ans:	a) Helium OR a) OR Helium	**1**

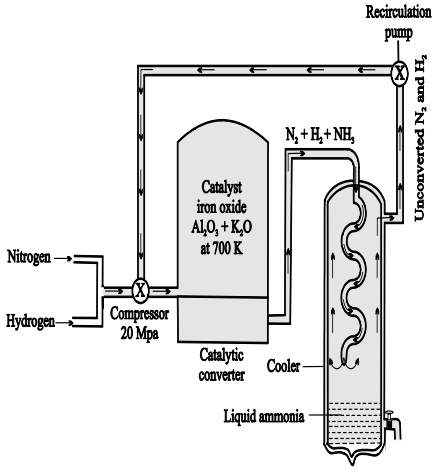
9)	**The transition element with stable electronic configuration is** **a) Sc b) V c) Cu d) Ti**	
Ans:	c) Cu OR c) OR Cu	**1**
10)	**The formula of the complex triaminetriaquachromium (III) chloride is** **a) $[Cr(H_2O)_3(NH_3)_3]Cl_3$ b)$[Cr(NH_3)_3(H_2O)_3]Cl_3$** **c) $[Cr(NH_3)_3(H_2O)_3]Cl_2$ d) $[Cr\ (H_2O)_3(NH_3)_3]Cl_2$**	
Ans:	a) $[Cr(H_2O)_3(NH_3)_3]Cl_3$ OR b) $[Cr(NH_3)_3(H_2O)_3]Cl_3$ OR a) OR b) OR $[Cr(H_2O)_3(NH_3)_3]Cl_3$ OR $Cr(NH_3)_3(H_2O)_3]Cl_3$	**1**
11)	**The reaction CH_3Br+ NaI $\xrightarrow{\text{dry acetone}}$ CH_3I + NaBr is** **a) Swarts reaction b) Fitting reaction** **c) Wurtz reaction d) Finkelstein reaction**	
Ans:	d) Finkelstein reaction OR d) OR Finkelstein reaction	**1**
12)	**The most acidic compound among the following is** **a) p- Nitrophenol b) p-cresol c) phenol d) m-nitro phenol**	
Ans:	a) p- Nitrophenol OR a) OR p- Nitrophenol	**1**
13)	**Ammonical $AgNO_3$ is** **a) Étard reagent b) Tollen's reagent** **c) Fehling reagent d) Jones reagent**	
Ans:	b) Tollen's reagent OR b) OR Tollen's reagent	**1**
14)	**14) N, N- dimethylmethanamine is** **a) primary amine b) secondary amine** **c) tertiary amine d) quaternary ammonium salt**	
Ans:	c) tertiary amine OR c) OR tertiary amine	**1**
15)	**Water soluble vitamin is** **a) B b) A c) D d) E**	
Ans:	a) B OR a) OR B	**1**
II.	**Fill in the blanks by choosing the appropriate word from those given in the brackets:** **[Square pyramidal, azeotropes, Aspirin, Arrhenius equation, enantiomers]**	**5 X 1 = 05**
16)	**_____ are the constant boiling binary mixtures having same composition in liquid and vapour phase.**	
Ans:	azeotropes	**1**

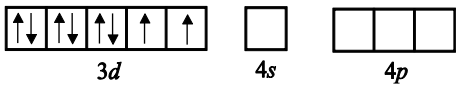
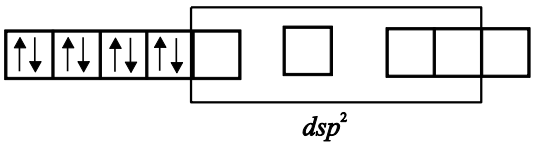
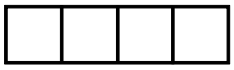
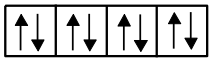
17)	**The temperature dependance of the rate of a chemical reaction is explained by _____.**	
Ans:	Arrhenius equation	**1**
18)	**The structure of $XeOF_4$ is _____.**	
Ans:	Square pyramidal	**1**
19)	**An equimolar mixture of _____ is racemic mixture.**	
Ans:	enantiomers	**1**
20)	**_____is an example of non-narcotic analgesic.**	
Ans:	Aspirin	**1**

