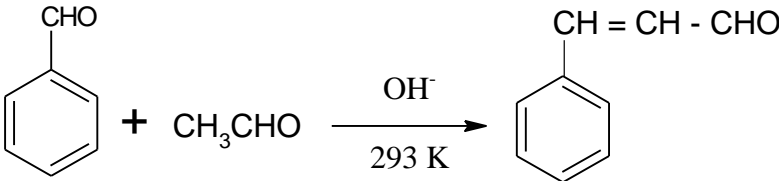| Q.No. | Value points | Marks |
|---|---|---|
| | **SECTION:A** | |
| 1. | Reaction taking place at cathode when the battery is in use: $$PbO_2(s) + SO_4^{2-}(aq) + 4H^+(aq) + 2e^- \rightarrow PbSO_4(s) + 2H_2O(l)$$ | 1 |
| 2. | 2 F | 1 |
| 3. | $$Molarity = \frac{38 \times 1.294 \times 1000}{98 \times 100} = 5.02M$$ | 1 |
| 4. | It can be recharged after use. | 1 |
| 5. | At anode: $O_2$ (g) <br> At cathode: $H_2$ (g) | ½ <br> ½ |
| 6. | Sodium cyanide. | 1 |
| 7. | Nucleotide | 1 |
| 8. | Zwitterion / dipolar ion | 1 |
| 9. | Condensation | 1 |
| 10. | Benzaldehyde | 1 |
| 11. | (c) | 1 |
| 12. | (b) | 1 |
| 13. | (b) | 1 |
| 14. | (a) | 1 |
| 15. | (b) | 1 |
| 16. | (c) | 1 |
| 17. | (a) | 1 |
| 18. | (d) | 1 |
| 19. | (d) | 1 |
| 20. | (d) | 1 |
| | **SECTION:B** | |
| 21. | Lone pairs : 2 <br> Geometry : Square planar | 1 <br> 1 |
| 22. (i) <br><br> (ii) | $$Slope = -\frac{E_a}{2.303 R}$$ <br><br> $k_1 > k_2$ | 1 <br><br> 1 |
| 23. | When there is dissociation of solute into ions, in dilute solutions (ignoring interionic attractions) the number of particles increases. As the value of colligative properties depends on the number of particles of the solute , the experimentally observed value of colligative property will be higher than the true value, therefore the experimentally determined (observed) molar mass is always lower than the true value. <br><br> For KCl(electrolyte) the experimentally determined molar mass is always | 1 <br><br><br><br><br><br> ½ |

| | | |
|---|---|---|
| | lower than the true value when water is used as solvent. | |
| | Glucose (non-electrolyte) does not show a large variation from the true value. | ½ |
| 24. (a) | CH₃-CH(Cl)-COOH | 1 |
| (b) | C₆H₅CHO | 1 |
| 25. |  | 1 |
| | **IUPAC Name of the entity:** Dichloridobis(ethane-1,2-diamine)platinum(IV) ion | 1 |
| | **OR** | |
| | **Bonding in** $[CO(NH_3)_6]^{3+}$ | |
| | $d^2sp^3$ hybridisation | ½ |
| |  | ½ |
| | Geometry: Octahedral | ½ |
| | Diamagnetic | ½ |
| 26. | **Vapour phase refining:** It is a refining method in which the metal is converted into its volatile compound and collected elsewhere. It is then decomposed to give pure metal. | 1 |
| | **Example:** Mond's Process for refining of Nickel / van Arkel method for refining of Zirconium | 1 |

| | | |
|---|---|---|
| | **Equations involved:**<br><br>$$Ni + 4CO \xrightarrow{330-350K} Ni(CO)_4$$ | ½ |
| | $$Ni(CO)_4 \xrightarrow{450-470K} Ni + 4CO$$ | ½ |
| | **OR**<br>Extraction of gold involves leaching the metal with $CN^-$<br>Oxidation reaction: | ½ |
| | $4\ Au\ (s) + 8\ CN^- (aq.) + 2H_2O\ (aq.) + O_2\ (g) \rightarrow 4[Au(CN)_2]^-(aq.) + 4\ OH^-$ (aq.) | ½ |
| | The metal is recovered by displacement method:<br>$2[Au(CN)_2]^-\ (aq.) + Zn\ (s) \rightarrow 2\ Au\ (s) + [Zn(CN)_4]^{2-}\ (aq.)$ | ½ |
| | Zinc acts as a reducing agent. | ½ |
| 27. | The following compound will undergo $S_N1$ faster:<br><br>CH₂Cl (on benzene ring) | ½ |
| | Greater the stability of the carbocation, greater will be its ease of formation from the corresponding halide and faster will be the rate of reaction.<br>The benzylic carbocation formed gets stabilised through resonance. | ½ |
| |  | ½ |
| | $CH_3CH_2CH_2Cl$ forms a $1^0$ carbocation, which is less stable than benzylic carbocation. | ½ |
| | **SECTION :C** | |
| 28. | $KCl \rightarrow K^+ + Cl^-$<br>$\quad\quad n = 2$<br>$\quad\quad i = 1 - \alpha + n\alpha$<br>$\quad\quad i = 1 + \alpha$ | ½<br>½<br>½ |

