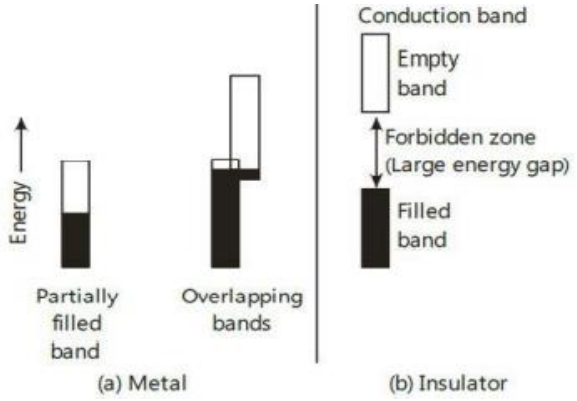
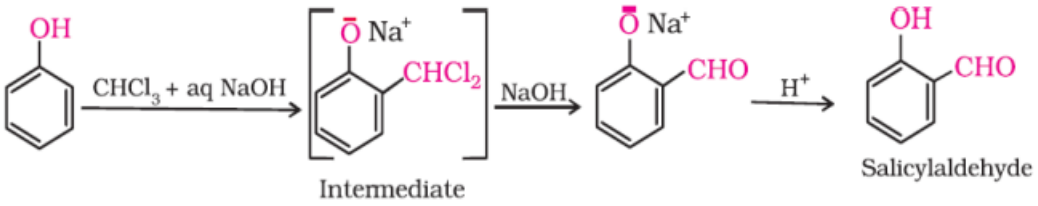
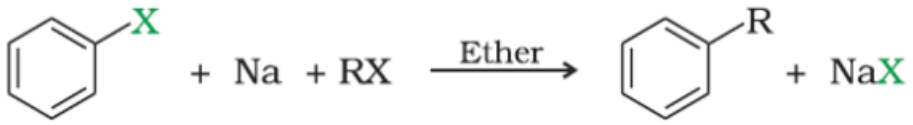
SECOND YEAR HIGHER SECONDARY MODEL EXAMINATION MARCH 2022

SUBJECT: CHEMISTRY **Qn. Code: ME 525**

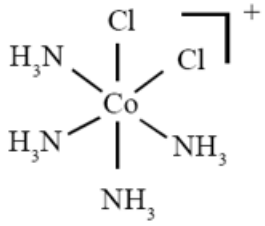
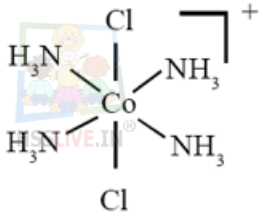
Qn. No.	Sub Qns.	Answer Key/Value Points	Score	Total
		PART I		
		A. Answer any 5 questions from 1 to 9. Each carries 1 score		
1.		(b) Co	1	1
2.		38% Sulphuric acid (H_2SO_4) solution	1	1
3.		(d) Molarity	1	1
4.		s^{-1}	1	1
5.		Nickel (Ni)	1	1
6.		(c) Rubber Latex	1	1
7.		(a) CH_3-NH_2	1	1
8.		CH_3-CH_2-OH (Ethanol)	1	1
9.		(c) $COCl_2$	1	1
		B. Answer all questions from 10 to 13. Each carries 1 score		
10.		(b) Thymine	1	1
11.		(b) Phenol, formaldehyde	1	1
12.		(c) Artificial Sweetener	1	1
13.		(b) Zinc	1	1
		PART II		
		A. Answer any 2 questions from 14 to 17. Each carries 2 scores		
14.		<table><tr><th></th><th>Order</th><th>Molecularity</th></tr><tr><td>1.</td><td>It is the sum of the powers of the concentration terms in the rate law expression</td><td>It is the total number of reactant species collide simultaneously in a chemical reaction</td></tr><tr><td>2.</td><td>It is an experimental quantity</td><td>It is a theoretical quantity</td></tr><tr><td>3.</td><td>It can be zero or fractional</td><td>It cannot be zero or fractional</td></tr></table> (Any 2 differences required)	2	2
15.		The regular decrease in the atomic and ionic radii along lanthanide series is known as lanthanide contraction. Consequences: i) Due to Lanthanide Contraction the 2nd and 3rd row transition series elements have similar radii. ii) Lanthanides have similar physical properties and they occur together in nature. So their isolation is difficult. [Any one required]	1 1	2
16.		Hinsberg reagent is benzene sulphonyl chloride ($C_6H_5SO_2Cl$). It is used to distinguish the three types of amines.	1 1	2
17.		Osmotic pressure (π) = CRT Here C = 0.1 M, R = 0.082 Latm/K/mol and T = 27^0C = 27 + 273 = 300 K So, π = 0.1 x 0.082 x 300 = **2.46 atm**	1 1	2
		B. Answer any 2 questions from 18 to 20. Each carries 2 scores		
18.		In conductors, the valence band is either partially filled or it is overlapped with the conduction band. So electrons can easily flow from valence band to conduction band. In insulators, there is a large gap between valence band and conduction band. So no	2	2

