

# Separating mixtures

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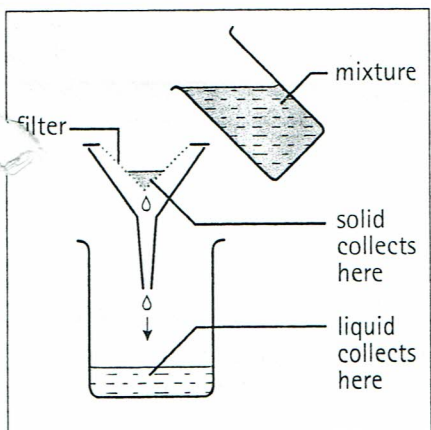
Mixtures of different substances can be separated in a variety of ways.

The following separation techniques can only be used to separate a mixture of substances that are not chemically combined.

## Filtration

Separates  
Insoluble solids from liquids.

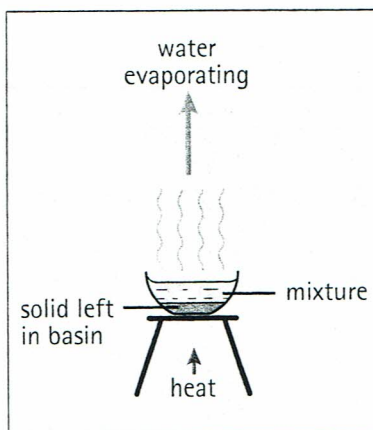
Example  
Sand from a sugar solution.



## Evaporation

Separates  
Soluble solids from their solvent.

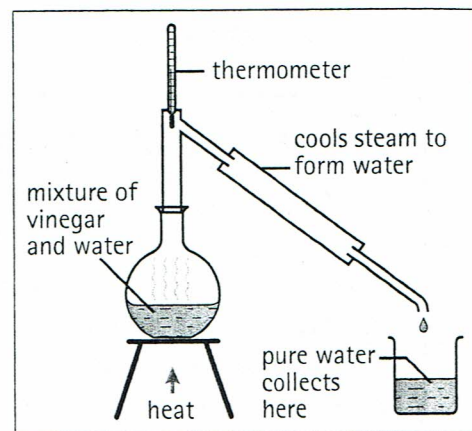
Example  
Copper sulphate from water.



## Distillation

Separates  
Solids from a liquid or a mixture of liquids.

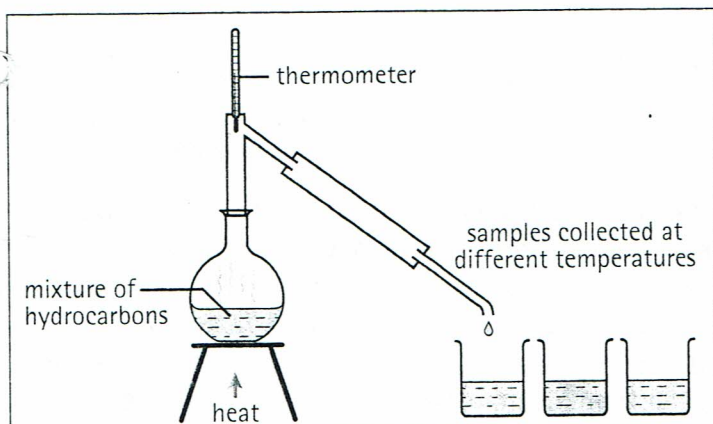
Example  
Vinegar from water.



## Fractional distillation

Separates: mixtures of liquids with different boiling temperatures.

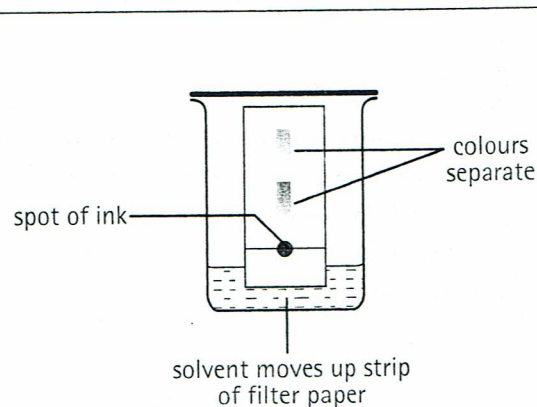
Example: hydrocarbons in crude oil.