| | | |
|---|---|---|
| | $\Delta T_f = iK_f m$ | ½ |
| | $\qquad = (1 + 0.92) \times 1.86 \times \dfrac{0.5 \times 1000}{74.5 \times 100}$ | ½ |
| | $\Delta T_f = 0.24$ | |
| | $\Delta T_f = T_f^0 - T_f^{'}$ | ½ |
| | $T_f^{'} = -0.24 \ ^0C$ | |
| 29. | $rate = k\,[A]^x[B]^y$ | |
| | $0.05 = k[0.1]^x[0.1]^y \qquad ......(i)$ | |
| | $0.10 = k[0.2]^x[0.1]^y \qquad .......(ii)$ | |
| | $0.05 = k[0.1]^x[0.2]^y \qquad ......(iii)$ | |
| | $(ii) \div (i)$ | |
| | $\dfrac{0.10}{0.05} = (2)^x$ | |
| | $x = 1$ | |
| | $(iii) \div (i)$ | |
| | $\dfrac{0.05}{0.05} = (2)^y$ | |
| | $y = 0$ | ½ |
| | $rate = k[A]^1[B]^0$ | |
| | It is a first order reaction. | |
| | $k = \dfrac{rate}{[A]} = o.5\,s^{-1}$ | ½ |
| | $t_{1/2} = \dfrac{0.693}{k} = \dfrac{0.693}{0.5}$ | ½ |
| | $t_{1/2} = 1.386 \ s$ | ½ |
| | $\qquad\qquad\qquad OR$ | |
| | $t_{1/2} = \dfrac{0.693}{k}$ | ½ |
| | $k_2 = \dfrac{0.693}{25} \qquad 350K$ | ½ |
| | $k_1 = \dfrac{0.693}{50} \qquad 300K$ | ½ |
| | $\dfrac{k_2}{k_1} = 2$ | |
| | | ½ |

| | | |
|---|---|---|
| | $$\log \frac{k_2}{k_1} = \frac{E_a}{2.303\,R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$ | ½ |
| | $$\log 2 = \frac{E_a}{2.303 \times 8.314}\left[\frac{350-300}{350 \times 300}\right]$$ | ½ |
| | Ea = 12.104 kJ / mol. | (1/2 +1/2) |
| 30. | | |
| (a) | $K_4[Fe(CN)_6]$ | 1 |
| (b) | $Fe(OH)_3$ is converted into colloidal state by preferential adsorption of $Fe^{3+}$ ions. | 1 |
| (c) | Proteins | 1 |
| 31. (a) | Moist sulphur dioxide behaves as a reducing agent, reduces $MnO_4^-$ to $Mn^{2+}$. | 1 |
| (b) | X –X' bond in interhalogens is weaker than X-X bond in halogensexcept F-F bond. | 1 |
| (c) | Due to the ease with which it liberates atoms of nascent oxygen. | 1 |
| 32. | 1-Propoxypropane is formed.<br>Mechanism involved:<br>Step 1 :Formation of protonated alcohol | 1<br>½ |
| |  | 1 |
| | Step 3: Deprotonation | |
| |  | ½ |
| 33. (a) (i) | | |

| | | Experiment | Ethanal | Propanone | |
|---|---|---|---|---|---|
| (ii) | | 1.**Tollens Test:** Warm the organic compound with freshly prepared ammonical silver nitrate solution(Tollen's reagent). | A bright silver mirror is produced | No silver mirror is formed. | 1 |
| | | 2.**Fehlings Test:** Heat the organic compound with Fehling's reagent. | A reddish bown precipitate is obtained. | No precipitate is obtained | |
| | | Any one test | | | |

| Experiment | Pentan-2-one | Pentan-3-one |
|---|---|---|
| **IodoformTest:** The organic compound is heated with iodine in presence of sodium hydroxide solution. | A yellow precipitate is obtained. | No yellow precipitate is obtained. |

(b)

Or any other suitable test.