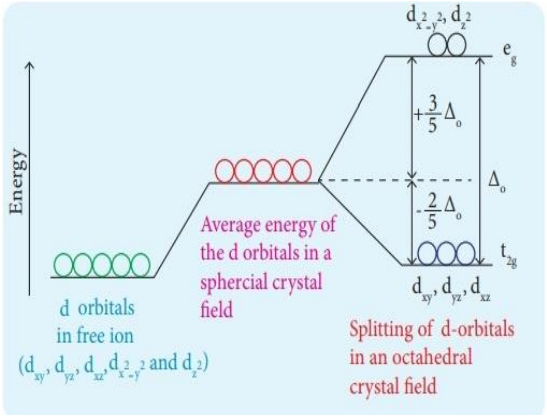
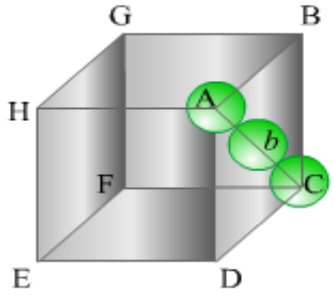
PART - B

III.	**Answer any four of the following. Each question carries two marks.**	**5 X 2 = 10**
21)	**What is Frenkel defect? Mention its effect on density.**	
Ans:	The dislocation of cation from its normal site to the interstitial site in the crystal is called Frenkel defect. Density remains same.	**1** **1**
22)	**Define limiting molar conductivity (Λ^0_m). Represent $\Lambda^0_{m\ (MgCl_2)}$ using Kohlrausch law.**	
Ans:	When concentration approaches zero, the molar conductivity of the solution is known as limiting molar conductivity. OR The conductivity of an electrolyte at infinite dilution is called limiting molar conductivity. $\Lambda^0_{m\,(MgCl_2)} = \lambda^0_{Mg^{2+}} + 2\,\lambda^0_{Cl^-}$	**1** **1**
23)	**Calculate the half-life of a first order reaction whose rate constant is 6.4 X $10^{-3}S^{-1}$.**	
Ans:	$k = \frac{0.693}{t_{1/2}}$ OR $t_{½} = \frac{0.693}{K}$ $t_{½} = \frac{0.693}{6.4\ X\ 10^{-3}} = 108.3\ s$	**1** **1**
24)	**What is Lanthanoid contraction? Mention its cause.**	
Ans:	The overall decrease in atomic radii and ionic radii from lanthanum to lutetium (across lanthanoids) is called Lanthanoid contraction. **Cause:** It is due to imperfect shielding of one electron by another in the same set of orbitals.	**1** **1**

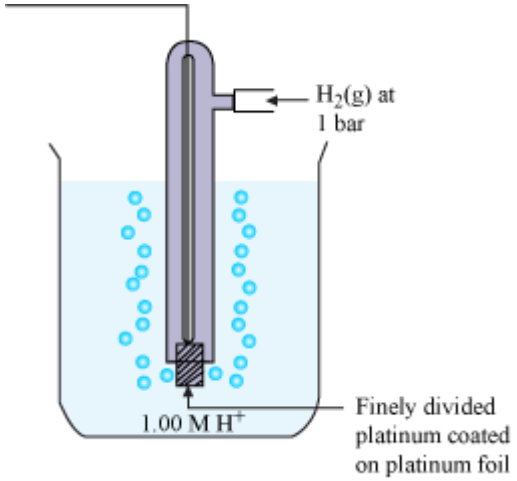
25)	**How was phenol manufactured by cumene?**	
Ans:	When cumene (isopropyl benzene) is oxidised in the presence of air, it gives cumene hydroperoxide which on acidification with dilute acid gives phenol.  Equation = 1M & Explanation =1M OR Self-explanatory equation: 2M	1 1
26)	**Write the chemical reaction for the conversion of acetic acid to acetamide.**	
Ans:	$CH_3COOH + NH_3 \longleftrightarrow CH_3COONH_4 \xrightarrow{\Delta} CH_3CONH_2 + H_2O$ ACETIC ACID AMMONIA AMMONIUM ACETATE ACETAMIDE **Each step = 1M**	1 + 1
27)	**What are anionic detergents? Give one example.**	
Ans:	Sodium salts of sulphonated long-chain alcohols or hydrocarbons in which anionic part is involved in the cleansing action. Example: Sodium docyl benzene sulphonate or Sodium lauryl sulphate or $CH_3(CH_2)_{10}CH_2OSO_3^-Na^+$ (Or any other correct example)	1 1
28)	**Mention the role of following chemicals in food.** a) saccharin b) Vegetable oil.	
Ans: a)	Artificial Sweetening agent	1
b)	Food preservative.	1
	PART - C	
IV.	**Answer any four of the following. Each question carries 3 marks.**	**5 X 3 = 15**
29) (a) (b) (c)	**In the Hall–Heroult process of the extraction of Aluminium, mention the Role of CaF_2. Electrolytic reaction at the cathode with equation. Write overall cell reaction.**	
Ans: (a)	CaF_2 acts as 1. Electrolyte 2. Increases the conductivity 3. Lowers the melting point of mixture. (Any One)	1
(b)	At Cathode: $Al^{3+}_{(melt)} + 3e^- \longrightarrow Al_{(l)}$	1
(c)	Overall, Cell Reaction: $2Al_2O_3 + 3C \longrightarrow 4Al + 3CO_2$	1

