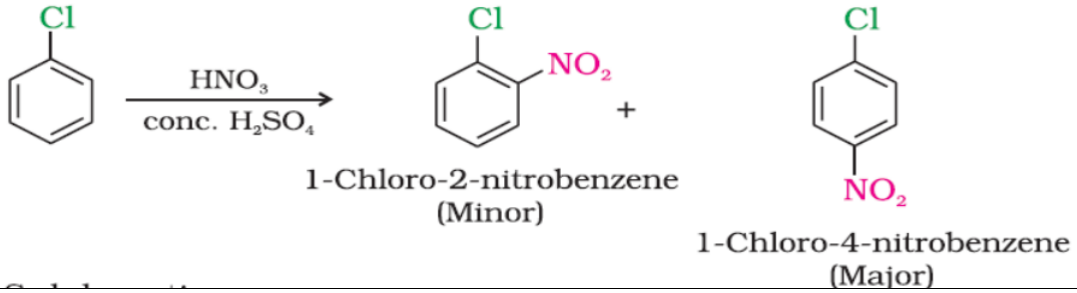
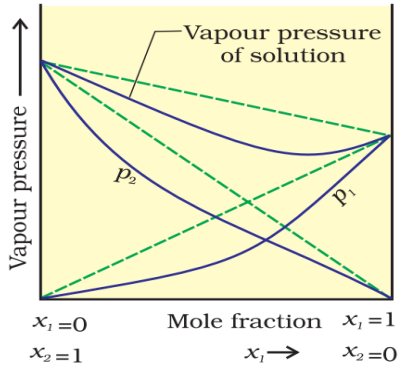
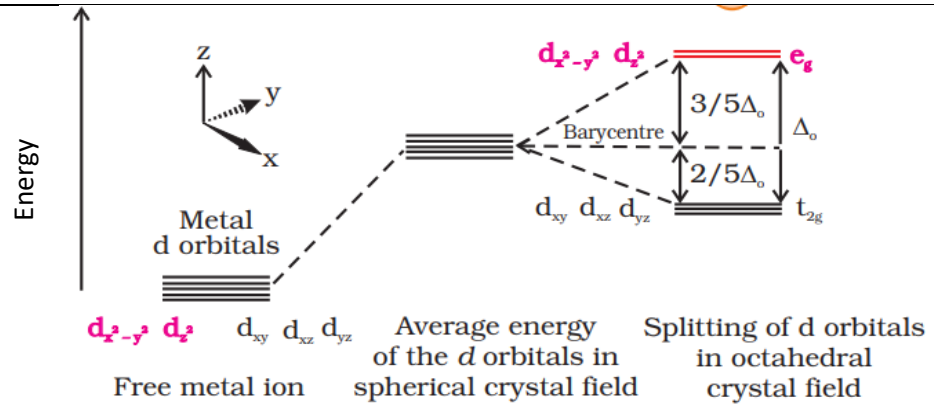
SECOND YEAR HIGHER SECONDARY 2nd TERMINAL EXAMINATION DEC 2022

CHEMISTRY - *ANSWER KEY (Question Code: 2025)*

Qn. No.	Sub Qns.	Answer Key/Value Points	Score	Total
Answer any 4 questions from 1 to 5. Each carries 1 score. (4 x 1 = 4)				
1.		Molarity	1	1
2.		(d) 0.0 V	1	1
3.		(b) 1	1	1
4.		(c) $C_2O_4^{2-}$	1	1
5.		Phosgene OR, Carbonyl chloride OR, $COCl_2$	1	1
Answer any 8 questions from 6 to 15. Each carries 2 scores. (8 x 2 = 16)				
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, at constant temperature, the partial pressure of the gas in vapour phase is proportional to the mole fraction of the gas in the solution. Application: In the preparation of soda water and soft drinks/ medical condition known as bends in scuba divers/ medical condition known as anoxia in people living at high altitudes or climbers.	1 1	2
7.		Two solutions having same osmotic pressure at a given temperature, are called isotonic solutions. E.g.: 0.9% (mass/volume) NaCl solution is isotonic with the fluid inside our blood cell.	1 1	2
8.		Van't Hoff factor (i) is defined as: $i = \frac{\text{Normal molar mass}}{\text{Abnormal molar mass}}$ $= \frac{\text{Observed colligative property}}{\text{Calculated colligative property}}$ $i = \frac{\text{Total number of moles of particles after association/dissociation}}{\text{Number of moles of particles before association/dissociation}}$ It is used to correct the abnormal molar mass of solute. Normal molar mass = i x abnormal molar mass	1 1	2
9.		Rate of a reaction is the change in concentration of any one of the reactants or products in unit time. Factors affecting rate of a reaction are nature of the reactants, concentration of the reactants, temperature, pressure, catalyst and radiation [Any 2 required]	1 1	2
10.		The reaction which appears to follow higher order but actually follows first order kinetics is called pseudo first order reaction. E.g.: Inversion of cane sugar, Hydrolysis of ester etc. [Any one example required]	1 1	2
11.	(i) (ii)	1 (unimolecular) 2 (bimolecular)	1 1	2

