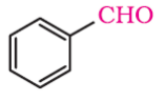
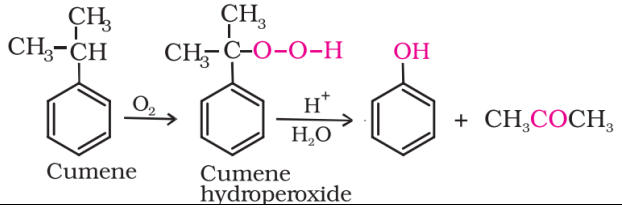
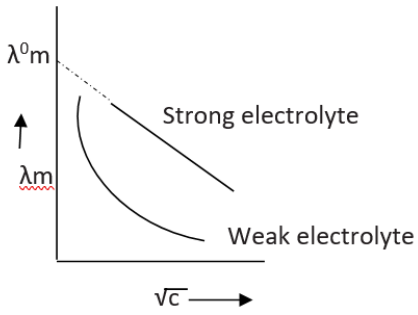
SECOND YEAR HIGHER SECONDARY EXAMINATION MARCH 2023 – ANSWER KEY

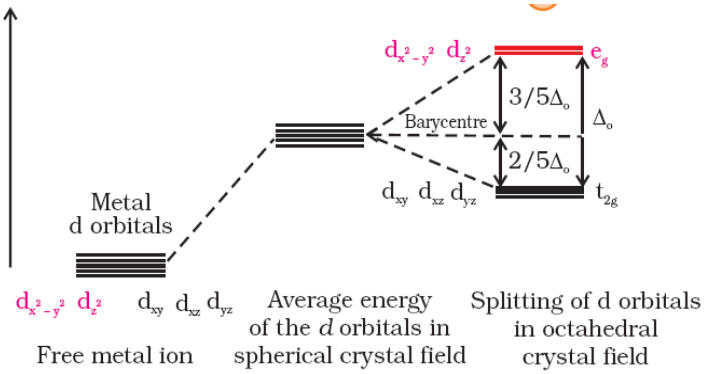
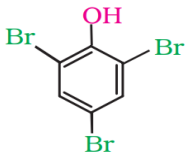
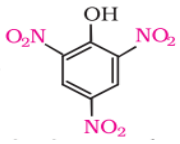
UNOFFICIAL **SUBJECT: CHEMISTRY** **Qn. Code: SY 525**

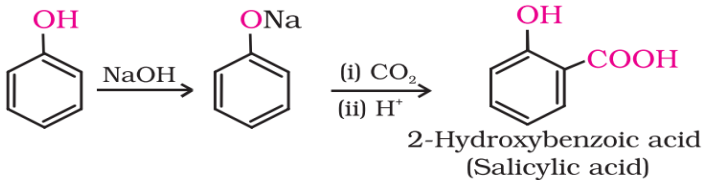
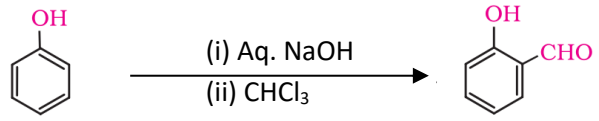
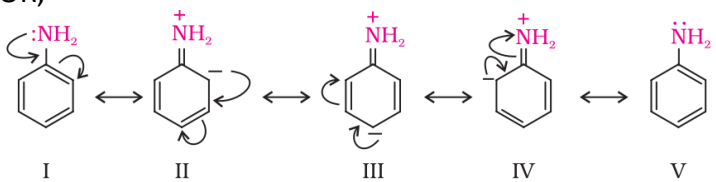
Qn. No.	Sub Qns.	Answer Key/Value Points	Score	Total
		Answer any 4 questions from 1 to 5. Each carry 1 score		
1.		mol L^{-1} s^{-1} (mol/L/s)	1	1
2.		(a) Ag	1	1
3.		Ethane-1,2-diamine OR, Ethylene diamine (H_2N-CH_2-CH_2-NH_2 OR, en)/Oxalate ion ($C_2O_4^{2-}$) *[Any one example is required]*	1	1
4.		Finkelstein Reaction	1	1
5.		Benzaldehyde OR, 	1	1
		Answer any 8 questions from 6 to 15. Each carry 2 scores		
6.		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, The partial pressure of the gas in vapour phase (p) is proportional to the mole fraction of the gas (x) in the solution. OR, the mathematical expression, $p = K_H.x$ (where p is the partial pressure of the gas, x is the mole fraction of the gas in the solution and K_H is the Henry's law constant). Applications: (i) In the preparation of soda water and soft drinks. (ii) A medical condition known as Bends in Scuba divers (ii) A medical condition known as Anoxia in people living at high altitudes or climbers. *[Any one application is required]*	1 1	2
7.		Ideal solutions are solutions which obey Raoult's law at all concentrations. E.g.: solutions of n-hexane and n-heptane, bromoethane and chloroethane, benzene and toluene etc. *[Any one example is required]*	1 1	2
8.		Given λ^0m (NaCl) = 126.4 Scm^2mol^{-1} , λ^0m (HCl) = 425.9 Scm^2mol^{-1} and λ^0m (NaAc) = 91.0 Scm^2mol^{-1} From Kohlrausch's law, $\lambda^0m(HAc) = \lambda^0m(NaAc) + \lambda^0m(HCl) - \lambda^0m(NaCl)$ $= 91.0 + 425.9 - 126.4 =$ **390.5 Scm^2mol^{-1}**	 1 1	2
9.	(i) (ii)	These are reactions which appear to follow higher order but actually follow first order kinetics. Hydrolysis of ester, Inversion of cane sugar etc. *[Any one example required]*	1 1	2
10.	(i) (ii)	Because of the comparable energies of s and d electrons. Manganese (Mn)	1 1	2
11.	(i) (ii)	Tetraammineaquabromidocobalt (III) bromide Potassium trioxalatoaluminate (III)	1 1	2
12.		**S_N1 Reaction** / **S_N2 Reaction** Occurs in two steps / Occurs in one step Order and molecularity = 1 / Order and molecularity = 2	2 x 1	2