30) a) **b)**	**Mention any two reasons for the anomalous behaviour of oxygen.** **Complete the following reaction: $S + 2H_2SO_4$ (conc) → _____ + $2H_2O$**	
Ans: a) b)	1. It has small size or Due to Smaller size 2. It has High electronegativity. 3. It does not contain empty d orbitals or non-availability of *d*-orbitals. and 4. It has High ionisation enthalpy. (Any Two) $3SO_2$ OR Sulphur dioxide	**1 +** **1** **1**
31)	**In the manufacture of ammonia by Haber's process, write the flow chart and balanced chemical equation with optimum conditions.**	
Ans:	Balanced chemical equation: $N_{2(g)} + 3H_{2(g)} \xrightarrow[\text{Iron oxide catalyst}]{700\ K\ \ 200atm} 2NH_{3(g)}$ $H_f^O = -46\ kJ\ mol^{-1}$ 1. Temperature: 700 K 2. Pressure: 200×10^5 Pa or 200 atm or 20 MPa. 3. Catalyst: Iron oxide. 4. K_2O and Al_2O_3 are used as catalytic promoter. (Any one correct answers)	
32. a) **b)**	**Write the balanced chemical equation for the reaction of chlorine with hot and concentrated NaOH.** **Which is the oxoacid of fluorine?**	
Ans: a) b)	Chlorine reacts with hot and conc. NaOH gives chloride and chlorates. $6NaOH_{(hot\ \&\ conc.)} + 3Cl_2 \rightarrow 5NaCl + NaClO_3 + 3H_2O$ Sodium hydroxide Chlorine Sodium chloride sodium chlorate water **Equation=1M; name of the product=1M; Self-explanatory equation=2M** Hypofluorous acid OR HOF	**1** **1** **1**
33) a) **b)**	**Calculate the spin only magnetic moment of $M^{3+}_{(aq)}$ ion. (Z = 22)** **Transition metal ions exhibit catalytic activity. Give reason.**	
Ans: a)	M (Z= 22, $3d^2, 4s^2$) ⟶ M^{3+} ([Ar]$3d^1\ 4s^o$), Hence it has 1 unpaired electron i.e., n=1 $\boldsymbol{\mu = \sqrt{n(n+2)}}$ BM $\mu = \sqrt{\mathbf{1(1+2)}} = \sqrt{3} = 1.73$BM	**1** **1**

b)	1) Due to variable (multiple) oxidation states. 2) Large surface area for adsorption of reactant. 3) Formation of intermediate compounds. (Bonds between reactant and atoms of the surface of the catalyst). 4) Due to their ability to form complexes **(Any one correct answers)**	**1**	
34)	**Write the balanced chemical equations in the manufacture of potassium dichromate ($K_2Cr_2O_7$) 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**	
35)	**On the basis of Valence Bond Theory explain hybridization, geometry and magnetic property of the complex $[Ni(CN)_4]^{2-}$.**		
Ans: a) b)	In this complex, the oxidation state of nickel is +2 Electronic configuration of Ni^{2+}: [Ar]$3d^8$  Due the presence of a strong ligand CN^- ion, the two unpaired electrons of the 3*d*-orbitals are forced to pair. Nickel (II) ion undergoes ***dsp*^{2} hybridisation** forming four equivalent *dsp*^{2} hybrid orbitals.   Four *dsp*^{2} hybrid orbitals These four hybrid orbitals overlap with the orbitals of ligands and ligands donate four pairs of electrons to form four coordinate bonds. Four *dsp*^{2} hybrid orbitals with 4 pairs of electrons of ligands CN^-.  The geometry is **Square planar**. It is **diamagnetic** complex due to the absence of unpaired electrons. Hybridisation: dsp^2; Geometry: Square planar; Magnetic property: Diamagnetic due to absence of unpaired electrons.	**1** **1** **1**	**No explanation: 2 marks; With explanation: 3marks**

