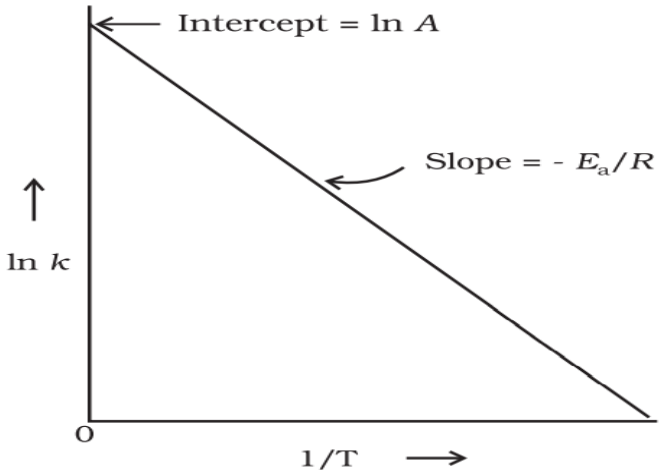
SECOND YEAR HIGHER SECONDARY EXAMINATION APRIL 2022

SUBJECT: CHEMISTRY **Qn. Code: SY 25**

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.		AgBr (Silver Bromide)	1	1
2.		Isotonic Solutions	1	1
3.		Kohlrausch law	1	1
4.		(b) s^{-1}	1	1
5.		(a) Emulsions	1	1
6.		(d) Froth flotation	1	1
7.		(b) Sandmeyer Reaction	1	1
8.		Lucas reagent [Conc. HCl & anhydrous $ZnCl_2$]	1	1
9.		Fuel cells	1	1
		B. Answer all questions from 10 to 13. Each carries 1 score		
10.		2,4,6-Tribromoaniline	1	1
11.		(c) -CO-NH-	1	1
12.		(a) Bakelite	1	1
13.		(b) Aspartame	1	1
		PART II		
		A. Answer any 2 questions from 14 to 17. Each carries 2 scores		
14.		This is due to the formation of f-centres. Or, by the metal excess defect due to anion vacancy. OR, When KCl crystals are heated in an atmosphere of potassium vapour, some potassium atoms are deposited at the surface of the crystal. Some Cl^- ions from the lattice sites diffuse to the surface of the crystal and combine with K atoms to form KCl. $K + Cl^- \rightarrow KCl + e^-$ The electrons so formed diffuse into the crystal and occupy the anion vacancies. These electrons are called f-centres. They absorb light energy and get excited. As a result the crystals become violet colour.	2	2
15.		Henry's law states that at constant temperature, the solubility of a gas in a liquid is directly proportional to the pressure of the gas. Or, at constant temperature, the partial pressure of the gas in vapour phase is proportional to the mole fraction of the gas in the solution. Or, the mathematical equation, $p = K_H.x$ (at constant temperature) Applications: In the preparation of soda water or soft drinks/ a condition known as Bends in Scuba divers/ a medical condition known as Anoxia in people living at high altitudes or climbers. (*Any one* application required)	1 1	2
16.	(i) (ii)	Arrhenius equation, $k = A.e^{-Ea/RT}$ Activation energy can be determined graphically by plotting ln k (log k) against 1/T. From the slop of the graph, the activation energy can be calculated as Ea = - slope x R	1 1	2

