AS level Chemistry A

H032/02 Depth in chemistry

Question Set 11

1. (a) 1-Bromobutane is an organic liquid with a boiling point of 102 °C.

A student prepares 1-bromobutane by reacting butan-1-ol with sulfuric acid and sodium bromide. The student boils the mixture for one hour.

The equation is shown below.

$$CH_3CH_2CH_2CH_2OH + H^+ + Br^- \rightarrow CH_3CH_2CH_2CH_2Br + H_2O$$

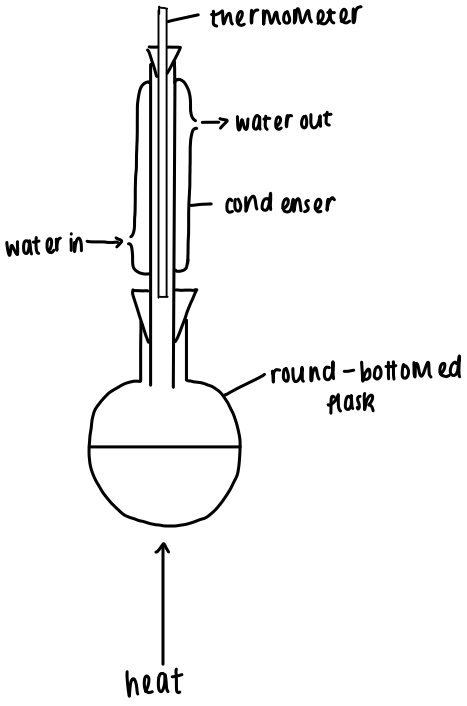
The student obtains a reaction mixture containing an organic layer (density = 1.27 g cm^{-3}) and an aqueous layer (density = 1.00 g cm^{-3}).

(i)* Draw a labelled diagram to show how you would safely set up apparatus for the preparation.

Outline a method to obtain a pure sample of 1-bromobutane from the reaction mixture.

[6]

apparatus for reflux :



purification :

1. separate the organic and aqueous layers using a separating funnel. Lower organic layer as density greater.
2. Dry organic layer using anhydrous magnesium sulfate ($MgSO_4$)
3. Redistil the product and collect the fraction distilling at 102°C.

(ii) The student used 0.150 mol of butan-1-ol. The student obtained a 61.4% percentage yield of 1-bromobutane.

Calculate the mass of 1-bromobutane obtained.

Give your answer to **three** significant figures. **[2]**

$$\% \text{ yield} = \frac{\text{actual mass}}{\text{theoretical mass}}$$

theoretical mass : 0.15 × 136.9

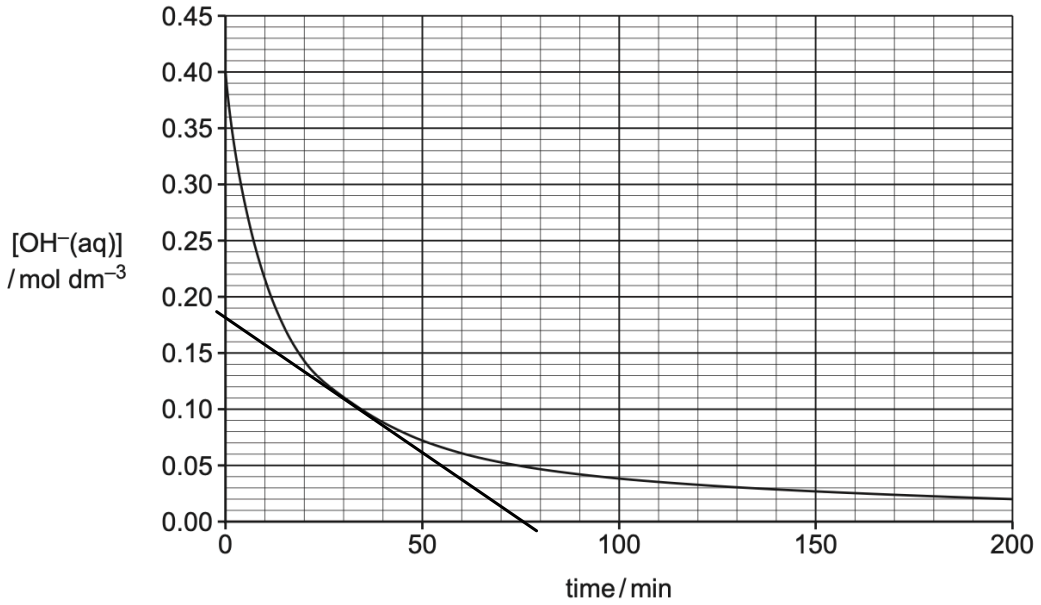
: 20.535 g

0.614 × theoretical mass = actual mass

actual mass = 0.614 × 20.535 = 12.6 g

(b) A student investigates the rate of reaction of 1-bromobutane with aqueous hydroxide ions.

The graph shows how the hydroxide ion concentration, $[OH^-(aq)]$, changes during the reaction.



Using the graph, calculate the rate of reaction, in mol dm^{-3} min^{-1}, at 30 minutes. Show your working on the graph and in the space below.

$$\frac{0.18 - 0}{75 - 0} = 0.0024$$

rate of reaction = 0.0024 mol dm^{-3} min^{-1}

[2]

Total Marks for Question Set 5: 10