## Chromatography

Separates: mixtures of different coloured substances.

Example: different colours in a sample of dye.



# Remember

These physical processes are the means by which substances in a mixture can be separated from each other.



# What happens to the solute during dissolving?

1 Use the words below to fill the gaps in these sentences. You may need to use a word more than once.

120 g    conserved    crystal    dissolving  
 disappear    particles    solute    solution

When you dissolve 20 g of \_\_\_\_\_ in 100 g of water else you get a solution of \_\_\_\_\_. The mass of the solute and mass of the liquid is always the same as the total mass of the \_\_\_\_\_. We say mass is \_\_\_\_\_.

A \_\_\_\_\_ of solid salt will break up into very small pieces that are surrounded by water \_\_\_\_\_. The pieces are too small to see, so the salt seems to \_\_\_\_\_.

2 Write down the total mass of solution that will be made when the following substances are dissolved.

- a 10 g of copper sulphate in 90 g of water \_\_\_\_\_
- b 20 g of copper sulphate in 100 g of water \_\_\_\_\_
- c 15 g of copper sulphate in 100 g of water \_\_\_\_\_
- d 12 g of copper sulphate in 200 g of water \_\_\_\_\_
- e 25 g of copper sulphate in 190 g of water \_\_\_\_\_
- f 200 g of copper sulphate in 1500 g of water \_\_\_\_\_

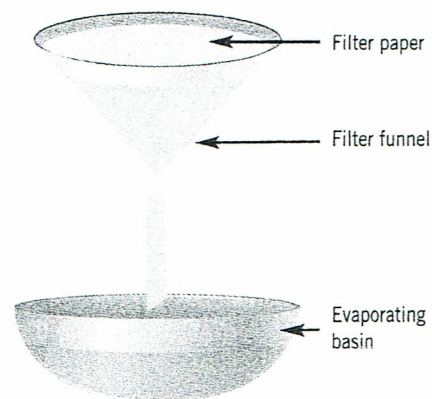


# Solutions

## Level 3

- 1 Rock salt is a mixture of pure salt, mud and sand. Choose the correct options to complete the sentences about how pure salt can be extracted from rock salt.

- a) Rock salt is a mixture of **salt/sugar**, mud and sand. The rock salt is put into a beaker with some water.
- b) The mixture dissolves. The salt is **soluble / insoluble** and dissolves. The mud and sand are **soluble /insoluble** so they don't dissolve.
- c) The mixture is filtered. The **salt/mud and sand** collect in the filter paper.
- d) The salty water is then placed on a warm windowsill. The **salt /water** evaporates leaving crystals of pure **salt /sugar**.

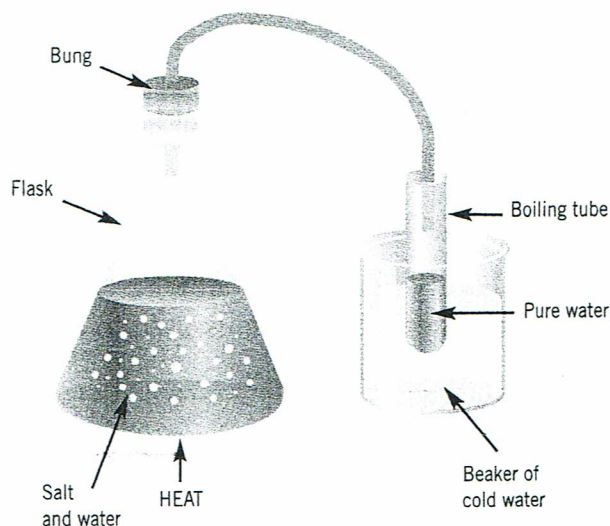


## Level 4

- 1 George used the equipment shown to separate pure water from salt water.

Circle the correct options to complete the following sentences.

- a) This method is called **filtration / distillation /dilution /chromatography**.
- b) The following change of state takes place in the flask: **solid to liquid /liquid to solid /liquid to gas /gas to liquid**.
- c) The following change of state takes place in the boiling tube: **solid to liquid /liquid to solid /liquid to gas /gas to liquid**.
- d) The temperature of the water in the beaker **stays the same /goes up /goes down**.



