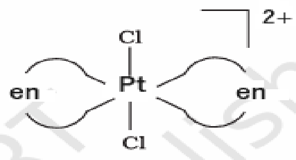
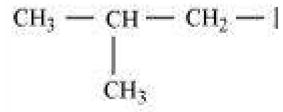
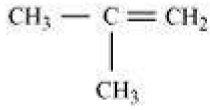
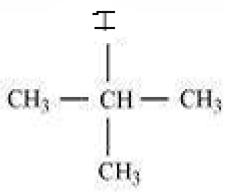
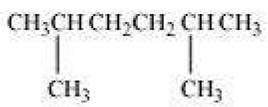
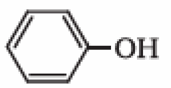
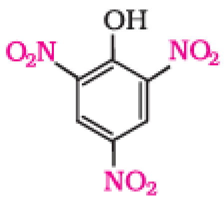
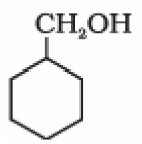
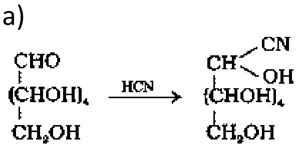
SOLUTIONS 2024-25

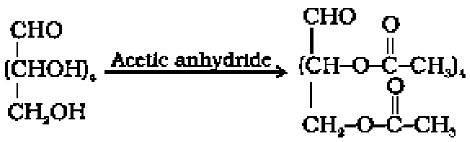
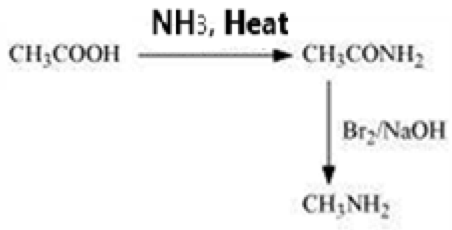
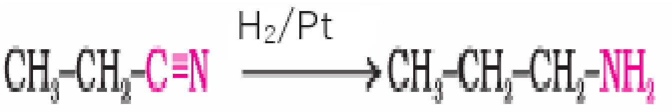
CHEMISTRY (Theory)- 043

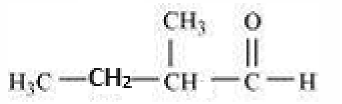
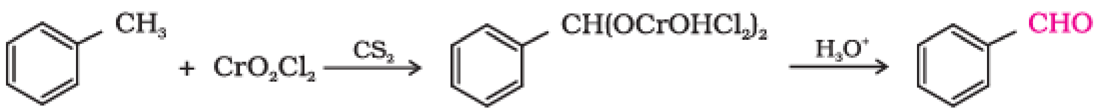
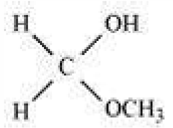
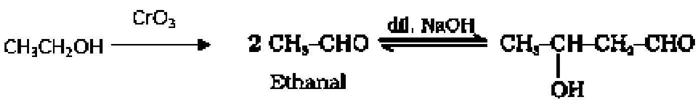
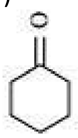
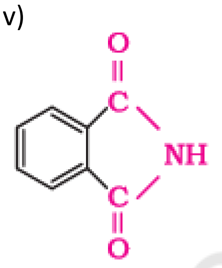
QP CODE 56/7/1 **MM: 70**

Q.No	Value points	Mark
	SECTION A	
1	**A**	**1**
2	**D**	**1**
3	**B**	**1**
4	**C**	**1**
5	**B**	**1**
6	**A**	**1**
7	**C**	**1**
8	**A**	**1**
9	**C**	**1**
10	**D**	**1**
11	**A**	**1**
12	**B**	**1**
13	**C**	**1**
14	**A**	**1**
15	**B**	**1**
16	**C**	**1**
	SECTION B	
17	When vapour pressure of the solution is higher than expected from the ideal behaviour. Example : ethanol and acetone/ carbon disulphide and acetone (or any other suitable example) Minimum boiling azeotrope	1 ½ ½
18	When one of the reactant is present in excess Hydrolysis of an ester/ sucrose (or any other suitable example) For elementary reaction, which takes place in a single step.	1 ½ ½
19	a) Dichloridobis(ethane-1,2-diamine)platinum(IV) ion 	1 1
	OR	
19	i) $[Co(NH_3)_5(CO_3)]Cl$ ii) Pentaamminenitrito-O-cobalt(III) chloride	1 1
20	-Because C—X bond acquires a partial double bond character due to resonance/ sp^2 hybridized carbon of C-X bond leading to shorter bond length (Or any other suitable reason). -Nitro group withdraws the electron density from the benzene ring and thus facilitates the attack of the nucleophile on haloarene / $-NO_2$ group being electron withdrawing stabilises the intermediate carbanion.	1 1
21	Because the hydrogen bonds are formed between specific pairs of bases 2-deoxyribose sugar , base and phosphoric acid	1 1