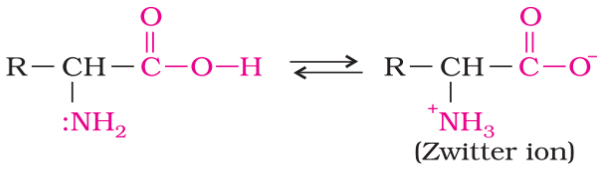
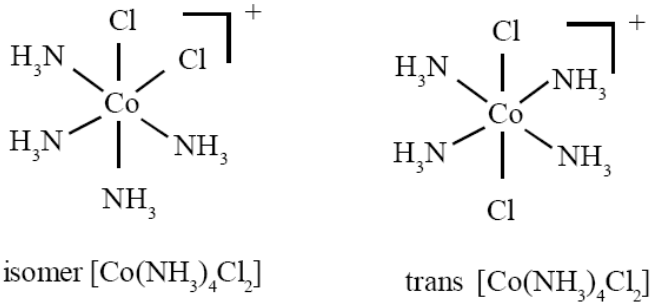
Intermediate carbocation is formed	No intermediate is formed.
For optically active compounds, the reaction proceeds through racemization.	For optically active compounds, the reaction proceeds through inversion of configuration.
The order of reactivity of alkyl halide is $3^0 > 2^0 > 1^0$	The order of reactivity of alkyl halide is $1^0 > 2^0 > 3^0$

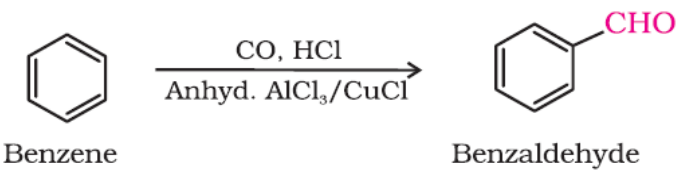
[Any 2 differences are required]