12.	(i) (ii)	$(n-1)d^{1-10}\ ns^{0-2}$ There is no partially filled d orbitals in the ground state or in the common oxidation state of zinc.	1 1	2
13.		(i) d and f block elements and their compounds are used as catalysts. (ii) Iron and steels are important construction materials. (iii) Cu, Ag, Au and some alloys are used for making coins. (iv) TiO is used in pigment industry. (v) Zn, Ni, Cd, MnO_2 etc are used in making batteries. (vi) Compounds of Ag are used in photography. [Any 2 required]	1 + 1	2
14.		Complexes which contain only one type of ligand are called homoleptic complexes. E.g.: $[Co(NH_3)_6]^{3+}$, $[Fe(CN)_6]^{4-}$, $[Ni(CO)_4]$ etc. Complexes which contain more than one type of ligands are called heteroleptic complexes. e.g., $[Co(NH_3)_4Cl_2]^{+}$, $[Pt(NH_3)_2Cl_2]$ etc. [Any one example for each is required]	2	2
15.		A is o-nitrochlorobenzene [1-chloro-2-nitrobenzene] B is p- nitrochlorobenzene [1-chloro-4-nitrobenzene] OR  1-Chloro-2-nitrobenzene (Minor) 1-Chloro-4-nitrobenzene (Major)	1 1	2
Answer any 8 questions from 16 to 25. Each carries 3 scores. (8 x 3 = 24)				
16	(i) (ii)	These 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 ½ 1½	3
17.		Cell representation is: $Mg|Mg^{2+}||Ag^{+}|Ag$ $E_{cell} = E^0_{cell} - \frac{0.0591}{2} \log\frac{[Mg^{2+}]}{[Ag^{+}]^2}$ $= 3.17 - \frac{0.0591}{2} \log\frac{(0.13)}{(0.001)^2}$ $= 3.17 - 0.15 =$ **3.02 V**	1 1 1	3

18.	(i) (ii) (iii)	It is the molar conductivity of an electrolytic solution at zero concentration or infinite dilution. Kohlrausch law of independent migration of ions OR, Kohlrausch law. It states that the limiting molar conductivity of an electrolyte is the sum of the individual contributions of the anion and the cation of the electrolyte.	1 1 1	3
19.	(i) (ii)	Anode reaction: $2\ Fe\ (s) \rightarrow 2\ Fe^{2+} + 4\ e^-$ Cathode reaction: $O_2(g) + 4\ H^+\ (aq) + 4\ e- \longrightarrow 2\ H_2O\ (l)$ The overall reaction is: $2Fe(s)+O_2(g) + 4H^+\ (aq) \rightarrow 2Fe^{2+}(aq)+ 2\ H_2O\ (l)$ The ferrous ions (Fe^{2+}) are further oxidised to ferric ions (Fe^{3+}) and finally to hydrated ferric oxide (Fe_2O_3. x H_2O), which is called rust. Corrosion can be prevented by (i) coating the metal surface with paint, varnish etc. (ii) coating the metal with more electropositive metal (E.g. Galvanisation) (iii) coating with anti-rust solution. (iv) by sacrificial protection or cathodic protection. [Any 2 methods are required]	1 1 1	3
20.	(i) (ii)	The integrated rate equation for a first order reaction is, $k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$ For a first order reaction, $k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$ When $t = t_{½}$, $[R] = [R]_0/2$ 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, $t_{½} = \frac{0.693}{k}$	1 2	3
21.	(i) (ii) (iii)	This is due to the presence of partially filled d-orbitals or due to d-d transition. This is due to their smaller size, high ionic charge, presence of partially filled d orbitals and ability to show variable oxidation state. This is due to the similar atomic radii of transition elements.	1 1 1	3
22.		The regular decrease in the atomic and ionic radii along lanthanide series is known as lanthanide contraction. The consequences of Lanthanoid contraction are: (i) The 2nd and 3rd row transition series elements have similar radii. (ii) Lanthanides have similar physical properties and they occur together in nature. (iii) Basicity of hydroxides decreases from Lanthanum to Lutetium. [Any 2 required]	1 2	3
23.	(i) (ii)	Oxidation state of Co is +3 and Co-ordination number of Co is 6. (a) $[Co(NH_3)_4(H_2O)Cl]Cl_2$ (b) $K_2[Zn(OH)_4]$	½ ½ 1 1	3