		electrons can move from valence band to conduction band. Or, the diagram.  		
19.		The preparation of Potassium permanganate from Pyrolusite (MnO_2) involves two steps. 1. MnO_2 is fused with KOH to form potassium manganate (K_2MnO_4). $2MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$ 2. K_2MnO_4 is electrolytically oxidised to potassium permanganate. $MnO_4^{2-} \xrightarrow[\text{in alkaline medium}]{\text{Electrolytic oxidation}} MnO_4^-$	1 1	2
20.		1. When aniline is treated with nitrous acid (prepared by mixing $NaNO_2$ & HCl) at 273-278K, benzene diazonium chloride is formed. 2. Benzene diazonium chloride on warming with water to form phenol. Or the equation:  	1 1	2
PART III **A. Answer any 3 questions from 21 to 24. Each carries 3 scores**				
21.		*Schottky Defect* / *Frenkel Defect* *Arising due to the missing of equal number of anions and cations from the lattice site* / *Arising due to the misplacing of a cation from the lattice site to the interstitial site.* *Decreases the density of the solid* / *No change in the density of the solid.* *It is shown by ionic crystals in which the anionic and cationic sizes are almost equal.* / *It is shown by ionic solids in which there is a large difference in the size of the ions.*	3	3
22.		For a first order reaction, $k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$	1	3

		For 90% completion, we can take $[R]_0 = 100$ and $[R] = 100 - 90 = 10$. Also, t = 20 s So $k = \frac{2.303}{20} \log \frac{100}{10}$ = **0.115 s^{-1}** Half life period ($t_{½}$) = 0.693/k = 0.693/0.115 = **6.026 s**	1 1	
23.		Williamson Synthesis: Alkyl halide reacts with sodium alkoxide to form ether. This reaction is called Williamson's ether synthesis. Or, R-X + R'-ONa → R-O-R' + NaX By Williamson synthesis, we can prepare methoxybenzene (Anisole) by treating sodium phenoxide (C_6H_5-ONa) with methyl bromide (CH_3-Br). C_6H_5-ONa + CH_3-Br ⟶ C_6H_5-O-CH_3 + NaBr	1 2	3
24.	(i) (ii)	Phenol when treated with chloroform in the presence of sodium hydroxide, followed by acidification, we get salicylaldehyde (o-hydroxybenzaldehyde). This reaction is known as Reimer - Tiemann reaction. Or the equation:  Intermediate Salicylaldehyde 2,4,6 – Tribromophenol	2 1	3
B. Answer any 2 questions from 25 to 27. Each carries 3 scores				
25.	(i) (ii)	*van't Hoff factor (i)* is defined as: $i = \frac{\text{Normal Molar mass}}{\text{Abnormal molar mass}}$ Or, $i = \frac{\text{Observed colligative property}}{\text{Calculated colligative property}}$ Or, $i = \frac{\text{Total number of moles of particles after association/dissociation}}{\text{Number of moles of particles before association/dissociation}}$ If the solvent is benzene, benzoic acid molecules undergo dimerization. So the number of particles decreases and hence the colligative properties. So the value of molar mass obtained by colligative property measurement is abnormal.	1 2	3
26.	(i) (ii)	Haloarenes are less reactive towards nucleophilic substitution reactions due to the following reasons: 1. Resonance effect: Due to this effect, the C – X bond gets a partial double bond character. 2. sp^2 hybridisation of the carbon to which halogen atom is bonded. 3. Due to instability of phenyl cation, S_{N2} reaction does not occur. 4. Due to repulsion between nucleophile and electron rich nucleophile. [Any 2 required] When a mixture of alkyl halide and aryl halide is treated with sodium in dry ether, an alkyl arene is formed. This reaction is called Wurtz-Fittig reaction. Or the equation:	2 1	3