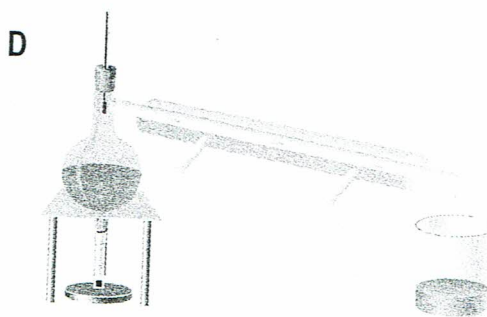
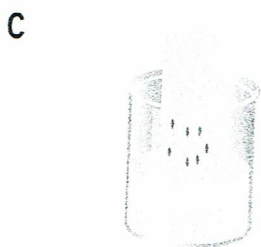
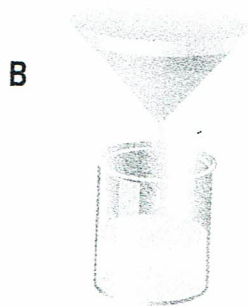
## Level 4 (cont.)

2 Nail varnish doesn't dissolve in water but it does dissolve in acetone. Which of the following statements are correct? Tick the correct options.

- A Nail varnish is soluble in water.
- B Water is a good solvent for all substances.
- C Nail varnish is soluble in acetone.
- D Acetone is a better solvent than water for nail varnish.
- E Water is a good solvent for many, but not all, substances.

3 The diagrams below show the equipment used to separate different substances.

Draw lines between the boxes to link each method of separation diagram with the name of the method and the type of the mixture that could be separated using that method.



Diagram

Method of Separation

Type of Mixture that can be Separated

A

Distillation

The dyes in felt-tip pen inks

B

Crystallisation

Water from an ink-and-water mixture

C

Filtration

Mud from muddy water

D

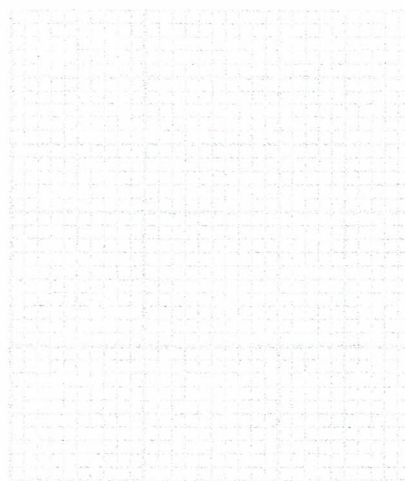
Chromatography

Salt from salty water

## Level 5

- 1 Marta carried out an experiment to find out how quickly different antacid tablets dissolve in water. These are Marta's results: tablet A dissolved in 30s, it took 20s for tablet C to dissolve and tablet B took 35s to dissolve.

a) Complete the table to show the results from Marta's experiment.

b) How could Marta make sure that this was a fair test?

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c) How could Marta make her results more reliable?

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d) Draw a graph to show the results from Marta's experiment.

- 2 The equipment below was used to separate pure water from an ink-and-water mixture.

a) The ink-and-water mixture is placed in flask A. The mixture is heated. What happens in flask A?

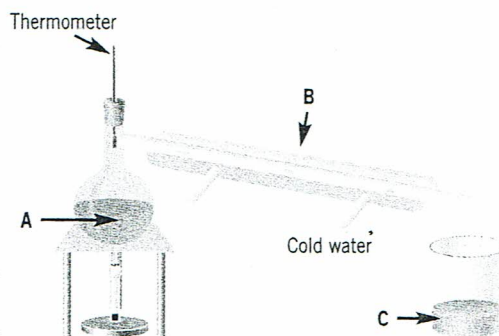
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b) What temperature will the thermometer show?

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c) What happens in the piece of equipment labelled B?

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d) Where is the pure water collected?

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e) What is the name of this method of separating mixtures?

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## Level 6

1 Peter wanted to find out what colours were in different coloured felt-tip pen inks.

a) Name this method of separation.