36) a)	**Draw the energy level diagram to show d-orbitals splitting in an octahedral crystal field.**	
b)	**Which type of isomerism arises in a coordination compound containing ambidentate ligand?**	
Ans: a)		**2**
b)	Linkage isomerism arises in coordination compound containing ambidentate ligand	**1**
	PART - D	
V.	**ANSWER ANY THREE OF THE FOLLOWING. EACH QUESTION CARRIES FIVE MARKS.**	**3 X 5 = 15**
37) a) **b)**	**Calculate the packing efficiency in CCP (FCC) structure. . (Atomic mass of copper = 63.1gmol^{-1}, N_A = 6.022 X 10^{23}).**	
Ans: a)	 Let the edge length be 'a' and face diagonal AC be 'b'. In ΔABC, $AC^2 = BC^2 + AB^2$ $b^2 = a^2 + a^2$ $b = \sqrt{2}\ a$ But $b = 4r$ $\therefore \sqrt{2}.a = 4r$ $a = \frac{4r}{\sqrt{2}} = 2\sqrt{2}\ r$ ∴ Total Volume of the unit cell, $a^3 = (2\sqrt{2}r)^3$ Volume of one sphere = $\frac{4}{3}\pi r^3$ The number of atoms per unit cell of FCC is 4. Volume occupied by four spheres in the unit cell = $4 \times \frac{4}{3}\pi r^3$	**1**

	$\therefore$ Packing efficiency $= \frac{\text{Volume occupied by four spheres in the unit cell}}{\text{Total volume of the unit cell}} \times 100\ \%$ $= \frac{4 \times \frac{4}{3}\pi r^3}{\left(2\sqrt{2}r\right)^3} \times 100\ \%$ $= \frac{\frac{16}{3}\pi r^3}{16\sqrt{2}r^3} \times 100\ \%$ $= 74\%$	**1** **1**
b)	$$d = \frac{z \times M}{a^3 \times N_A}$$ $= \frac{4 \text{ X } 63.1}{(3.608 \text{ X } 10^{-8})^3 \text{ X } 6.022 \text{ X } 10^{23}} = 8.9 gcm^{-3}$	**1** **1**
38) a) **b)**	**0.3L of an aqueous solution contains 1.89g of the protein. At 300K, the osmotic pressure of this solution was found to be 2.57×10^{-3} bar. Calculate the molar mass of protein. (R = 0.083Lbar $mol^{-1}K^{-1}$)** **State Henry's law. Give its mathematical form.**	
Ans: a)	$M_B = \frac{w_B RT}{\pi V}$ OR $M_2 = \frac{w_2 RT}{\pi V}$ $M_2 = \frac{1.89 \text{ x } 0.083 \text{ x } 300}{2.57 \text{ x } 10^{-3} \text{ x } 0.3}$ $M_2 = 61{,}039\ gmol^{-1}$	**1** **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". Mathematical expression: $p = K_H x$ where K_H = Henry's law constant, x = mole fraction of the gas, p = Partial pressure of the gas in vapour phase.	**1** **1**

