3. Simple distillation

Method

Step 1 Set up the apparatus as shown in the diagram.

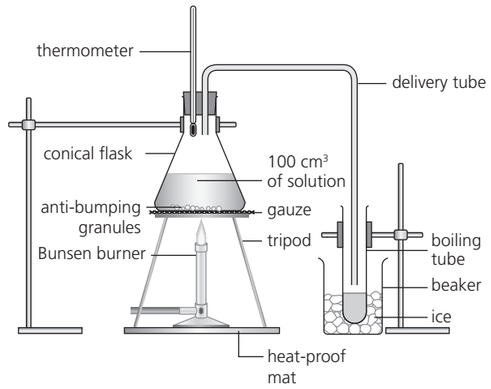
Step 2 Adjust the height of the thermometer so that the bulb is in line with the opening of the delivery tube.

Step 3 Light the Bunsen burner with the air hole closed.

Step 4 Open the air hole of the Bunsen burner so that the flame turns blue and move the Bunsen burner under the tripod to heat the solution.

Step 5 Note the temperature on the thermometer when it is at a constant value. This is the boiling point of the distillate.

Step 6 Once half a boiling tube of distillate has been collected, remove the delivery tube and turn off the Bunsen burner.



a. List the hazards in this experiment and describe how students can keep themselves safe.

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..... [4]

b. A student carries out the experiment. The solution started to boil at 100 °C. Identify this solution.

..... [1]

c. Name an item of equipment that could be used to measure 100 cm^3 of solution.

..... [1]

d. Give the function of the ice.

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..... [2]

e. After the distillation, identify what will be left in the conical flask.

..... [1]

f. A student labels two solutions A and B but forgets to write down which one is which. They know that the two solutions are:

- 1 mol/dm^3 sodium chloride (NaCl)
- 1 mol/dm^3 sodium hydrogen carbonate ($NaHCO_3$).

After evaporating the water, sample A was found to contain 0.585 g of salt and sample B contained 0.84 g of salt.

Exam tip

Don't do more calculations than necessary. The solutions have the same concentration, so you only need to compare their relative formula mass.

i. Identify which sample is 0.5 mol/dm^3 sodium hydrogen carbonate. Explain how you know.

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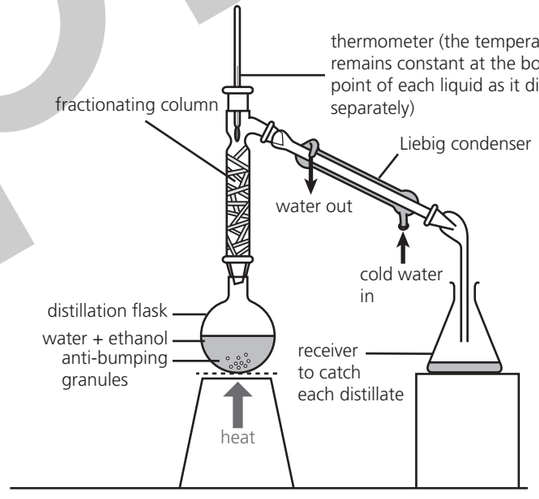
..... [3]

ii. Suggest another way of identifying the two solutions that doesn't require the liquid to be evaporated.

..... [1]

4. Fractional distillation



Simple **fractional distillation** can be carried out in the laboratory using the equipment shown.

The boiling point of water is 100 °C. The boiling point of ethanol is 78 °C. Both are colourless liquids. Describe a method you could use to separate a mixture of 25% ethanol and 75% water.

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..... [6]

5. Chromatography

Method

Step 1 Use a pencil to draw a horizontal origin line, 1 cm from the bottom of the **chromatography** paper.

Step 2 Use a pencil to draw a cross on the centre of the origin line.

Step 3 Use a thin paint brush or capillary tube to add some of the food colouring onto the cross and allow it to dry.

Step 4 Fold the top edge of the chromatography paper over a wooden splint and keep in place with a paper clip.

Step 5 Add water to a depth of 0.5 cm into the beaker.

Step 6 Carefully lower the chromatography paper into the beaker, taking care to keep the pencil line above the water level. Leave until the water line (solvent front) has passed the last coloured spot.

Step 7 Remove the **chromatogram** and allow it to dry.

a. Explain why it is important to draw the origin line in pencil.

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..... [2]

b. Explain where the solvent should be, in relation to the origin line, at the start of the practical.

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..... [2]

c. Explain why a lid might be needed in this experiment.

..... [1]

d. A capillary tube is used to make small dots of the sample. This needs to be done carefully to stop the spots touching each other. Describe why it is important to have separate spots of each sample.

..... [1]

e. To calculate the R_f value, you need to measure the distance of the spot from the origin line. State where on the spot you should take the measurement from.

..... [1]

f. Two groups of students carry out a chromatography practical task. Group A allows the solvent to move up until it reaches $\frac{3}{4}$ of the way up the paper. Group B lets the experiment run until the solvent has reached the top of the paper. Comment on these two methods and explain which will give more accurate results.

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..... [3]

g. Describe why it is important to ensure that the sides of the paper do not touch the sides of the beaker.

..... [1]

h. State and explain whether chromatography is a **qualitative** or a **quantitative** technique.

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..... [2]

i. For the sample to move up the paper, it must dissolve in the solvent. Describe what you would see if a soluble sample was compared with an insoluble sample.

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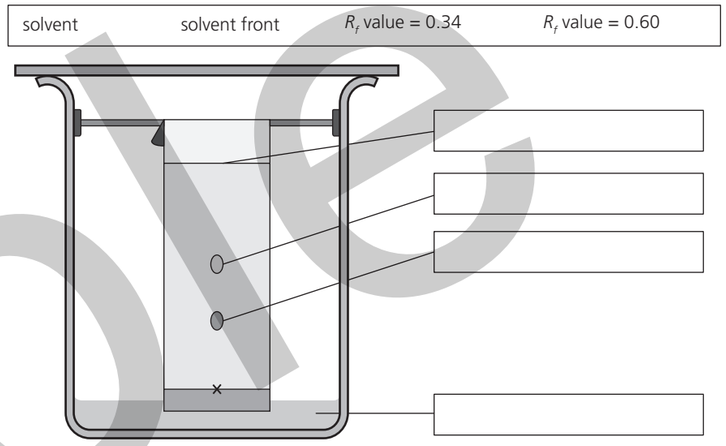
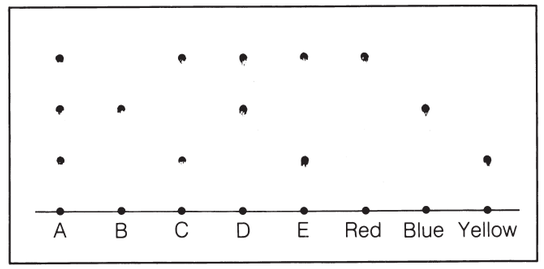
..... [2]

j. Complete the diagram using the terms in the box. [4]



k. Chromatography can be used to test whether certain known substances are present in a sample. Five different food colouring samples (A–E) are compared to red, blue and yellow reference samples. The results are shown.



i. Use evidence from the diagram to suggest which colour is sample B.

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ii. State how many different substances make up sample A.

..... [1]

iii. Give the letters of two unknown samples that are actually the same mixture.

..... [2]

iv. Use a ruler to draw a line on the diagram showing where the solvent should be in relation to the origin line at the start of the experiment. [1]