Mixtures and Separation Techniques

Not everything around us is a pure substance — learning how mixtures form and how to separate them again is a key practical skill in KS3 chemistry and GCSE Science.

(a) Amy's family are at the beach during the summer.
Amy and her sister have a bucket containing seawater and sand.



Read the following statements.
Which are **true** and which are **false**?

Tick **one** box for each statement.

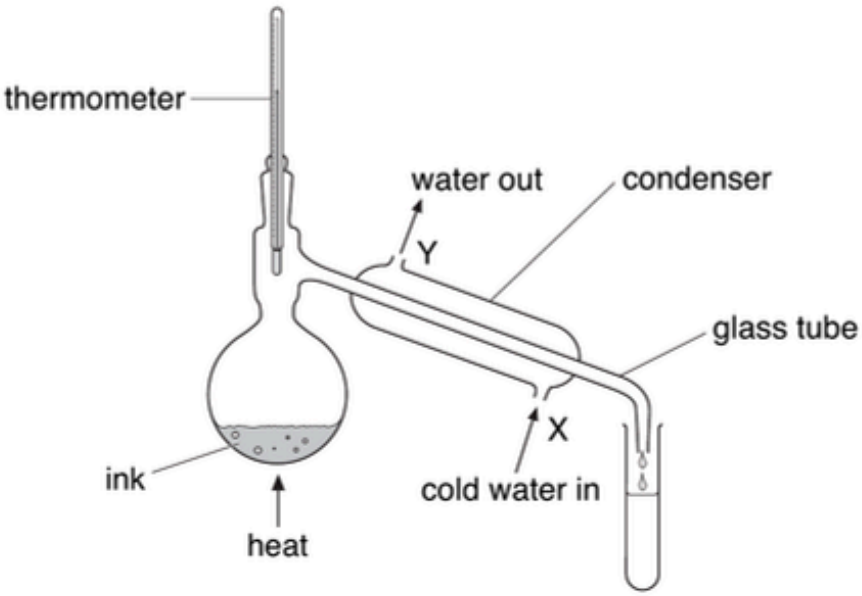
	true	false
Water is a solvent for salt.	☐	☐
Sand sinks in water because water is more dense than sand.	☐	☐
When a solid dissolves in water, the solid is called a solute.	☐	☐

(b) Seawater contains dissolved salt.
Describe what Amy can do to separate **and** collect pure water from seawater.

_____

KS3 Science SATs, Tier 3-6, Paper 1 (2009) - Q14(a)-(b)

12. Rema used the apparatus below to distil 100 cm^3 of water-soluble ink.



apparatus A

not to scale

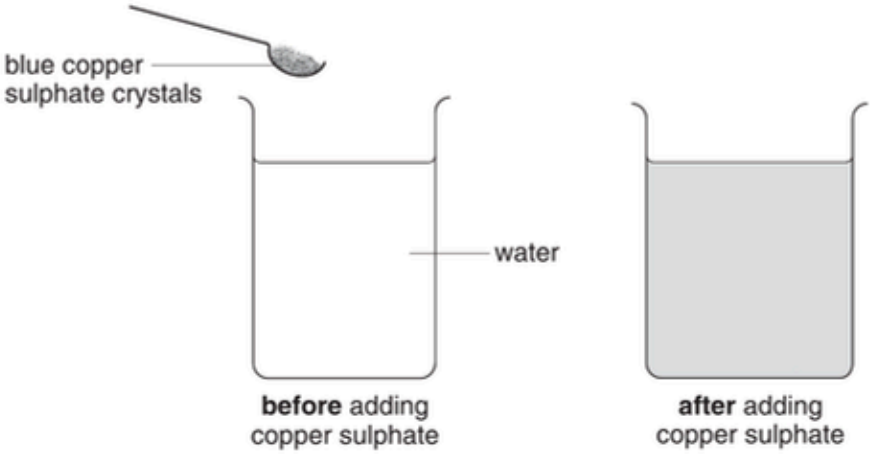
(a) Which processes occur during distillation?
Tick the correct box.

condensation then evaporation	☐
evaporation then condensation	☐
melting then boiling	☐
melting then evaporation	☐

(b) Give the name of the colourless liquid that collects in the test-tube.

Modern Tuition

(c) Meera added blue copper sulphate crystals to some water in a beaker. The copper sulphate dissolved in the water.



(i) Give one way Meera could see that the copper sulphate had dissolved in the water.