39) a) **(i)** **(ii)** **(iii)** **b)**	**For the standard hydrogen electrode,** **Draw the neat labelled diagram.** **Write the half-cell reaction.** **Write the cell representation.** **Calculate the standard Gibb's energy (Δ_rG^0) for the reaction:** **$Ni_{(s)} + 2Ag^+_{(aq)} \rightarrow Ag_{(s)} + Ni^{2+}_{(aq)}$ [Given: E^o_{cell} = 1.05V & F = 96,500 C mol^{-1}].**	
Ans: a) (i) b)	 (ii) **The half-cell reaction:** $H^+_{(aq)} + e^- \longrightarrow \frac{1}{2}H_{2(g)}$ (iii) **The cell representation:** $Pt(s), H_2(g, 1bar) \mid H^+(1M)$ $\Delta_rG^0 = -nFE^0_{cell}$ ΔG^0 = - 2 X 96500 X 1.05 = −202650J = -202.65KJ	**1** **1** **1** **1** **1**
40) a) **b)**	**Derive integrated rate equation for the rate constant of a zero-order reaction.** **Mention the factor that account for the effective collisions.**	
Ans: a)	Consider a zero-order reaction, R → P $[R]_0$ = Initial concentration of the reactant. [R] = Concentration of the reactant at any time. $\text{Rate} = -\frac{d[R]}{dt} = k[R]^0$ Where k is rate constant of a zero order reaction $\therefore -\frac{d[R]}{dt} = k[R]^0$ $-\frac{d[R]}{dt} = k \times 1$ $d[R] = -k[dt]$ Integrating both sides: [R] = − *kt* + I … (i) (I or C= Integration constant)	**1**

When $t = 0$, $[R] = [R]_0$;

Substituting $[R] = [R]_0$ 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**

b) i) Activation energy. **1**

ii) Proper orientation of reactant molecules. **1**

41. a) Distinguish between physisorption and chemisorption based on specificity and molecular layer formation on the adsorbent.

b) What is shape selective catalyst? Name Zeolite catalyst used to directly convert alcohols to gasoline (petrol).

c) What is kraft temperature?

Ans:

a)

Physisorption	Chemisorption	
Not specific	Highly specific	**1**
Multi-molecular layers or Multi-layer adsorption	Uni-molecular layer or Uni-layer adsorption	**1**

b) The catalytic reaction depends upon the pore structure of the catalyst and the size of the reactant and product molecules is called shape- selective catalysis. **1**

ZSM-5 Or Zeolite Sieve Molecular porosity – 5 Or any suitable example **1**

c) The temperature above which the formation of micelles takes place is called Kraft temperature (T_k). **1**

VI. Answer any four of the following. Each question carries 5 marks. **4X5 =20**

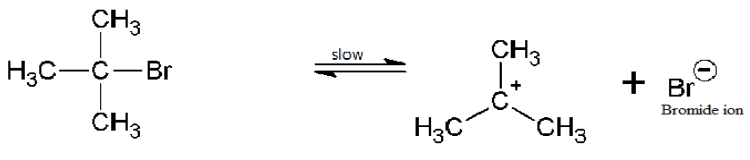
42) a) Discuss substitution nucleophilic unimolecular (S_N^1) reaction mechanism for the conversion of tert-butyl bromide to tert-butyl alcohol.

b) Explain Fittig reaction with an equation.

c) What are freons?

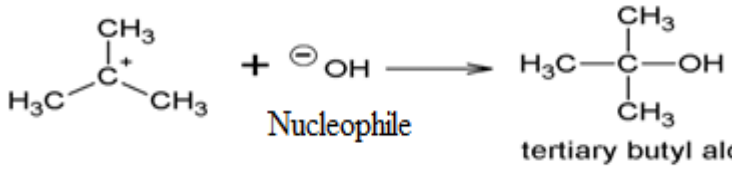
Ans:

a) **I Step:**



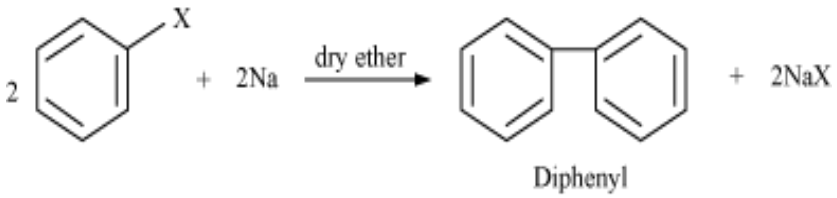
Tertiary butyl bromide — tertiary butyl carbocation **1**

II Step:



1

b) When aryl halide is treated with sodium metal in the presence of dry ether forms diphenyl or biphenyl. **1**