24.	(i)		2	3
	(ii)	It is a series in which the various ligands are arranged in the increasing order of their field strength.	1	
25.		S_N1 Mechanism / S_N2 Mechanism Proceeds in 2 steps / Proceeds in a single step An intermediate (carbocation) is formed / No intermediate is formed Order and molecularity are 1 / Order and molecularity are 2 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 3 differences required]	3	3
Answer any 4 questions from 26 to 30. Each carries 4 scores. (4 x 4 = 16)				
26.	(i)	The properties which depend only on the number of solute particles and not on their nature are called colligative properties. E.g.: Relative lowering of Vapour pressure, Elevation of boiling point, Depression of freezing point, Osmotic pressure. [Any 2 required]	1 1	4
	(ii)	Here w_2 = 1.26 g, R = 0.083 Lbar/K/mol, π = 2.57 x 10^{-3} bar, T = 300K & V= 200 cm^3 = 0.2 L We Know that, Molar mass of solute, $M_2 = \frac{w_2RT}{\pi V} = \frac{1.26 \times 0.083 \times 300}{2.57 \times 10^{-3} \times 0.2}$ = **61038.9 g/mol**	2	
27.	(i)	Anode reaction: $2H_2 + 4OH^- \rightarrow 4H_2O + 4e^-$ Cathode reaction: $O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$ Overall reaction: $2H_2(g) + O_2(g) \longrightarrow 2\ H_2O(l)$	1 1 1	4
	(ii)	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 since water is the only product formed. iv) Water obtained from $H_2 - O_2$ fuel cell can be used for drinking perpose. [Any 2 required]	1	
28.	(i)	Arrhenius equation, $k = A.e^{-Ea/RT}$ We know that, $\log \frac{k_2}{k_1} = \frac{Ea}{2.303R} \frac{[T_2 - T_1]}{T_1.T_2}$	1 1	4

		Here T_1 = 500 K, k_1 = 0.02 s^{-1} , T_2 = 700 K, k_2 = 0.07 s^{-1} and R = 8.314 J K^{-1} mol^{-1} $\log \frac{(0.07)}{(0.02)} = \frac{Ea}{2.303 \times 8.314} \frac{[700-500]}{500 \times 700}$ $Ea = \frac{0.5441 \times 2.303 \times 8.314 \times 500 \times 700}{200}$ = 18231 J mol^{-1} = **18.231 kJ mol^{-1}**	2	
29.		The different types of structural isomerism shown by co-ordination compounds are: 1. **Ionisation isomerism:** Arising due to the exchange of ligands between the inside and outside of co-ordination sphere. E.g. $[Co(NH_3)_5SO_4]Br$ and $[Co(NH_3)_5Br]SO_4$ 2. **Linkage isomerism:** Arising due to the presence of ambidentate ligands, which can bind to the central atom through different donor atoms. E.g.: $[Co(NH_3)_5(NO_2)]Cl_2$ and $[Co(NH_3)_5(ONO)]Cl_2$ 3. **Solvate or hydrate isomerism:** Arising due to the difference in the number of solvent molecules (water molecules) attached to the central atom as ligand. E.g.: $[Cr(H_2O)_6]Cl_3$ and $[Cr(H_2O)_5Cl]Cl_2.H_2O$ 4. **Co-ordination isomerism**: Arising due to the exchange of ligands between the cationic and anionic parts of the complex. E.g.: $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$	4 x 1	4
30.	(i) (ii) (iii)	CH_3-CH_2-Cl [Chloroethane or Ethyl chloride] CH_3-CH_2-CH_2-Br [1-Bromopropane or n-Propyl bromide] CH_3-CH_2-CH_2-I [1-Iodopropane or n-Propyl iodide]	1 2 1	4

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