13.		Phenol is manufactured by Cumene process. When cumene is oxidised in presence of air followed by acid hydrolysis, we get phenol.  	1 1	2
14.		Aniline (a Lewis base) forms a salt with anhydrous aluminium chloride (a Lewis acid), which is used as catalyst in Friedel-Crafts reaction. So the catalyst is not available for the reaction and hence it does not undergo Friedel-Crafts reaction.	2	2
15.		Oligosaccharides are carbohydrates which give two to ten monosaccharide units on hydrolysis. E.g. Sucrose, maltose, lactose, raffinose etc. *[Any one example required]*	2	2
		Answer any 8 questions from 16 to 26. Each carries 3 scores		
16.	(i)	Molar conductivity is the conductivity of 1 mole of an electrolytic solution kept between two electrodes of a conductivity cell with unit area of cross section and at a distance of unit length. OR, Molar conductivity of a solution at a given concentration is the conductance of 'V' volume of a solution containing one mole of electrolyte kept between two electrodes with area of cross section A and distance of unit length. OR, Molar conductivity, $\lambda_m = k.V$ OR, $\lambda_m = k/c$ (where k is the conductivity and c is the concentration of the electrolytic solution in mol/m^3). OR, Molar conductivity, $\lambda_m = \frac{1000\ k}{M}$ [Where M is the molarity of the solution].	1	
	(ii)	 	2	3
17.	(i)	Here $k = 6.8 \times 10^{-14}\ s^{-1}$ $t½ = \frac{0.693}{k} = \frac{0.693}{6.8 \times 10^{-14}} =$ **1.019×10^{13} s**	1	
	(ii)	Integrated rate equation for a first order reaction is:		3

		$k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$ Where k – rate constant, t- time taken, $[R]_0$ – Initial concentration of the reactant and [R] is the concentration of the reactant at time 't'.	1 1	
18.		When temperature increases, the fraction of molecules (number of molecules) with energy equal to or greater than activation energy increases. So, the rate of reaction also increases. A catalyst increases the rate of a reaction by providing a new path for the reaction with low activation energy.	1½ 1 ½	3
19.		Potassium dichromate is generally prepared from chromite ore ($FeCr_2O_4$) by the following three steps. 1. Conversion of chromite ore to sodium chromate by fusing with sodium carbonate in presence of air. $4\ FeCr_2O_4 + 8\ Na_2CO_3 + 7\ O_2 \rightarrow 8\ Na_2CrO_4 + 2\ Fe_2O_3 + 8\ CO_2$ 2. Sodium chromate is acidified with sulphuric acid to form sodium dichromate. $2Na_2CrO_4 + 2\ H^+ \rightarrow Na_2Cr_2O_7 + 2\ Na^+ + H_2O$ 3. Conversion of sodium dichromate to potassium dichromate by treating with potassium chloride. $Na_2Cr_2O_7 + 2\ KCl \rightarrow K_2Cr_2O_7 + 2\ NaCl$	1 1 1	3
20.	(i) (ii)	It is a series in which the ligands are arranged in the increasing order of their field strength. OR, The series is: $I^- < Br^- < SCN^- < Cl^- < S^{2-} < F^- < OH^- < C_2O_4^{2-} < H_2O < NCS^- < edta^{4-} < NH_3 < en < CN^- < CO$.  	1 2	3
21.	(i) (ii) (iii)	2,4,6-Tribromophenol OR,  Benzene (C_6H_6) OR,  2,4,6-Trinitrophenol OR, Picric acid OR, 	1 1 1	3

22.	(i)	**Kolbe's Reaction:** When phenol is treated with sodium hydroxide, we get sodium phenoxide, which on treating with CO_2 followed by acidification, we get salicylic acid. OR,  2-Hydroxybenzoic acid (Salicylic acid)	1½	3
	(ii)	**Reimer-Tiemann Reaction:** When phenol is treated with chloroform in the presence of sodium hydroxide, followed by acidification, we get salicylaldehyde. OR,  Phenol Salicylaldehyde	1½	
23.	(i)	Aldehydes add HCN to form cyanohydrin. OR, the Chemical equation Aldehydes add alcohol to form hemi-acetal or acetal. OR, the Chemical equation Aldehydes add sodium bisulphite to form bisulphite addition product. OR, the Chemical equation Aldehydes add Grignard reagent to give alcohols. OR, the Chemical equation Aldehydes add ammonia or ammonia derivatives to give imines or substituted imines. OR, the Chemical equation [Any 2 reactions required]	2	3
	(ii)	Ethanol OR, Ethyl alcohol (C_2H_5-OH OR, CH_3-CH_2-OH)	1	
24.	(i)	Aldehydes.	1	3
	(ii)	Tests to distinguish aldehydes from ketones: 1. Tollens' Test: When an aldehyde is heated with Tollens' reagent, we get a bright silver mirror. 2. Fehling's Test: When an aldehyde is heated with equal volume of Fehling's reagent A (aqueous solution of $CuSO_4$) and B (alkaline sodium potassium tartarate), we get a red precipitate of cuprous oxide (Cu_2O). These reactions are not answered by ketones.	1 1	
25.	(i)	Primary amines on heating with chloroform and alcoholic potassium hydroxide form foul smelling isocyanides or carbyl amines. This reaction is known as **carbyl amine reaction.** **OR,** $R–NH_2 + CHCl_3 + 3\ KOH \xrightarrow{heat} R–NC + 3\ KCl + 3\ H_2O$ OR, any other example.	1	3
	(ii)	In Aniline ($C_6H_5–NH_2$), the lone pair of electrons is in conjugation with the benzene ring and it is less available for protonation. So it is less basic than NH_3. OR,  I II III IV V	2	