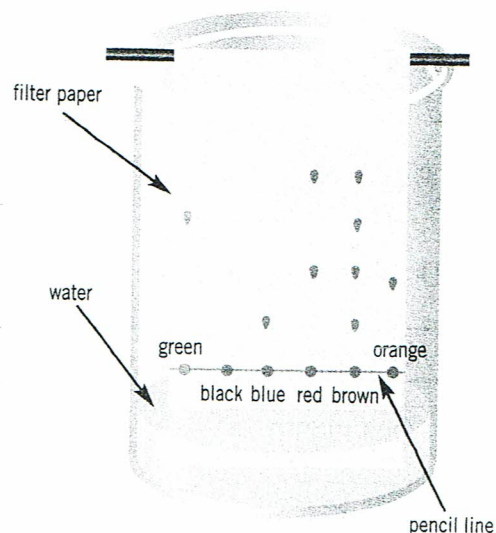
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b) Why is the line drawn in pencil, not ink?

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c) Brown ink is made from a mixture of different inks. Use the chromatogram to name the different coloured inks found in brown ink.

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## Level 7

1 The table below shows the results from Callum's experiment to find out how the solubility of potassium chloride changes as the temperature changes.

Temperature (°C)	0	10	20	30	40	50	60	70	80	90	100
Solubility (g per 100cm <sup>3</sup> of water)	30	33	36	39	42	45	50	51	54	57	60

a) Why are there no results above 100°C?

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b) Draw a graph to show how the solubility of potassium chloride changes as the temperature increases.

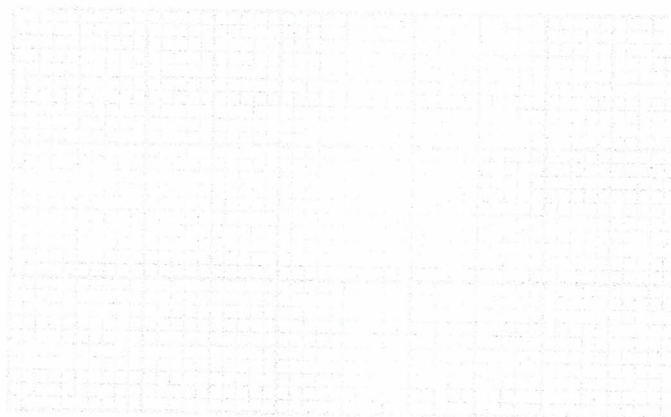
c) Circle the anomalous result and add a line of best fit.

d) Describe how the solubility of potassium chloride changes as the temperature changes.

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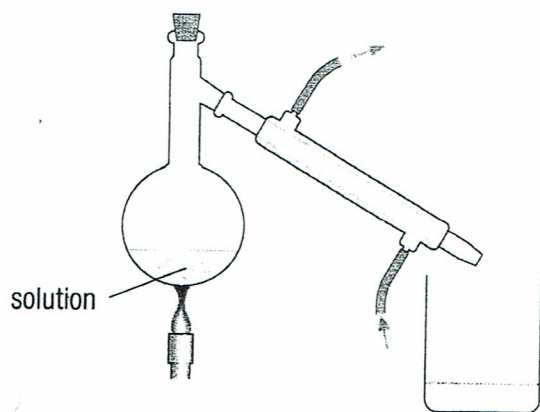
e) Callum takes a beaker containing 45g potassium chloride and cools it from 50°C to 30°C. What would Callum see?

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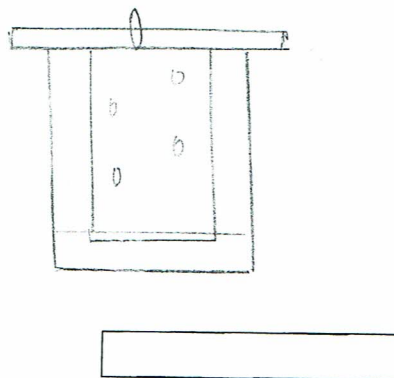




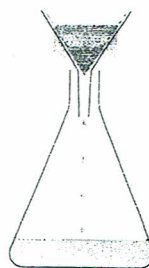
4 Look at the diagrams below of different methods of separating substances.



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_

a Choose from the following words to label each separation technique with its correct name.

**chromatography    distillation    evaporation    filtration**

**4 marks**

b Match the correctly named technique to the mixture that it could be used for.

i Separating the different coloured food dyes that make up the colour of a purple Smartie. \_\_\_\_\_

**1 mark**

ii The water from the dye in black ink. \_\_\_\_\_

**1 mark**

iii To get a solution of dissolved coffee in water from large pieces of ground coffee beans. \_\_\_\_\_

**1 mark**

iv To get blue copper sulphate crystals from a solution of copper sulphate in water. \_\_\_\_\_

**1 mark**