



07-MAR-2022

ANSWER KEY

Time:2Hr

Roll No:

1	.i) Butanone < Propanone < Propanal < Ethanal	1
	ii) Acetophenone < Benzaldehyde < <i>p</i> -Nitrobenzaldehyde	1

$$\begin{aligned} E_{\text{cell}} &= E^{\circ}_{\text{cell}} - (RT/2F) \times \ln([Mg^{2+}]/[Ag^+]^2) \\ &= 3.17 \text{ V} - 0.059/2 \times \log 0.130/(0.0001)^2 \\ &= 2.96 \text{ V} \end{aligned}$$

 $\frac{1}{2}$

1

 $\frac{1}{2}$

3

- Propanal being an aliphatic aldehyde reduces Fehling's solution to form a red-brown precipitate of cuprous oxide whereas benzaldehyde do not respond.

$$CH_3CH_2CHO + 2Cu^{2+} + 5OH^- \rightarrow CH_3CH_2COO^- + Cu_2O \downarrow + 3H_2O$$
- Acetophenone is a methyl ketone, whereas benzophenone is a phenyl ketone. Therefore, acetophenone gives a positive iodoform test by giving a yellow precipitate of iodoform with an alkaline solution of iodine. Whereas, benzophenone gives a negative test.

$$\begin{array}{ccccccc} C_6H_5COCH_3 & + & 3NaOI & \longrightarrow & C_6H_5COONa & + & CHI_3 & + & 2NaOH \\ \text{Acetophenone} & & \text{Sodium} & & \text{Sodium} & & \text{Iodoform} & & \\ & & \text{hypoiodite} & & \text{benzoate} & & (\text{yellow ppt}) & & \end{array}$$

$$\begin{array}{ccc} C_6H_5COC_6H_5 & + & NaOI \longrightarrow \text{No yellow ppt of } CHI_3 \\ \text{Benzophenone} & & \end{array}$$

$$\frac{1 \times 2}{2}$$

SECTION B

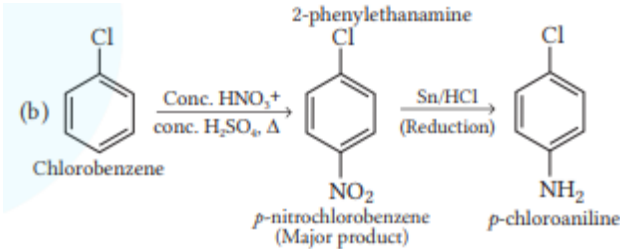
4	<p>In strongly acidic medium, aniline is protonated to form the anilium ion which is meta directing.</p> <p>Aryl halides do not undergo nucleophilic substitution with the anion formed by phthalimide.</p> <p>(iii) Isocyanide test which can be given by only primary amines. Ethyl amine can give isocyanide test. N-methyl ethanamine is a secondary amine.</p>
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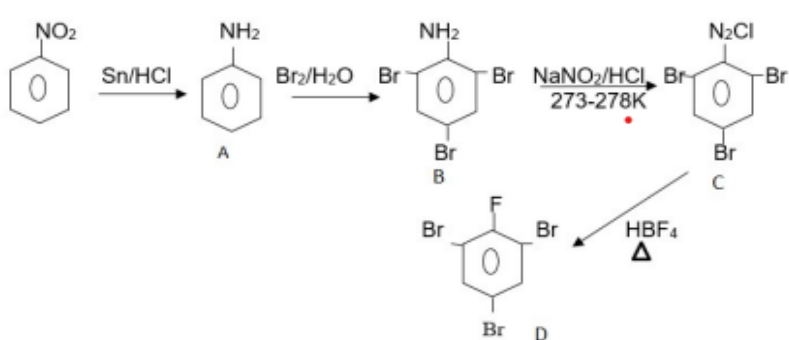
1