1

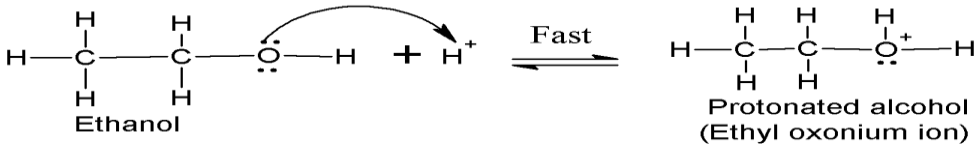
Equation = 1M & Explanation =1M OR **Self-explanatory equation: 2M**

c) Chlorofluorocarbon compounds of methane and ethane are called freons. **1**

43) a) Write the reaction mechanism for the of acid catalysed dehydration of ethanol to ethene.

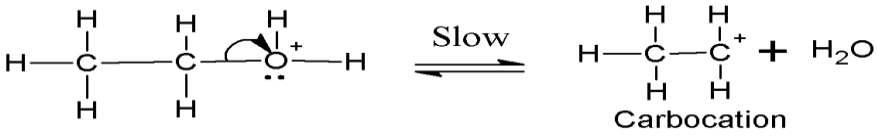
b) Explain nitration of anisole.

Ans: a) Step1:



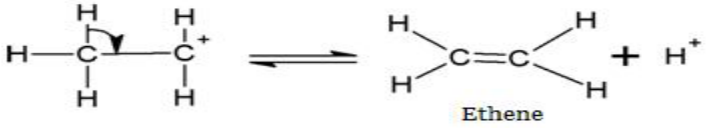
1

Step2:



1

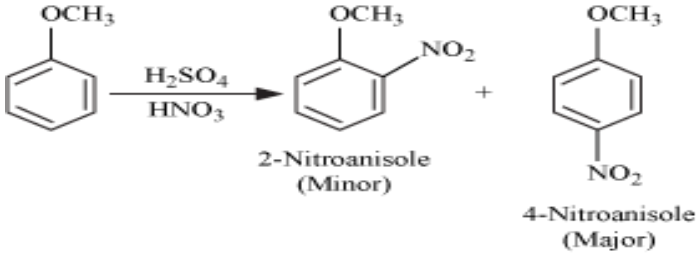
Step3:



1

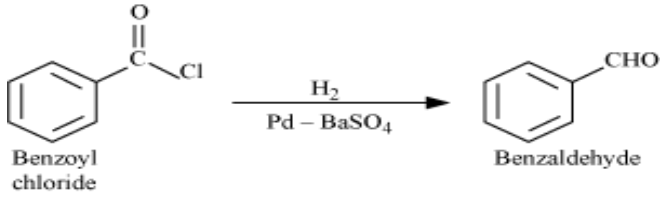
(One mark for each step)

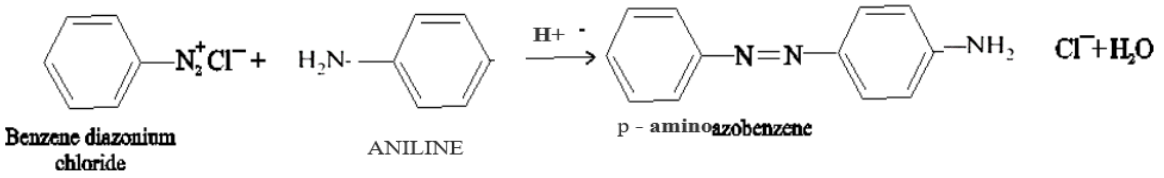
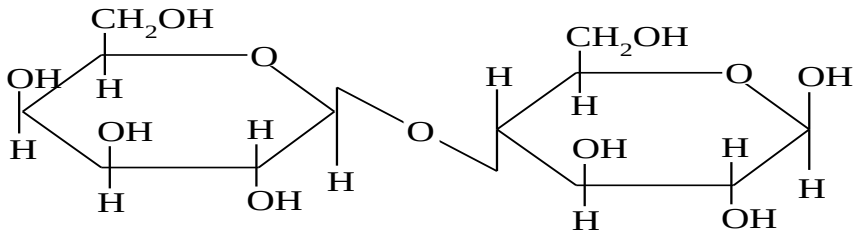
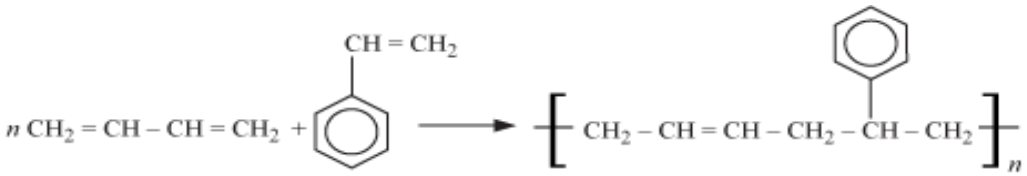
b) Anisole reacts with a mixture of concentrated nitric acid and concentrated sulphuric acids to yield a mixture of ortho nitroanisole and para nitroanisole. **1**