_____

(ii) Give one way that she could get the copper sulphate to dissolve more quickly.

_____

(d) Meera poured some of the copper sulphate solution into a dish. She left it in a warm room for a week.



A week later there was a blue solid but no liquid in the dish.

(i) What happened to the water in the copper sulphate solution?

_____

(ii) What was the blue solid left in the dish?

_____

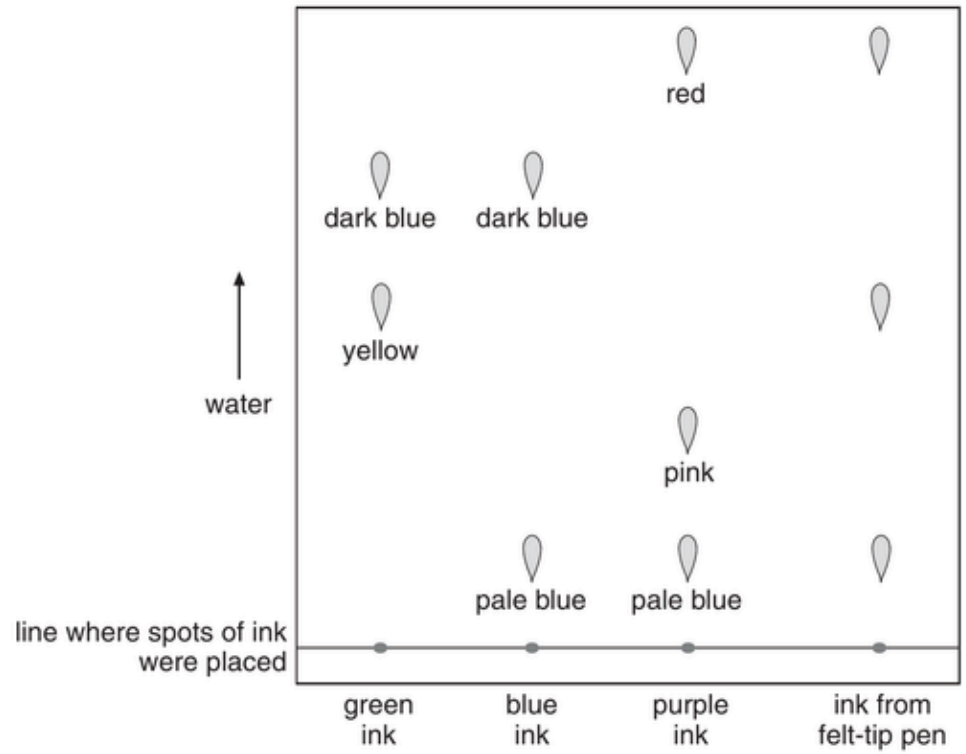
Modern Tuition

13. Susie used chromatography to identify the coloured substances in the ink from a felt-tip pen.

She used:

- green ink
- blue ink
- purple ink
- ink from her felt-tip pen.

She used water as the solvent.



Look at the diagram above.

(a) (i) Which colours were present in the ink from the felt-tip pen?

_____

Modern Tuition

(ii) How many coloured substances were there in green ink?

_____

How can you tell?

_____

_____

(iii) Susie placed the spots of ink on a line on the chromatography paper as shown in the diagram.
To draw the line, Susie had to choose a felt-tip pen or a pencil.

Which one should she use?

_____

Give the reason for your answer.

_____

_____

(b) Susie used water as the solvent in this experiment.
When she repeated the experiment with a different set of pens, it did not work.
She then used ethanol instead of water.

Suggest why the experiment worked with ethanol but not with water.