1

1

3

5	<p>(a) Ethanoic acid into methanamine</p> $\text{CH}_3\text{COOH} \xrightarrow{\text{SOCl}_2} \text{CH}_3\text{COCl} \xrightarrow{\text{NH}_3 (\text{excess})}$ <p style="text-align: center;">Ethanoic acid Ethanoyl chloride</p> $\text{CH}_3\text{CONH}_2 \xrightarrow[\text{Hofmann bromamide reaction}]{\text{Br}_2 / \text{KOH}} \text{CH}_3\text{NH}_2$ <p style="text-align: center;">Ethanamide Methanamine</p> <p>(b) Hexane nitrile into 1-aminopentane</p> $\text{CH}_3(\text{CH}_2)_4\text{CN} \xrightarrow[\text{Partial hydrolysis}]{\text{H}_3\text{O}^+} \text{CH}_3(\text{CH}_2)_4\text{CONH}_2$ <p style="text-align: center;">Hexane nitrile Hexanamide</p> $\xrightarrow[\text{Hofmann-bromamide reaction}]{\text{Br}_2 / \text{KOH}} \text{CH}_3(\text{CH}_2)_4\text{NH}_2$ <p style="text-align: center;">1-aminopentane</p> <p>(b) </p> <p style="text-align: center;">Chlorobenzene 2-phenylethanamine p-nitrochlorobenzene (Major product) p-chloroaniline</p>	3
6	<p>(i) $sp^3 d^2$, paramagnetic $\frac{1}{2}, \frac{1}{2}$</p> <p>(ii) dsp^2, diamagnetic $\frac{1}{2}, \frac{1}{2}$</p> <p>iii</p> <p>) hexaaquamanganese (II) sulphate / hexaaquomanganese (II) sulphate</p> <p>Or</p> <div style="display: flex; justify-content: space-between;"> <div> <p>(a) Hexacyanidoferrate(III) / Hexacyanoferrate(III)</p> <p>(i) $d^2 sp^3$</p> <p>(ii)</p> </div> <div style="text-align: right;"> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> </div> </div> <p>$[\text{Cr}(\text{Cl})_6]^{3-} < [\text{Cr}(\text{NH}_3)_6]^{3+} < [\text{Cr}(\text{CN})_6]^{3-}$ 1</p> <p>(iii) sp^3, diamagnetic $\frac{1}{2} + \frac{1}{2}$</p>	3
7	<p>$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_2\text{CH}_2\text{CH}_2\text{CH}_3 + \text{H}_2\text{O} \xrightarrow{\text{H}_2\text{SO}_4 (\text{dil.})}$</p> <p style="text-align: center;">Butyl butanoate</p> <p>$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} + \text{CH}_3\text{CH}_2\text{CH}_2\text{COOH} \leftarrow$</p> <p style="text-align: center;">1-Butanol Butanoic acid</p> <p>$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} \xrightarrow[\text{Oxidation}]{\text{CrO}_3} \text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$</p> <p style="text-align: center;">1-Butanol Butanoic acid</p> <p>$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} \xrightarrow[\text{dehydration}]{\text{heat, conc. H}_2\text{SO}_4} \text{CH}_3\text{—CH}_2\text{—CH=CH}_2 + \text{H}_2\text{O}$</p> <p style="text-align: center;">1-Butanol But-1-ene</p>	3

8	<p>i) There is strong Van der Waal's forces in easily liquefiable gases hence, easily liquefiable gases such as NH_3, HCl etc. are adsorbed to a great extent in comparison to gases such as H_2, O_2 etc.</p> <p>ii) The residual forces on the surface of the adsorbent are decreased due to adsorption. As a result, the surface energy of the adsorbent is also reduced. Therefore, adsorption is always exothermic. The movement of a gas is restricted when it is adsorbed on a solid surface. This leads to a decrease in the entropy of the gas i.e., ΔS is negative. Now for a process to be spontaneous, ΔG should be negative. $\Delta G = \Delta H - T\Delta S$</p> <p>Since, ΔS is negative, ΔH has to be negative to make ΔG negative. Hence, adsorption is always exothermic.</p>	3	
9	<p>(a)When N-ethylethanamine reacts with benzenesulphonyl chloride , N,N-diethylbenzenesulphonamide is formed.</p> <p>b)When benzylchloride is treated with ammonia , Benzylamine is formed which on reation with Chloromethane yields a secondary amine , N-methylbenzylamine .</p> <p>c)When aniline reacts with chloroform in the presence of alcoholic potassium hydroxide , phenyl isocyanides or phenyl isonitrile is formed .</p> <p>OR</p> <p>(i) N-Ethyl-N-methylbenzenamine or N-Ethyl-N-ethylaniline</p> <p>(ii)</p> 	3	
10	$\Lambda^{\circ}(\text{CH}_3\text{COOH}) = \lambda_{\text{H}^+}^{\circ} + \lambda_{\text{CH}_3\text{COO}^-}^{\circ}$ $= 349.6 + 40.9 = 390.5 \text{ S cm}^2 \text{ mol}^{-1}$ $\Lambda_m = \frac{\kappa \times 1000}{c}$ $\Lambda_m = \frac{8.0 \times 10^{-5} \text{ S cm}^{-1} \times 1000 \text{ cm}^3 \text{ L}^{-1}}{0.0024 \text{ mol L}^{-1}} = 33.33 \text{ S cm}^2 \text{ mol}^{-1}$ $\alpha = \frac{\Lambda_m}{\Lambda_m^{\circ}}$ $\alpha = \frac{33.33 \text{ S cm}^2 \text{ mol}^{-1}}{390.5 \text{ S cm}^2 \text{ mol}^{-1}} = 0.085$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	3