1

4- Methoxybenzoic acid<Benzoic acid<4- Nitrobenzoic acid< 3,4-Dinitrobenzoic acid

OR

The carbon atom of the carbonyl group of benzaldehyde is less electrophilic than carbon atom of the carbonyl group present in ethanal. The polarity of the carbonyl group is reduced in benzaldehyde due to resonance hence less reactive than ethanal.

1

CHO + CH₃CHO  →(OH⁻, 293 K)→  CH = CH - CHO

1

1

1

1

| 34. (a) | Broad spectrum antibiotics: Antibiotics which kill or inhibit a wide range of Gram-positive and Gram-negative bacteria. e.g. Chloramphenicol. any other suitable example. | 1 ½ |
|---|---|---|
| (b) | Analgesics: | |

| | | |
|---|---|---|
| | Reduce or abolish pain without causing impairement of consciousness, mental confusion, incoordination or paralysis or some other disturbances of nervous system. | |
| | e.g. Aspirin / paracetamol etc. | 1 |
| | any other suitable example. | ½ |

<div align="center"><b>SECTION:D</b></div>

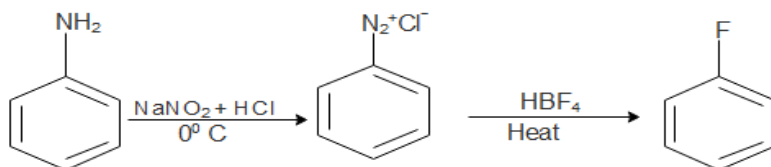| 35. (a) | $Fe + 2H^+ \rightarrow H_2 + Fe^{2+}$ | |
|---|---|---|
| | $E_{cell} = E_{cell}^0 - \dfrac{2.303RT}{nF} \log \dfrac{Fe^{2+}}{[H^+]^2}$ | 1 |
| | $E_{cell}^0 = E_{H^+/H_2}^0 - E_{Fe^{2+}/Fe}^0$ | |
| | $= 0 - (-0.44) = 0.44V$ | ½ |
| | $0.1745 = 0.44 - \dfrac{0.0591}{2} \log \dfrac{[0.1]}{[x]^2}$ | ½ |
| | Log x = -5 | |
| | Log[H$^+$] = -5 | |
| | [H$^+$] = 10$^{-5}$ | ½ |
| (b) | The mass of copper and silver deposited at the cathode will be different. | 1 |
| | The amount of different substances deposited by the same quantity of electricity passing through the electrolytic solution are directly proportional to their chemical equivalents. | 1 |
| | OR | |
| (a) | $\Lambda^o (CH_3COOH) = \lambda_{H^+}^o + \lambda_{CH_3COO^-}^o$ | ½ |
| | $= 349.6 + 40.9 = 390.5 \text{ S cm}^2 \text{ mol}^{-1}$ | ½ |
| | $\Lambda_m = \dfrac{\kappa \times 1000}{c}$ | ½ |
| | $\Lambda_m = \dfrac{8.0 \times 10^{-5} S\,cm^{-1} \times 1000\,cm^3 L^{-1}}{0.0024\,mol\,L^{-1}} = 33.33\,S\,cm^2\,mol^{-1}$ | ½ |
| | $\alpha = \dfrac{\Lambda_m}{\Lambda_m^o}$ | ½ |
| | $\alpha = \dfrac{33.33\ S\,cm^2\,mol^{-1}}{390.5\ S\,cm^2\,mol^{-1}} = 0.085$ | ½ |
| (b) | Electrolyte B is a strong electrolyte. | 1 |
| | Limiting molar conductivity increases only to a smaller extent for a strong electrolyte, as on dilution the interionic interactions are overcome. | ½ |
| | Limiting molar conductivity increases to alarger extent for a weak electrolyte, as on dilution the degree of dissociation increases, therefore the number of ions in total volume of solution increases. | ½ |

**36.**

(A)       (B)       (C)