				
27.	(i) (ii)	Hydroboration - oxidation reaction: Propene add diborane (B_2H_6) to give tripropyl borane as addition product. This on oxidation by hydrogen peroxide in the presence of aqueous sodium hydroxide to form propan-1-ol. $CH_3\text{-}CH{=}CH_2 + B_2H_6 \longrightarrow (CH_3\text{-}CH_2\text{-}CH_2)_3B \xrightarrow{H_2O_2/OH^-} CH_3\text{-}CH_2\text{-}CH_2\text{-}OH$ Wood spirit is Methanol or methyl alcohol	2 1	3
		PART IV **A. Answer any 3 questions from 28 to 31. Each carries 4 scores**		
28.	(i) (ii)	Fuel cells are galvanic cells which convert the energy of combustion of fuels directly into electrical energy. Working of H_2 - O_2 fuel cell: Anode reaction: $2H_2 + 4OH- \rightarrow 4H_2O + 4e-$ Cathode reaction: $O_2 + 2H_2O + 4e- \rightarrow 4OH-$ Overall reaction: $2H_2\ (g) + O_2\ (g)- \rightarrow 2\ H_2O(l$ The advantages of fuel cell are: i) The cell works continuously as long as the reactants are supplied. ii) It has higher efficiency as compared to other conventional cells. iii) It is eco-friendly (i.e. pollution free) since water is the only product formed. iv) Water obtained from $H_2 - O_2$ fuel cell can be used for drinking. [Any 2 required]	1 2 1	4
29.	(i) (ii)	<table><tr><th>Polymer</th><th>Monomer</th></tr><tr><td>HDP</td><td>Ethylene</td></tr><tr><td>Teflon</td><td>Tetrafluoroethene</td></tr><tr><td>Protein</td><td>Amino acid</td></tr><tr><td>Starch</td><td>D-glucose</td></tr></table> The process of heating natural rubber with sulphur and an appropriate additive at a temperature of 373 to 415 K is called vulcanisation. On vulcanisation, sulphur forms cross links between the different poly isoprene units and thus the rubber gets stiffened.	4 x ½ 1 1	4
30.	(i) (ii)	Cane sugar (sucrose) on hydrolysis gives an equimolar mixture of glucose and fructose. $C_{12}H_{22}O_{11} + H_2O \rightarrow C_6H_{12}O_6 + C_6H_{12}O_6$ Sucrose D(+)Glucose (+52.5^0) D(-)Fructose (-92.4^0) Sucrose is dextro rotatory, but after hydrolysis it gives dextro rotatory glucose and laevo rotatory fructose. Since the laevo rotation of fructose is more than dextro rotation of glucose, the mixture is laevo rotatory. So the process is called *inversion of cane sugar.* Sucrose molecule does not contain free aldehydic or ketonic group. So it is called non-reducing sugar.	2 2	4
31.	(i)	**Leaching of alumina from Bauxite:** Here the powdered ore is treated with a concentrated solution of NaOH at 473 – 523 K and 35 – 36 bar pressure. Alumina		4