11	<p>(i) Due to almost similar / comparable atomic radii.</p> <p>(ii) Weak metallic bonding / no unpaired electrons / weak interatomic interaction.</p> <p>(iii) The ability of oxygen to form multiple bonds with metals while F cannot.</p> <p>OR</p> <p>a) At + 3, Stable d^0 is obtained</p> <p>b) Absence of unpaired electron / no d-d transition occurs</p> <p>c) MnO has Mn in +2 Oxidation State</p> <p>Mn₂O₇ has Mn in +7 Oxidation State . Higher the Oxidation State , Higher is the acidic character.</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	3							
SECTION C										
12	<p>(a) PSEUDO FIRST ORDER REACTION: - Those reactions which are not truly of first order reaction but under some condition (when one of the reactant presents in excess) they behave like a first order reaction</p> <p>b)(i)The rate law according to given information may be given as, $\frac{dx}{dt} = K[A]^1[B]^2[C]^0$</p> <p>ii) When concentration of A, B and C are doubled then rate will be</p> <p>$\frac{dx}{dt} = K[2A][2B]^2[C]^0 = 8K[A][B]^2[C]^0$ i.e., rate becomes 8-fold, the original rate.</p> <p>(c)</p> <p>$SO_2Cl_{2(g)} \rightarrow SO_{2(g)} + Cl_{2(g)}$</p> <table><tr><td>Initial pressure</td><td>P_0</td><td>0</td><td>0</td></tr><tr><td>After time 't'</td><td>$P_0 - x$</td><td>x</td><td>x</td></tr></table> <p>Total pressure after time 't'</p> <p>$P_t = (P_0 - x) + x + x$</p> <p>$P_t = P_0 + x$</p> <p>$x = P_t - P_0$</p> <p>Initial pressure = P_0</p> <p>Final pressure = $P_0 - x$</p> <p>$= P_0 - (P_t - P_0)$</p> <p>$= 2P_0 - P_t$</p> <p>$k = \frac{2.303}{t} \log \frac{P_0}{2P_0 - P_t}$</p> <p>or $k = \frac{2.303}{100} \log \frac{0.5}{2 \times 0.5 - 0.6}$</p> <p>or $k = \frac{2.303}{100} \log \frac{0.5}{1.0 - 0.6}$</p> <p>or $k = \frac{2.303}{100} \log \frac{5}{4}$</p> <p>$k = \frac{2.303}{100} \log(1.25)$</p> <p>$k = \frac{2.303}{100} \log 0.0969$</p>	Initial pressure	P_0	0	0	After time 't'	$P_0 - x$	x	x	<p>1</p> <p>1</p> <p>1+1+1</p>
Initial pressure	P_0	0	0							
After time 't'	$P_0 - x$	x	x							

<p> $k = 2.2316 \times 10^{-3} \text{ s}^{-1}$ $P_t = 0.65 \text{ atm}$ i.e., $(P_0 + P) = 0.65 \text{ atm}$ $P = 0.65 - P_0 = 0.65 - 0.50$ $P = 0.15 \text{ atm}$ Pressure of SO_2Cl_2 at time t $P_{\text{SO}_2\text{Cl}_2} = P_0 - P$ $= 0.50 - 0.15$ $= 0.35 \text{ atm}$ At time 't' Rate = $k \times P_{\text{SO}_2\text{Cl}_2}$ $= 2.2316 \times 10^{-3} \times 0.35$ $= 7.8 \times 10^{-4} \text{ atm s}^{-1}$ Hence when total pressure is 0.65 atm then the rate will be $7.8 \times 10^{-4} \text{ atm s}^{-1}$ $K_1 = 2.23 \times 10^{-3} \text{ s}^{-1}$, $K_2 = 7.8 \times 10^{-5} \text{ atm sec}^{-1}$) </p>	
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