		or, Ea = -2.303 x slope x R. OR, the graph:  		
17.		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
		B. Answer any 2 questions from 18 to 20. Each carries 2 scores		
18.		This is due to the extra stability of Cr^{3+} and Mn^{2+} ions. OR, Cr^{2+} is reducing as its configuration changes from d^4 to d^3. d^3 configuration is stable, since it has a half-filled t_{2g} level (t_{2g}^3). On the other hand, the change from Mn^{2+} to Mn^{3+} results in the half-filled (d^5) configuration, which has extra stability. So Mn^{3+} is oxidizing.	2	2
19.		Primary amines on heating with chloroform and alcoholic KOH to form foul smelling isocyanides or carbylamines. This reaction is known as **carbylamine reaction.** $R\text{-}NH_2 + CHCl_3 + 3\ KOH \xrightarrow{heat} R\text{-}NC + 3\ KCl + 3\ H_2O$	1 1	2
20.		This is due to the +I effect of CH_3 group in $CH_3\text{-}NH_2$ and the resonance effect (+R effect of $-NH_2$ group) in aniline ($C_6H_5\text{-}NH_2$). OR, Due to the electron releasing inductive effect (+I effect) of CH_3 group, the electron density on N increases. So $CH_3\text{-}NH_2$ is easily protonated and hence it is more basic than NH_3. But in $C_6H_5\text{-}NH_2$, due to resonance, the lone pair of electrons is in conjugation with the benzene ring and is less available for protonation. So, it is less basic than NH_3.	2	2

PART III

A. Answer any 3 questions from 21 to 24. Each carries 3 scores

21.

Crystalline Solids	Amorphous Solids
Have long range order	Have only short range order
Have definite geometrical shape	No definite geometrical shape
Definite and sharp m.p	No definite m.p
Definite heat of fusion	No definite heat of fusion
Give regular cleavage on cutting	Give irregular cleavage on cutting
True solids	Pseudo solids
Are anisotropic	Are isotropic

[Any ***3*** differences required]

3 | 3

22.

We know that $\Delta T_b = \frac{1000\ K_b\ .\ w_2}{w_1.\ M_2}$

Here w_2 = 18 g, w_1 = 1 kg = 1000 g, K_b = 0.52 K kg/mol, Molar mass of glucose (M_2)= 180 g/mol, T_b^0 = 373.15 K

On substituting in the above equation, we get $\Delta T_b = \frac{1000 \times 0.52 \times 18}{1000 \times 180}$ = **0.052 K**

Also, $\Delta T_b = T_b - T_b^0$

So $T_b = \Delta T_b + T_b^0$ = 0.052 + 373.15 = **373.202 K**

1 | 1 | 1 | 3

23.

(i) The important factors which affect the rate of a chemical reaction are:

1. Nature of the reactants
2. Concentration of the reactants
3. Temperature
4. Pressure (for gaseous reaction only)
5. Effect of catalyst
6. Influence of radiation [Any ***2*** Required]

1

(ii) For a first order reaction,

$k = \frac{2.303}{t} \log\frac{[R]_0}{[R]}$

When t = t½ , $[R] = [R]_0/2$

Substitute these values in the above equation, we get

$k = \frac{2.303}{t_{½}} \log\frac{[R]_0}{[R]_0/2}$

Or, $t_{½} = \frac{2.303}{k} \log 2$

$= \frac{2.303 \times 0.3010}{k}$

Or, $t_{½} = \frac{0.693}{k}$

2 | 3

24.

(i) By Finkelstein Reaction/ by treating with NaI in dry acetone.

OR, the equation:

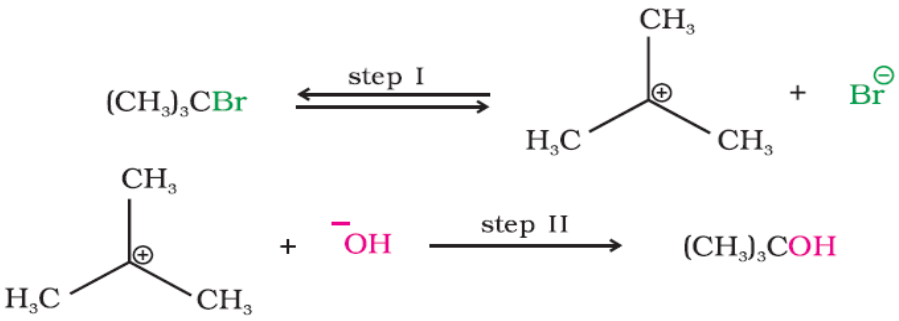
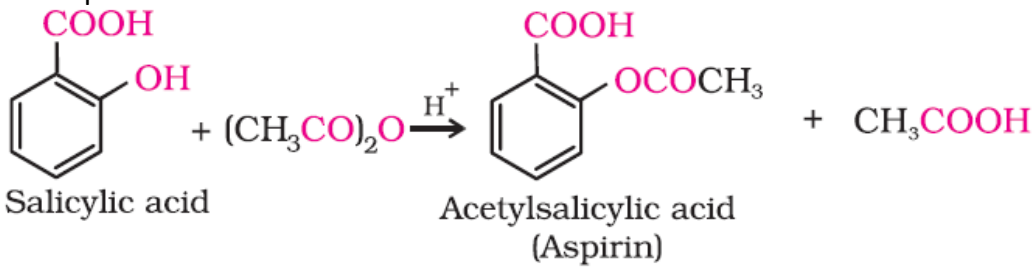
$CH_3\text{-}CH_2\text{-}Br + NaI \xrightarrow{\text{Dry acetone}} CH_3\text{-}CH_2\text{-}I + NaBr$