	SECTION C	
22	$\Delta T_f = iK_f m$ $\Delta T_f = \dfrac{i \times K_f \times w_2 \times 1000}{M_2 \times w_1}$ $0.45 = \dfrac{i \, X \, 5.12 \, X \, 0.3 \, X \, 1000}{60 \, X \, 30}$ $i = 0.527$ $\alpha = \dfrac{i-1}{1/n-1}$ $\alpha = \dfrac{0.527-1}{1/2-1}$ (n=2) α= 0.946 or 94.6% (Or any other suitable method)	½ 1 ½ ½ ½
23	(a) Lead storage battery Anode: $Pb(s) + SO_4^{2-}(aq) \rightarrow PbSO_4(s) + 2e^-$ Cathode: $PbO_2(s) + SO_4^{2-}(aq) + 4H^+(aq) + 2e^- \rightarrow PbSO_4(s) + 2H_2O(l)$	1 1 1
	OR	
23	(b)Because at cathode the reaction with higher value of E° is preferred and therefore, the reduction of H_2O to H_2 gas is preferred whereas at anode water should get oxidised in preference to Cl^- (aq), however, on account of overpotential of oxygen, oxidation of Cl^- to Cl_2 gas is preferred. $NaCl(aq) + H_2O(l) \rightarrow Na^+(aq) + OH^-(aq) + ½H_2(g) + ½Cl_2(g)$	1 1 1
24	$2N_2O_5(g) \rightarrow 2N_2O_4(g) + O_2(g)$ Start $t = 0$: P_i atm, 0 atm, 0 atm At time t: $(P_i - 2x)$ atm, 2x atm, x atm $P_t = P_i - 2x + 2x + x = P_i + x$ $x = = P_t - P_i$ $p_A = P_i - 2x$ $= P_i - 2(P_t - P_i)$ $= 3P_i - 2P_t$ $k = \dfrac{2.303}{t} \log \dfrac{p_i}{p_A}$ Where pi=0.5 atm, $p_A = 3p_i - 2p_t$ = (3X 0.5)-(2x0.625) =0.25atm $k = \dfrac{2.303}{100 s} \log \dfrac{0.5 \text{ atm}}{0.25 \text{ atm}}$ $= \dfrac{2.303}{100 s} \times 0.3010$ $= 6.93 \times 10^{-3} s^{-1}$	1 1 1

25	A=  B=  C=  D=   + KI + H2O	½ ½ ½ ½ 1
26	a) CH_3I +  b)  c) 	1 1 1
27	a) Because the carboxyl group is deactivating and the catalyst aluminium chloride (Lewis acid) gets bonded to the carboxyl group.(forms salt) b) Because carbonyl carbon of HCHO is more electrophilic than CH_3CHO/ due to +I effect of methyl group/ steric effect of methyl group, CH_3CHO is less reactive. c) Because of greater electronegativity of sp^2 hybridised carbon to which carboxyl carbon is attached.	1 1 1
28	a)  b) 	1 1