(E)       (D)
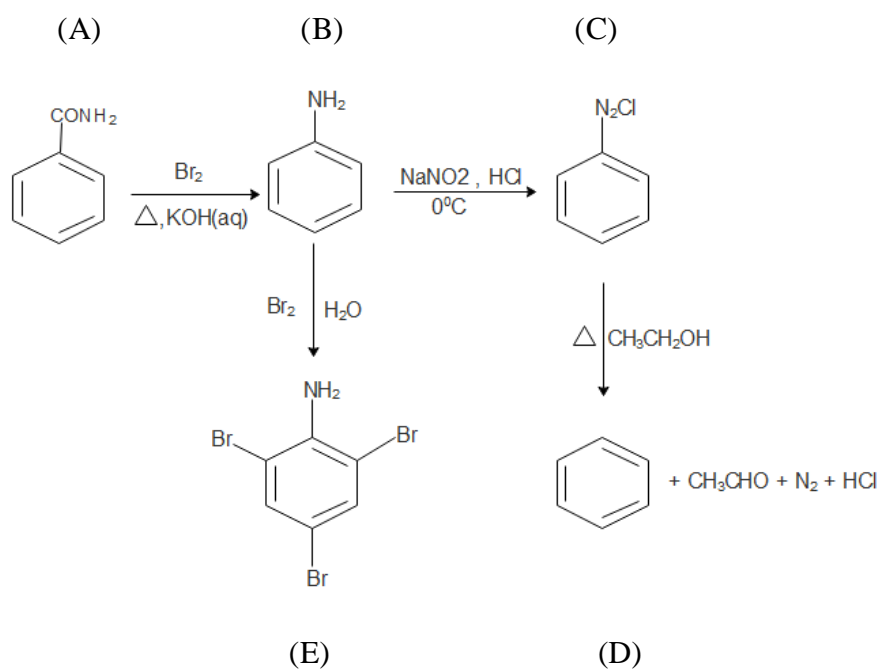
(1/2 x 5 marks for structure and ½ x 5 for writing equations)

OR

(a)

(i)



(ii)



(iii)

$$CH_3CH_2NH_2 \xrightarrow{C_2H_5Cl} \underset{C_2H_5\text{-}N\text{-}C_2H_5}{\overset{H}{|}} \xrightarrow{C_2H_5Cl} \underset{\underset{C_2H_5}{|}}{C_2H_5\text{-}N\text{-}C_2H_5}$$

(b)
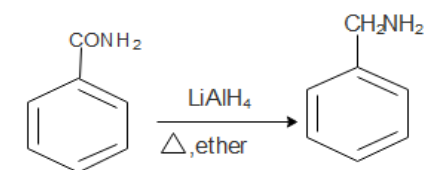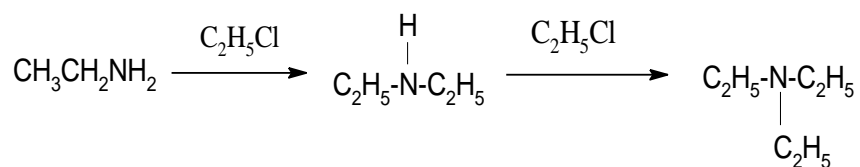
(i)

A : $CH_3CH_2CONH_2$
B : $CH_3CH_2NH_2$

(ii)

5

1

1

1

½
½

½
½

| | | | |
|---|---|---|---|
| | A: $CH_3CH_2CH_2NH_2$<br>B:$CH_3CH_2CH_2OH$ | | |
| 37.<br>(a) | $A = FeCr_2O_4$  $B = Na_2CrO_4$  $C = Na_2Cr_2O_7$<br>$D = K_2Cr_2O_7$ | | (1/2x 2) |
| (b) | | | |
| (i) | 5f, 6d and 7s levels in actinoids are of comparable energies. | | 1 |
| (ii) | This is due to poorer shielding by 5f electrons in actinoids as compared to shielding by 4f electrons in lanthanoids. | | 1 |
| (iii) | In actinoids, 5f electrons are more effectively shielded from the nuclear charge than the 4f electrons of the corresponding lanthanoids. Since the outer electrons are less firmly held, they are available for bonding in the actinoids. | | 1 |
| | <div align="center">OR</div> | | |
| (a) | | | |
| (i) | $MnO_4^{2-}$ ions disproportionate in acidic medium to give Permanganate ions and   Manganese(IV) oxide. | | ½ |
| | $$3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$$ | | ½ |
| (ii) | Lanthanum sulphide if formed. | | ½ |
| | $$2La + 3S \xrightarrow{\ heat\ } La_2S_3$$<br>(Deduct overall ½ mark if equation not balanced/ statements not written) | | ½ |
| (b) | | | |
| (i) | Copper has high enthalpy of atomisation and low enthalpy of hydration. Since the high energy to transform Cu(s) to $Cu^{2+}$(aq) is not balanced by hydration enthalpy, therefore $E^o(M^{2+}/M)$ value for copper is positive(+0.34 V). | | 1 |
| (ii) | $Cr^{2+}$ is reducing as its configuration changes from $d^4$ to $d^3$, the latter having more stable half filled $t_{2g}$ level. On the other hand, the change from $Mn^{3+}$ to $Mn^{2+}$ results in extra stable $d^5$ configuration. | | 1 |

| | | |
|---|---|---|
| (iii) | This is due to the increasing stability of the species of lower oxidation state to which they are reduced. | 1 |
| | | 1 |