1

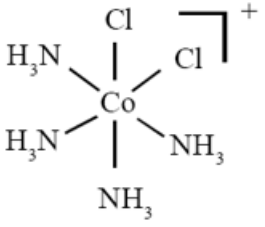
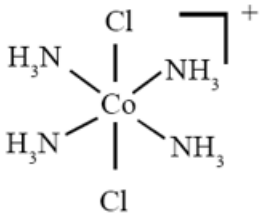
(ii) S_N1 mechanism or Substitution Nucleophilic unimolecular mechanism.

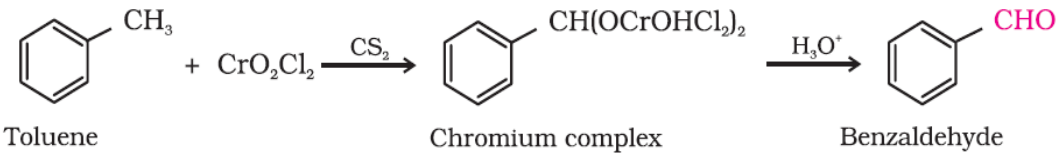
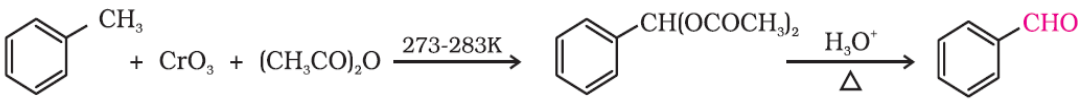
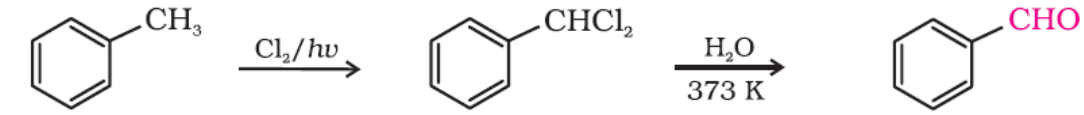
The reaction occurs in two steps:

3

		In the first step, the C—Br bond undergoes slow cleavage to produce a tert-butyl carbocation and a bromide ion. In the second step, the carbocation is attacked by the nucleophile (OH^-) to form the product, tert-butyl alcohol. Or, the equations: 	2	
B. Answer any 2 questions from 25 to 27. Each carries 3 scores				
25.	(i)	Alkyl magnesium halides or R-MgX	1	
	(ii)	Saytzeff rule states that in dehydrohalogenation reactions, if there is a possibility of formation of more than one alkenes, the preferred product is that alkene which contains greater number of alkyl groups attached to the C = C bond. E.g. when 2-bromobutane is treated with alcoholic KOH, 2-butene is formed as the major product. CH_3-CH_2-CHBr-CH_3 + KOH (alc) ⟶ CH_3-CH_2-CH=CH_2 + CH_3-CH=CH-CH_3 2-Bromobutane — 1-butene (minor) — 2-butene (major)	2	3
26.	(i)	Due to the presence of inter molecular hydrogen bonding in alcohols and phenols.	1	
	(ii)	Aspirin is acetyl salicylic acid. It is prepared by the acetylation of salicylic acid by treating with acetic anhydride in presence of a mineral acid or by treating with acetyl chloride in presence of a base. Or, the equation: 	1 1 1	3
27.	(i)	A is phenol (C_6H_5-OH) and B is Methyl iodide or Iodomethane (CH_3-I)	1	
	(ii)	Hydroboration - oxidation reaction: Alkenes add diborane to give trialkyl boranes which on oxidation by hydrogen peroxide in the presence of aqueous NaOH to form alcohols. E.g. Propene add diborane (B_2H_6) to give tripropyl borane which on oxidation by hydrogen peroxide in the presence of aqueous NaOH to form propan-1-ol.	1 1	3

