Edexcel International Chemistry A-level
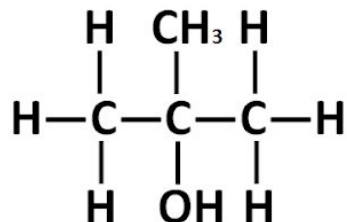
Practical 6

Chlorination of 2-methlypropan-2-ol with Concentrated Hydrochloric Acid

2-methylpropan-2-ol

The structure of this alcohol is shown. It is a tertiary alcohol as the -OH hydroxyl functional group is bonded to a carbon which is bonded to 3 other carbon atoms.

$$\begin{array}{ccc} H & CH_3 & H \\ | & | & | \\ H-C- & C- & C-H \\ | & | & | \\ H & OH & H \end{array}$$

Method

1. Add 35 cm^3 of concentrated HCl and 10 cm^3 of the tertiary alcohol to a 250 cm^3 conical flask.
2. Put the rubber bung in and swirl the flask gently. Open the bung to release the pressure from fumes from time to time. Repeat this regularly for 20 minutes.
3. Use a spatula to add 2-3 scoops of anhydrous $CaCl_2$ and shake. At this point, there should be two distinct layers.
   - In this case, the upper (organic) layer contains the desired product. The lower layer is the aqueous layer.
4. Transfer the contents of the flask to separating funnel.
5. Allow the layers to separate and discard the lower (aqueous) layer. Close the tap, keep the organic layer in the separatory funnel.
6. Add a solution of $NaHCO_3$ to remove the unreacted HCl. Swirl gently. Stopper the separating funnel and shake it. Invert the separatory funnel and open the tap to release the pressure due to CO_2 formed. Repeat twice.
7. Remove the stopper and run off the aqueous layer. Then, run the organic layer into a 50 cm^3 conical flask. Add a spatula of anhydrous Na_2SO_4 which acts as a drying agent.
8. Swirl the contents and leave the flask to stand for a bit. Then decant the liquid into a 50 cm^3 pear-shaped flask.
9. Distill to purify the product. The method for this is detailed in core practical 7.
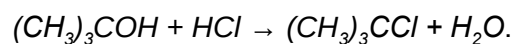
Diagram

Lower density liquid

Higher density liquid

Separating funnel
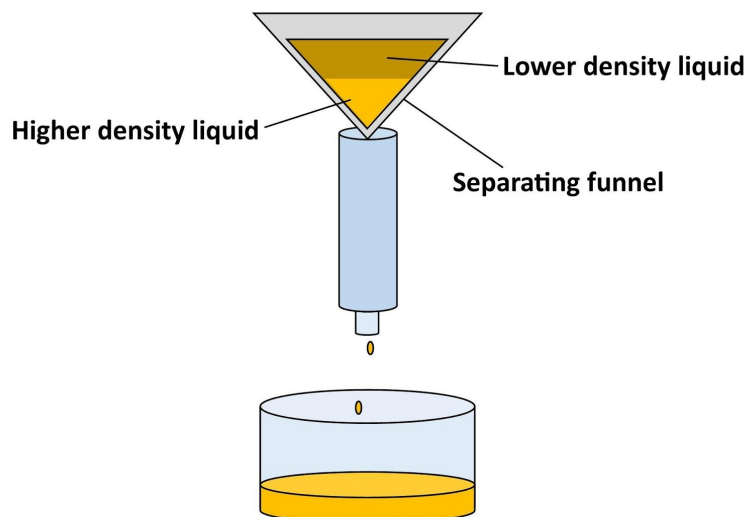
Key Points

- A **weaker base is used to prevent hydrolysis of haloalkane. NaOH could react with the product via nucleophilic substitution**.
- Equation:

$$(CH_3)_3COH + HCl \rightarrow (CH_3)_3CCl + H_2O.$$

Errors

- Some product is lost when **transferring** liquids between the vessels.