	c) 	1
	SECTION D	
29	a) Due to presence of one unpaired electron in t_{2g} which gets excited to e_g / Due to excitation energy $t_{2g}^{1} \rightarrow e_g^{1}$, it gives colour. (d-d transition) When heated, water is lost therefore crystal field splitting does not occur and it becomes colourless. b) The energy required to split the degenerate d-orbitals into two sets of orbitals (t_2g and e_g). /The difference of energy between the two sets of d-orbitals t_2g and eg due to the presence of ligands in a definite geometry . **OR** b) (ii) $\Delta_o < P$, weak filed ligand $\Delta_o > P$, strong field ligand c) Because the orbital splitting energies are not sufficiently large for forcing pairing / Due to low crystal field splitting energy.	1 1 1 ½ + ½ 1
30	a) (i)  (ii)  (or by any other method) **b)** Aniline undergoes resonance and as a result the electrons on the N-atom are less available for donation. **c)** (i) $(CH_3)_3N < CH_3NH_2 < (CH_3)_2NH$ OR c) (ii) A= $C_6H_5NH_2$; B= $=C_6H_5N_2^+Cl$	1 1 1 1 ½ + ½
	SECTION E	
31	(a) (i) (I) Because Mn^{2+} is more stable than Mn^{3+} due to extra stable half-filled d^5 configuration. (II) Due to comparable energies of 5f, 6d and 7s orbitals (III) Due to the involvement of greater number of electrons from (n-1)d in addition to the ns electrons in the inter-atomic metallic bonding. (ii) (I) $5SO_3^{2-} + 2MnO_4^- + 6H^+ \longrightarrow 2Mn^{2+} + 3H_2O + 5SO_4^{2-}$ (II) $2MnO_4^- + H_2O + I^- \longrightarrow 2MnO_2 + 2OH^- + IO_3^-$	 1 1 1 1 1
	OR	
31	b) (i) Mn, Zn, Ni, Cu (any two) (ii) K_2MnO_4, due to presence of one unpaired electron (iii) Similar radii of 4d and 5d series elements/ similar properties/ difficulty in separation of lanthanoids (or any other relevant consequence)	 ½ , ½ ½ , ½ 1

	(iv) It is prepared by fusion of MnO_2 with an alkali metal hydroxide and an oxidising agent / $2MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$ (v) because of the ability of oxygen to form multiple bonds with metal	1 1
32	(a) (i) (I) $(CH_3)_3C\text{-}CHO$ (II)  (III) $CH_3\text{-}CO\text{-}CH_2CH_2CH_3$ (ii)  (I) (II) 	1 1 1 1 1
	OR	
32.	(b) i)  ii) Because semicarbazide undergoes resonance involving only one of the two - NH_2 groups, which is attached directly to the carbonyl-carbon atom. iii)  iv)  v) 	1 1 1 1 1
33	**(a) (i)** $E_{Cell} = (E^o{}_c - E^o{}_a) - \frac{0\cdot059}{2}\log\frac{[Zn^{2+}]}{[H^+]^2}$	1

	$= [(0) - (-0 \cdot 76)] - \frac{0 \cdot 059}{2} log \frac{0 \cdot 1}{(0 \cdot 01)^2}$ $= 0.76 - 0.0295 \log 10^3$ $= 0.76 - 0.0885$ $= 0.6715$ V or 0.67 V (Deduct ½ mark for no or incorrect unit) (ii) The amounts of different substances liberated by the same quantity of electricity passing through the electrolytic solution are proportional to their chemical equivalent weights. 6F	1 1 1 1
	OR	
33	(b) (i) $\Lambda_m = \frac{K}{C} \times 1000$ $\Lambda_m = \frac{2.48 \times 10^{-2}}{0.2} \times 1000$ $= 124\ S\ cm^2\ mol^{-1}$ $\Lambda_m^\circ = \lambda^\circ_{K^+} + \lambda^\circ_{Cl^-}$ $= 73.5 + 76.5$ $= 150\ S\ cm^2\ mol^{-1}$ $\alpha = \frac{\Lambda_m}{\Lambda_m^\circ}$ $= \frac{124}{150}$ $= 0.827$ (ii) $E^0_{cell} = E^0_{cathode} - E^0_{anode}$ $= 0.34 - (-2.37)$ $= 2.71V$ $\Delta_r G^0 = -nFE^0_{cell}$ $= -2 \times 96500 \times 2.71$ $= -523030\ Jmol^{-1}$ or $-523.03\ kJmol^{-1}$ (iii) Primary cell Maintains constant potential throughout its usage/ longer lifespan	½ ½ ½ ½ ½ ½ ½ ½ ½ ½