		Or, the equation: $CH_3\text{-}CH{=}CH_2 + B_2H_6 \longrightarrow (CH_3\text{-}CH_2\text{-}CH_2)_3B \xrightarrow{H_2O_2/OH^-} CH_3\text{-}CH_2\text{-}CH_2\text{-}OH$		
PART IV **A. Answer any 3 questions from 28 to 31. Each carries 4 scores**				
28.	(i)	Cells that can be recharged and reused are called secondary cells.	1	
	(ii)	The cell reactions taking place in a lead storage battery are: Anode: $Pb + SO_4^{2-} \rightarrow PbSO_4 + 2e^-$ Cathode: $PbO_2 + SO_4^{2-} + 4H^+ + 2e^- \rightarrow PbSO_4 + 2H_2O$ The overall cell reaction is: $Pb + PbO_2 + 2H_2SO_4 \rightarrow 2PbSO_4 + 2H_2O$	3	4
29.	(i)	In homogeneous catalysis, the reactants and catalysts are in same phase. But in heterogeneous catalysis, the reactants and catalysts are in different phases. Or, any one example for each.	2	4
	(ii)	Tyndall effect is the scattering of light beam by the colloidal particles. Working of ultra-microscope is based on the principle of Tyndall effect.	1 1	
30.	(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 (Al_2O_3) dissolves in NaOH to form sodium aluminate [$Na[Al(OH)_4]$] leaving behind the impurities. $Al_2O_3 + 2NaOH + 3H_2O \rightarrow 2Na[Al(OH)_4]$ The aluminate in solution is neutralised by passing CO_2 gas and hydrated Al_2O_3 is precipitated. $2Na[Al(OH)_4] + CO_2 \rightarrow Al_2O_3.xH_2O + 2NaHCO_3$ The hydrated alumina is filtered, dried and heated to give back pure alumina (Al_2O_3). $Al_2O_3.xH_2O \xrightarrow{1470\ K} Al_2O_3 + x\ H_2O$ [***Either the explanation or the equations is required***]	3	4
	(ii)	Cryolite or CaF_2 is added to purified alumina to lower the melting point of bauxite and to increase the conductivity.	1	
31.	(i)	Oligosaccharides are carbohydrates which give 2 to 10 monosaccharide units on hydrolysis. E.g. Sucrose, maltose, lactose etc. [***any one*** example is required]	2	
	(ii)	Glycogen is animal starch. OR, In animal body, carbohydrates are stored in the form of Glycogen.	1	4
	(iii)	Starch contains two components – amylose and amylopectin.	1	
B. Answer any 1 questions from 32 to 33. Each carries 4 scores				
32.	(i)	<table><tr><th>Thermoplastics</th><th>Thermosetting plastics</th></tr><tr><td>i) They can be repeatedly softening on heating and hardening on cooling.</td><td>i) They become permanently hard on heating.</td></tr><tr><td>ii) These are the linear or slightly branched long chain molecules.</td><td>ii) These are cross linked or heavily branched molecules.</td></tr><tr><td>iii) On heating a physical change occurs.</td><td>iii) On heating a chemical change occurs.</td></tr><tr><td>iv) Can be recycled and reused.</td><td>iv) Cannot be recycled or reused.</td></tr><tr><td>E.g.: polythene, polystyrene, polyvinyls etc.</td><td>E.g. bakelite, urea-formaldelyde resins, polyesters like glyptal, terylene etc.</td></tr></table>***[Any one difference or example required]***	2	4
	(ii)	Monomer of neoprene is chloroprene OR, 2-Chloro-1,3-butadiene.	1	

