Q1 : a) Glucose Sample (C, H, O) 0.1014 g $+ O_2$ → combustion → CO_2 0.1486 g + H_2O 0.0609 g

Molekul weight = 180
@ M_r (molar mass) = 180 g mol^{-1}.

$CO_2 \longrightarrow C$

$\frac{n_C}{n_{CO_2}} = \frac{1}{1} \Rightarrow n_C = n_{CO_2} = \left(\frac{0.1486}{44}\right)$ mol

$= 3.4 \times 10^{-3}$ mol

$m_C = (3.4 \times 10^{-3})(12) = 0.0408$ g

$H_2O \longrightarrow 2H$

$\frac{n_H}{n_{H_2O}} = \frac{2}{1} \Rightarrow n_H = 2 \times n_{H_2O} = \left(2 \times \frac{0.0609}{18}\right)$ mol

$= 6.8 \times 10^{-3}$ mol

$m_H = 6.8 \times 10^{-3}$ g

$\therefore m_O = 0.1014 - (0.0408 + 6.8 \times 10^{-3})$ g $= 0.0538$ g

$\therefore n_O = \left(\frac{0.0538}{16}\right) = 3.4 \times 10^{-3}$ mol.

$n_C : n_H : n_O = 3.4 \times 10^{-3} : 6.8 \times 10^{-3} : 3.4 \times 10^{-3}$

$= 1 : 2 : 1$

$\therefore$ Empirical formula = CH_2O //

Molecula formula, $(CH_2O)n = 180$

$(12 + 2 + 16)n = 180$

$30n = 180$

$n = \frac{180}{30} = 6$

$\therefore$ Molecular formula = $(CH_2O)6$ @ $C_6H_{12}O_6$ //

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Q1 (b) Under alkaline conditions : (Q1)

$MnO_4^- \longrightarrow MnO_4^{2-}$ (dark green soln)

OR $MnO_4^- \longrightarrow MnO_2$ (dark brown ppt.)

} both can happen.

(i) +

$(e^- + MnO_4^- \longrightarrow MnO_4^{2-}) \times 2$ – reduction (half rxn)

$CH_2=CH_2 + 2OH^- \longrightarrow \underset{OH}{CH_2}-\underset{OH}{CH_2} + 2e^-$ – oxidation (half rxn)

$2MnO_4^- + 2OH^- + CH_2=CH_2 \longrightarrow 2MnO_4^{2-} + \underset{OH}{CH_2}-\underset{OH}{CH_2}$ Redox rxn

OR (ii) +

$(3e^- + 4H_2O + MnO_4^- \longrightarrow MnO_2 + 2H_2O + 4OH^-) \times 2$ – reduction

$(CH_2=CH_2 + 2OH^- \longrightarrow \underset{OH}{CH_2}-\underset{OH}{CH_2} + 2e) \times 3$ – oxidation.

$8H_2O + 2MnO_4^- + 6OH^- + 3CH_2=CH_2 \longrightarrow 2MnO_2 + 8OH^- + 3\underset{OH}{CH_2}-\underset{OH}{CH_2} + 4H_2O$

simply to :

$4H_2O + 2MnO_4^- + 2MnO_4^- \longrightarrow 3\underset{OH}{CH_2}-\underset{OH}{CH_2} + 2MnO_2(s) + 2OH^-$ (dark brown ppt) (redox rxn)

* Under acid conditions ($MnO_4^- \longrightarrow Mn^{2+}$)

+

$(MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O) \times 2$ – (reduction)

$(2H_2O + CH_2=CH_2 \longrightarrow \underset{OH}{CH_2}-\underset{OH}{CH_2} + 2H^+ + 2e^-) \times 5$ (oxidation)

$2MnO_4^- + 16H^+ + 10H_2O + 5CH_2=CH_2 \longrightarrow 5\underset{OH}{CH_2}-\underset{OH}{CH_2} + 10H^+ + 2Mn^{2+} + 8H_2O$

simply to :

$2MnO_4^- + 6H^+ + 2H_2O + 5CH_2=CH_2 \longrightarrow 5\underset{OH}{CH_2}-\underset{OH}{CH_2} + 2Mn^{2+}$

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Sem1 : 1997/1998 : Q1c

Sem 1 (1997/98): Stoichiometry

1(c)

HNO_3 (0.150M) $\xrightarrow{\text{reduced to}}$ NH_4^+

$8e^- + 10H^+ + NO_3^- \longrightarrow NH_4^+ + 3H_2O$ (reduction)

+10 −1 +1 0

−8 +9

+1

(i) Half-rxn: $NO_3^- + 10H^+ + 8e^- \longrightarrow NH_4^+ + 3H_2O$ (reduction)

(ii) One mole HNO_3 $\longrightarrow$ 1 mole of H^+

∴ molarity of HNO_3 = normality of HNO_3

∴ Normality of HNO_3 = 0.150N //

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