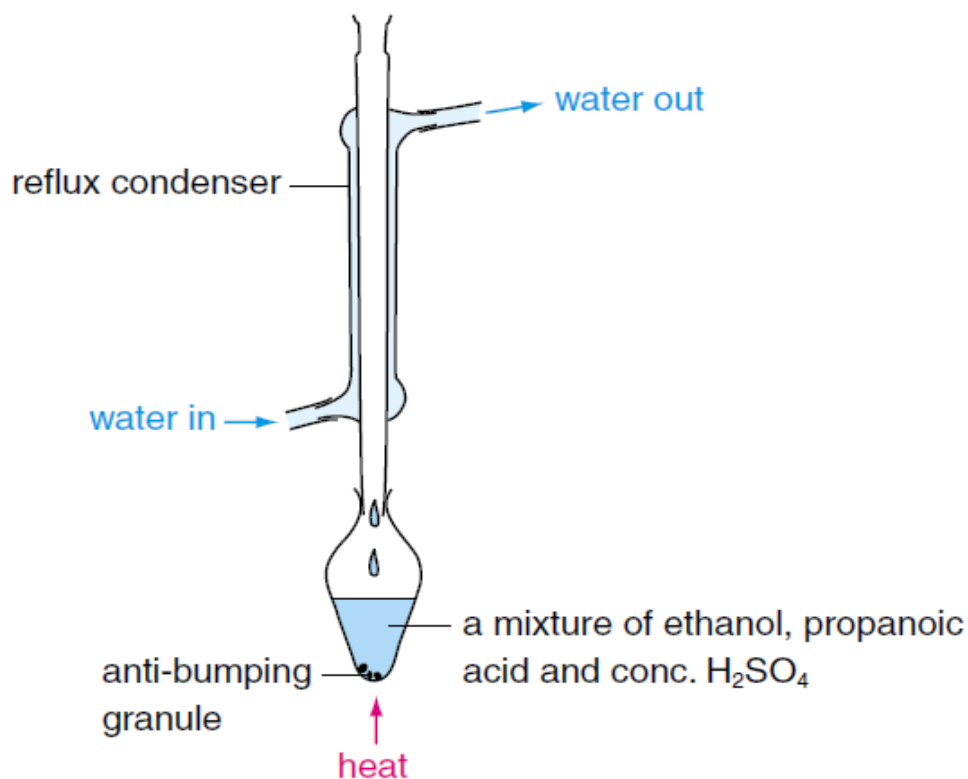


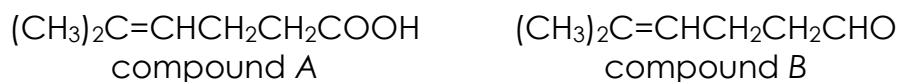
## Quiz (Separation Methods Part II)

1. In the laboratory, ethyl propanoate is prepared by heating a mixture of propanoic acid and ethanol in the presence of concentrated sulphuric acid under reflux.



- (a) Suggest how to obtain crude ethyl propanoate from the reaction mixture.
- (b) The crude ethyl propanoate still contains impurities. One of the impurities is ethanol. Name the solution that can be used to remove ethanol from ethyl propanoate.
- (c) Apart from ethanol mentioned in (b), name ONE more organic impurity that may be present.
- (d) Outline the steps in purifying the crude ethyl propanoate. You have to state the additional chemical reagents and apparatus that are required.  
(Boiling point of ethyl propanoate = 98°C; boiling point of ethanol = 78°C)

2. The following equation shows the selective reduction of a carboxylic acid:



After the reaction, both compound A and compound B are present. The reaction mixture is shaken with excess sodium carbonate solution. Diethyl ether (an organic solvent) is added to the reaction mixture. Compound B is separated from the reaction mixture by liquid-liquid extraction.

- Write the chemical formula of the compound formed when sodium carbonate solution is added to the reaction mixture.
- Draw a labelled diagram to show the set-up used in liquid-liquid extraction.
- Explain how compound B can be separated from the reaction mixture by liquid-liquid extraction.

## Suggested Answer

- Carry out simple distillation. Collect the distillate with a boiling point range from 96°C to 100°C.
  - Calcium chloride solution
  - Propanoic acid
  - Pour the distillate into a separating funnel.

Then add excess sodium carbonate solution to remove any acid and shake.

Discard the lower aqueous layer.

After that, add excess calcium chloride solution to the organic layer to remove the unreacted ethanol and shake.

Discard the lower aqueous layer.

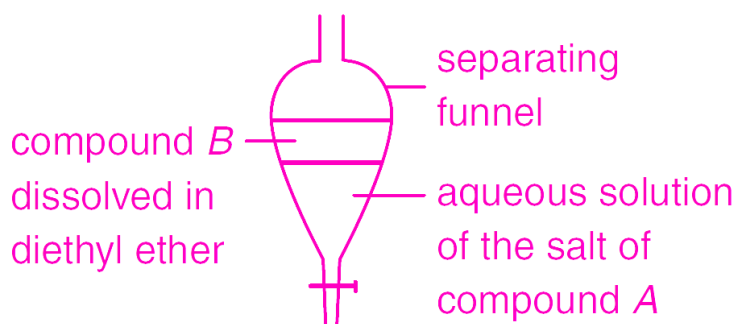
Afterwards, add anhydrous calcium chloride to the organic layer.

Filter the organic layer and carry out distillation of the filtrate.

Finally, collect the distillate (ethyl propanoate) with a boiling point range from 96°C to 100°C.

- $(\text{CH}_3)_2\text{C}=\text{CHCH}_2\text{CH}_2\text{COO}^-\text{Na}^+$

(b)



- After the reaction mixture is shaken with excess sodium carbonate solution, discard the aqueous layer (containing the salt of compound A).

As compound B is more soluble in diethyl ether than in water, it is extracted into the organic layer.

Diethyl ether can be removed from compound B by simple distillation.