		Its structure is: $CH_2=\underset{\displaystyle Cl}{\underset{|}{C}}-CH=CH_2$	1	
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>	3	4
	(ii)	Butylated hydroxy toluene (BHT), Butylated hydroxy anisole (BHA), SO_2, sulphites etc. [*Any one required*]	1	
		PART V **Answer any 3 questions from 34 to 36. Each carries 6 scores**		
34.	(i)	When strongly heated PCl_5 decomposes to form PCl_3 and Cl_2 $PCl_5 \longrightarrow PCl_3 + Cl_2$	1	6
	(ii)	Inter halogen compounds are compounds formed by combination of different halogen atoms. E.g.: ClF, BrF, IF, ClF_3, BrF_3, BrF_5 etc. [*Any 2* examples required]	2	
	(iii)	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 ($H_2S_2O_7$). $SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$ Dilution of oleum with water gives H_2SO_4 of the desired concentration. $H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$	3	
35.	(i)	Geometrical isomers of $[Co(NH_3)_4Cl_2]^+$  Cis isomer  Trans isomer	2	6
	(ii)	The different types of structural isomerism shown by co-ordination compounds are: 1. Ionisation isomerism 2. Linkage isomerism 3. Solvate or hydrate isomerism 4. Co-ordination isomerism. a) **Ionization isomerism:** It arises due to the exchange of ions between the inside and outside of co-ordination sphere. E.g. $[Co(NH_3)_5SO_4]Br$ and $[Co(NH_3)_5Br]SO_4$. b) **Linkage isomerism**: It arises in a co-ordination compound containing ambidentate ligand, which can bind to the central atom through more than	4	

		one donor atoms. E.g. $[Co(NH_3)_5(ONO)]Cl_2$ and $[Co(NH_3)_5(NO_2)]Cl_2$ c) **Solvate isomerism:** It arises due to different no. of solvent molecules which are bonded to the metal ion as ligand. Example $[Cr(H_2O)_6]Cl_3$ and $[Cr(H_2O)_5Cl]Cl_2.H_2O$ d) **Co-ordination isomerism:** This type of isomerism arises due to the interchange of ligands between cationic and anionic complexes. E.g. $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$		
36.	(i)	$2\ HCHO \xrightarrow{\text{Conc. KOH}} CH_3\text{-}OH + H\text{-}COOK$ methanol potassium formate	2	
	(ii)	**Hell-Volhard-Zelinsky(HVZ) reaction:** Carboxylic acids having an α-hydrogen atom, when treated with halogen (chlorine or bromine) in the presence of red phosphorus, we get α-halocarboxylic acids. Or, the equation: $R\text{-}CH_2\text{-}COOH \xrightarrow[(ii)\ H_2O]{(i)\ X_2/\text{Red phosphorus}} R\text{-}\underset{\displaystyle X}{\underset{|}{CH}}\text{-}COOH$ $X = Cl, Br$	2	
	(iii)	**Etard Reaction:** Toluene when oxidised using Chromyl chloride (CrO_2Cl_2) followed by hydrolysis gives benzaldehyde. Or the equation:  Toluene → Chromium complex → Benzaldehyde **OR** Toluene on treating with chromic oxide in acetic anhydride followed by acidification gives benzaldehyde.  Benzaldehyde **OR** **Side chain chlorination of toluene** gives benzal chloride, which on hydrolysis gives benzaldehyde.  Toluene → Benzal chloride → Benzaldehyde [***Any One*** method (***equation or explanation***) is required]	2	6

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