Organic & Biological Chemistry Assignment 2 SOLUTIONS

1.

a) $C_3H_8O \longrightarrow C_3H_6O + 2H^+ + 2e^-$

$6e^- + 14H^+ + Cr_2O_7^{2-} \longrightarrow 2Cr^{3+} + 7H_2O$

b) $3(C_3H_8O) + 8H^+ + Cr_2O_7^{2-} \longrightarrow 3(C_3H_6O) + 2Cr^{3+} + 7H_2O$

c) $M_{\text{2-propanol}} = 60.094 \text{ g mol}^{-1}$

$M_{\text{propanone}} = 58.078 \text{ g mol}^{-1}$

$m_{\text{2-propanol}} = 0.68 \text{ g mL}^{-1} \times 10.0 \text{ mL} = 6.8 \text{ g}$

$n_{\text{2-propanol}} = \frac{m}{M} = \frac{6.8}{60.094} = 0.113 \text{ moles}$

Mole ratio is 1:1 $\therefore\ n_{\text{propanone}} = 0.113 \text{ moles}$

$m_{\text{propanone}} = nM = 0.113 \times 58.078 = 6.56 \text{ g}$

d) $\%\text{yield} = \frac{4.7}{6.56} \times 100 = 72\%$ OR $\%\text{yield} = \frac{4.7}{6.6} \times 100 = 71\%$

2.

a) Hexane
b) Propanoate ion and silver metal
c) Carbon dioxide and water
d) Hexanal and then to hexanoic acid, also chromium ions

3. Add sodium carbonate, which turns heptanoic acid into soluble heptanoate ions.
Separate the aqueous and organic layers. *This collected organic layer is heptan-1-ol*.
Add dilute hydrochloric acid to the heptanoate solution. Heptanoic acid will form.
Separate the aqueous and organic layers. *This collected organic layer is heptanoic acid*.

4. Add a *small* amount of acidified dichromate to each and heat. The liquid which stays orange (doesn't turn green due to the following reaction) is the 2-methyl 2-butanol.

$6e^- + 14H^+ + Cr_2O_7^{2-} \longrightarrow 2Cr^{3+} + 7H_2O$

The mixture should be boiled while oxidising with acidified dichromate and the distillate collected with Tollen's reagent. The aldehyde from the primary alcohol will form a silver mirror.

$Ag(NH_3)_2^+ + e^- \longrightarrow Ag + 2NH_3$

5.

a) $C_7H_{14}O_2 + NaOH \xrightarrow{\text{reflux}} C_2H_5OH + C_5H_9O_2Na$

(ethyl pentanoate + sodium hydroxide → ethanol + sodium pentanoate)

b) $CH_3COOH + CH_3CH_2CH_2OH \xrightarrow{\text{reflux with } H^+\text{catalyst}} C_5H_{10}O_2 + H_2O$

(ethanoic acid + propan-1-ol → propyl ethanoate + water)

c) $C_7H_{17}N + HCl \rightarrow C_7H_{18}N^+ + Cl^-$

(*N*-methylhexan-2-amine and dilute hydrochloric acid → *N*-methylhexan-2-ammonium ion and chloride ion)