		(Al_2O_3) dissolves in NaOH to form sodium aluminate [$2Na[Al(OH)_4]$ leaving behind the impurities. Al_2O_3 (s) + $2NaOH(aq) + 3H_2O(l) \rightarrow 2Na[Al(OH)_4](aq)$ The aluminate in solution is neutralised by passing CO_2 gas and hydrated Al_2O_3 is precipitated. The solution is seeded with freshly prepared hydrated Al_2O_3 which induces the precipitation. $2Na[Al(OH)_4](aq) + CO_2$ (g) $\rightarrow Al_2O_3.xH_2O(s) + 2NaHCO_3$ (aq)	3	
	(ii)	The hydrated alumina is filtered, dried and heated to give back pure alumina (Al_2O_3). $Al_2O_3.xH_2O(s) \xrightarrow{1470\ K} Al_2O_3$ (s) + $xH_2O(g)$ Cryolite is used to lower the melting point of bauxite and to increase the conductivity.	1	
B. Answer any 1 questions from 32 to 33. Each carries 4 scores				
32.	(i)	**Brownian movement:** It is the zig-zag movement of colloidal particles in dispersion medium. It is due to the unbalanced bombardment of particles of the dispersed phase by the particles of dispersion medium.	1 1	4
	(ii)	Zeolites are aluminosilicates of metals, which have honey-comb like structure. They are used as shape selective catalysts in petrochemical industries.	2	
33.	(i)	<table><tr><th>Anionic Detergents</th><th>Cationic Detergents</th></tr><tr><td>a) These are sodium salts of sulphonated long chain alcohols or hydrocarbons.</td><td>a) These are quaternary ammonium salts of amines with acetates, chlorides or bromides as anions.</td></tr><tr><td>b) Here the anionic part of the molecule is involved in the cleansing action.</td><td>b) Here the cationic part is responsible for cleansing action.</td></tr><tr><td>E.g. Sodium salts of alkylbenzenesulphonates.</td><td>E.g. Cetyltrimethylammoniumbromide</td></tr></table>	2	4
	(ii)	Antibiotics which kill or inhibit a wide range of Gram-positive and Gram-negative bacteria are called broad spectrum antibiotics. E.g. Ampicillin, Amoxycillin, Chloramphenicol, Vancomycin, Ofloxacin etc. [Any one example required]	2	
PART V Answer any 3 questions from 34 to 36. Each carries 6 scores				
34.	(i)	Contact process involves the following steps: (i) Burning of sulphur or sulphide ores in air to generate SO_2. $S(s) + O_2$ (g) $\rightarrow SO_2$ (g) (ii) Conversion of SO_2 to SO_3 by the reaction with oxygen in the presence of a catalyst (V_2O_5) $2SO_2 + O_2 \rightarrow 2SO_3$ (iii) Absorption of SO_3 in H_2SO_4 to give Oleum ($H_2S_2O_7$). $SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$ (iv) Dilution of oleum with water gives H_2SO_4 of the desired concentration. $H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$	3	6
	(ii)	Inter halogen compounds are compounds formed by combination of different halogen atoms. E.g.: ClF	2	
	(iii)	PCl_3 reacts with moisture and forms fumes of HCl gas. $PCl_3 + H_2O \longrightarrow H_3PO_3 + HCl$	1	

35.	(i)	Rosenmund reduction : Acid chlorides react with hydrogen in presence of Pd supported on $BaSO_4$, we get aldehydes. This reaction is called Rosenmund's reduction. Or, the equation: $R\text{-}COCl + H_2 \xrightarrow{Pd/BaSO_4} R\text{-}CHO + HCl$	2	6
	(ii)	Crotanaldehyde or, But-2-enal $2CH_3\text{-}CHO \xrightleftharpoons{dil.\ NaOH} CH_3\text{-}CH(OH)\text{-}CH_2\text{-}CHO \longrightarrow CH_3\text{-}CH{=}CH\text{-}CHO$ Ethanal — 3-Hydroxybutanal (aldol) — But-2-enal (Crotanaldehyde)	2	
	(iii)	Fluoroacetic acid. This is due to the greater electronegativity (-I effect) of fluorine.	2	
36.	(i)	$[Co(NH_3)_5Br]SO_4$ – Pentaamminebromidocobalt(III)sulphate $[Ni(CO)_4]$ – Tetracarbonylnickel(0)	1	
	(ii)	**Linkage isomerism**: This type of isomerism is shown by co-ordination compounds containing ambidentate ligand, which can bind to the central atom through more than one donor atoms. E..g. NO_2 ligand can bind to the central atom either through nitrogen atom or through oxygen atom. In $[Co(NH_3)_5(ONO)]Cl_2$, it is bound through oxygen atom, and in $[Co(NH_3)_5(NO_2)]Cl_2$ it is bound through nitrogen atom.	1	
	(iii)	Geometrical isomers of $[Co(NH_3)_4Cl_2]^+$  cis isomer  trans isomer		

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