1

Equation = 1M & Explanation =1M OR Self-explanatory equation: 2M

44) a)	**Identify the organic product formed in the following reactions.**	
(i)	$>C=O \xrightarrow{H_2N-NH_2} \_\_\_\_\_ + H_2O$	
(ii)	$RCOONa \xrightarrow{NaOH-CaO} \_\_\_\_\_ + Na_2CO_3$	
(iii)	$RCHO + [O] \xrightarrow[H_3O^+]{KMnO_4-KOH} \_\_\_\_\_$	
b)	**Explain Rosenmund reduction of the Benzoyl chloride.**	
Ans: a)		
(i)	$>C=N-NH_2$	**1**
(ii)	R – H	**1**
(iii)	RCOOH	**1**
b)	Benzoyl chloride (acid chloride) is hydrogenated over catalyst, palladium on barium sulphate to give benzaldehyde (aldehyde). 	**1**
	Equation = 1M & Explanation =1M or Self-explanatory equation: 2M	**1**
45) a)	**Explain carbylamine reaction with example.**	
b)	**Discuss the coupling reaction of Benzene diazonium chloride with aniline.**	
c)	**Why are lower members of aliphatic amines soluble in water?**	
Ans: a)	Primary amines on heating with chloroform and ethanolic KOH (potassium hydroxide) gives isocyanides or carbylamines. This reaction is called carbylamine reaction.	**1**
	$R-NH_2 + CHCl_3 + 3\,KOH \xrightarrow{Heat} R-NC + 3KCl + 3H_2O$ OR $\underset{1^\circ\text{ amine}}{R-NH_2} + \underset{\text{Chloroform}}{CHCl_3} + 3KOH \xrightarrow[(\text{Alcoholic})]{\Delta} \underset{\text{isocyanide}}{R-NC} + 3KCl + 3H_2O$ **OR** any suitable example	**1**
	Equation = 1M & Explanation =1M or Self-explanatory equation: 2M	

b)	Benzene diazonium chloride reacts with aniline to give azo dyes (p-amino azobenzene). These reactions are called coupling reactions.  Benzene diazonium chloride ANILINE p - aminoazobenzene Equation = 1M & Explanation =1M or Self-explanatory equation: 2M	**1** **1**
c)	Lower members of amines can form hydrogen bonds with water molecule.	**1**
46) a) **b)** **c)**	**Write the Haworth's structure of lactose.** **Mention the two types of secondary structures of proteins.** **Which nucleic acid contains the base uracil?**	
Ans: a)	 β-D-Galactose unit β-D-Glucose unit Lactose	**2**
b)	α – helix and β – pleated are the two types of secondary structures of protein.	**1 +1**
c)	RNA or ribonucleic acid	**1**
47) a) **b)**	**Explain the preparation of Buna-S with equation** **Mention the following:** **(i) monomer of natural rubber.** **(ii) example of a biodegradable polymer** **(iii) polymer of caprolactam**	
Ans: a)	Buna-S is formed by polymerisation of 1, 3 butadiene and styrene.  1,3-Butadiene Styrene Butadiene-styrene co-polymer **Equation = 1M & Explanation =1M** OR **Self-explanatory equation: 2M**	**1** **1**
b) (i)	2- methylbuta-1,3-diene OR isoprene	**1**
(ii)	Nylon 2-nylon 6, PHBV OR poly β- hydroxybutyrate-co-β-hydroxy valerate, starch, cellulose, glycogen, proteins etc (any one correct example)	**1**
(iii)	Nylon 6	**1**