26.	(i)	The amino acids which can be synthesised in the body are known as ***non-essential amino acids***. OR, E.g.: Glycine, Alanine, Glutamic acid, Aspartic acid, Glutamine, Asparagine, Serine, Cysteine, Tyrosine and Proline. The amino acids which cannot be synthesised in the body and must be obtained through diet, are known as ***essential amino acids***. OR, E.g.: Valine, Leucine, Isoleucine, Arginine, Lysine, Threonine, Methionine, Phenylalanine, Tryptophan and Histidine.	½ ½	3
	(ii)	Amino acids contain both acidic (carboxyl group) and basic (amino group) groups. In aqueous solution, they form internal salts known as zwitter ions. These ions are neutral, but contains both positive and negative charges and hence show amphoteric behaviour. OR,  (Zwitter ion)	2	
		Answer any 4 questions from 27 to 31. Each carry 4 scores		
27.	(i)	These are properties of dilute solutions, which depend only on the number of solute particles and not on their nature.	1	4
	(ii)	The important colligative properties: (i) Relative lowering of vapour pressure (ii) Elevation of boiling point (iii) Depression of freezing point (iv) Osmotic pressure. [Any 2 Required]	1	
	(iii)	If a pressure higher than the osmotic pressure is applied to the solution side, the direction of osmosis gets reversed. This phenomenon is called reverse osmosis. Application of reverse osmosis is desalination of sea water.	1 1	
28.	(i)	Anode: Lead (Pb) Cathode: A grid of lead packed with PbO_2	½ ½	4
	(ii)	Anode reaction: $Pb + SO_4^{2-} \rightarrow PbSO_4 + 2e^-$ Cathode reaction: $PbO_2 + SO_4^{2-} + 4H^+ + 2e^- \rightarrow PbSO_4 + 2H_2O$.	1 1	
	(iii)	The cell can be recharged by applying an external potential higher than the potential of the cell.	1	
29.	(i)	 cis isomer $[Co(NH_3)_4Cl_2]$ trans $[Co(NH_3)_4Cl_2]$	2	4
	(ii)	In $[Ni(CN)_4]^{2-}$, the central atom Ni is in **dsp^2 hybridisation**. So it has a **square planar** geometry. Due to the absence of unpaired electrons, the complex is **diamagnetic.**	2	
30.	(i)	Major product is But–2–ene ($CH_3 – CH = CH – CH_3$) and minor product is But-1-ene ($CH_3 – CH_2 – CH = CH_2$) .	1 1	4

	(ii)	The rule is Saytzeff's rule or Zaitsev's rule. It states that in dehydrohalogenation reactions, the major product is that alkene which contains maximum number of alkyl groups around C = C bond.	1 1	
31.	(i)	**Haloform Reaction:** Compounds having CH_3–CO– group or CH_3–CHOH– group, when treated with sodium hypohalite (or, halogen and alkali), we get a haloform (CHX_3). $R–CO–CH_3 \xrightarrow{NaOX} R–COONa + CHX_3$ (where X = Cl, Br or I) OR, Any other example.	2	4
	(ii)	Gatterman – Koch Reaction: Benzene when treated with CO and HCl in the presence of anhydrous aluminium chloride or cuprous chloride, we get benzaldehyde. OR,  Benzene Benzaldehyde	1	
	(iii)	Clemmensen Reduction	1	

##########