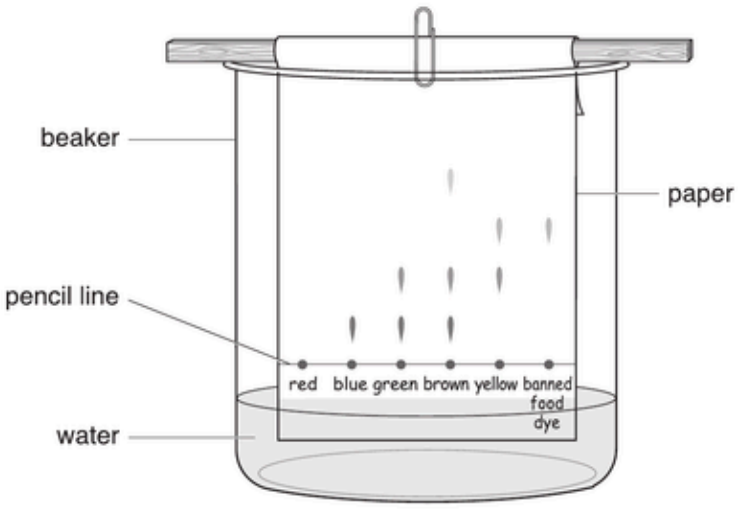
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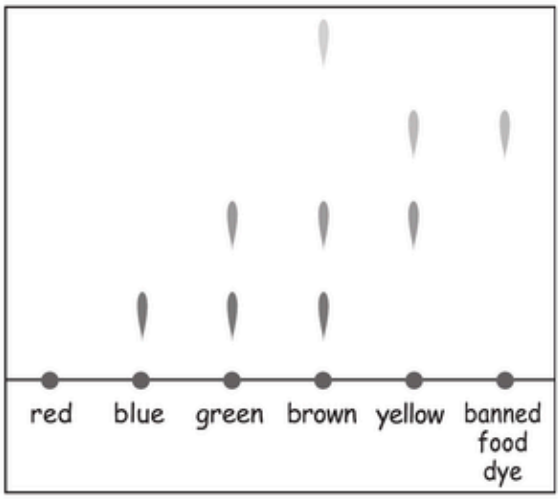
Modern Tuition

4. Gary wanted to find out if some food colourings contained a banned food dye.

He put a drop of each food colouring and the banned food dye onto some special paper.
He hung the paper in a beaker of water.

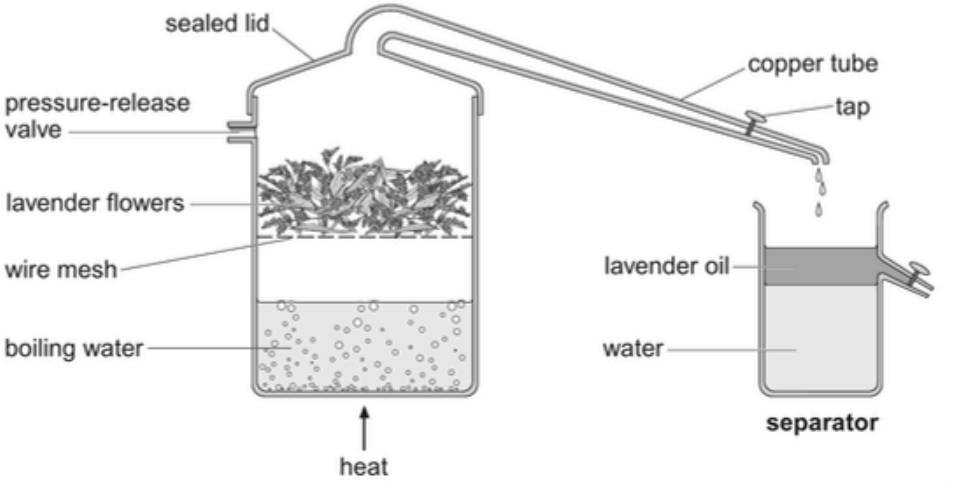


After 10 minutes, the banned food dye and some of the dyes from the food colourings had moved up the paper.
Gary's results are shown below.



Modern Tuition

13. Lavender oil is a perfume obtained from lavender flowers.
Steam at 100°C is passed through the flowers in the apparatus below.



not to scale

Water vapour and lavender oil vapour pass down a copper tube towards a separator.

(a) (i) The lavender flowers are heated in a container with a sealed lid.

Why must the lid be sealed?

_____

_____

(ii) What would happen if the container did **not** have a pressure-release valve?

_____

_____

(b) Lavender oil vapour and water vapour cool as they pass down the copper tube.
A mixture of lavender oil and water collects in the separator.

(i) What is the change in the physical state of both lavender oil vapour and water vapour as they cool?

from _____ to _____

(ii) Look at the separator.

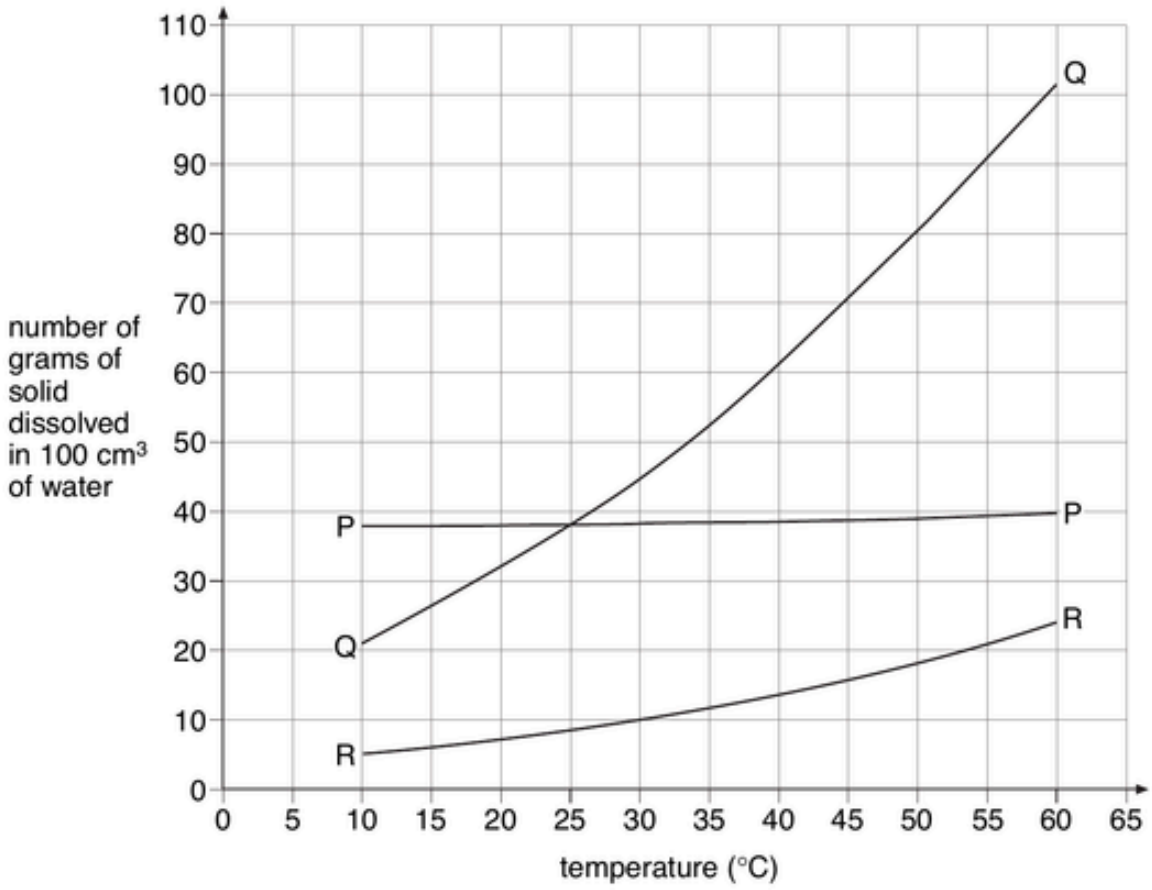
How does this show that the water is denser than lavender oil?

_____

_____

Modern Tuition

(c) Ruth did an experiment to see how much of three solids, P, Q and R, will dissolve in water at different temperatures.
She plotted her results on graph paper as shown below.



Use the graph above to answer the questions below.

(i) At 30°C how many grams of solid R dissolved in the water?

_____ g

(ii) At 60°C which solid dissolved the most in water? Give the letter.

_____

(iii) Which **two** solids were equally soluble at 25°C? Give the letters.

_____ and _____

KS3 Science SATs, Tier 3-6, Paper 2 (2005) - Q5(c)

12. Two groups of pupils investigated the factors affecting the time taken for an indigestion tablet to dissolve in 100 cm^3 of water.



Group 1 recorded their results in the table below.

results of group 1

tablet	time taken to dissolve (s)
whole tablet	34
broken tablet	28
finely crushed tablet	22

(a) What factor did group 1 change as they carried out their investigation?

_____

(b) Before the investigation, group 1 made a prediction.
They found this prediction was supported by the results in the table.

What prediction did group 1 make?

_____

_____

Modern Tuition

(c) Group 2 investigated how the temperature of the water affects the time taken for a whole tablet to dissolve.

Here are their results.

results of group 2

temperature of water (°C)	time taken to dissolve (s)
65	24
40	35
15	90
5	100

What factor did group 2 change as they carried out their investigation?

_____

_____

(d) What pattern do the results recorded by group 2 show?

_____

_____

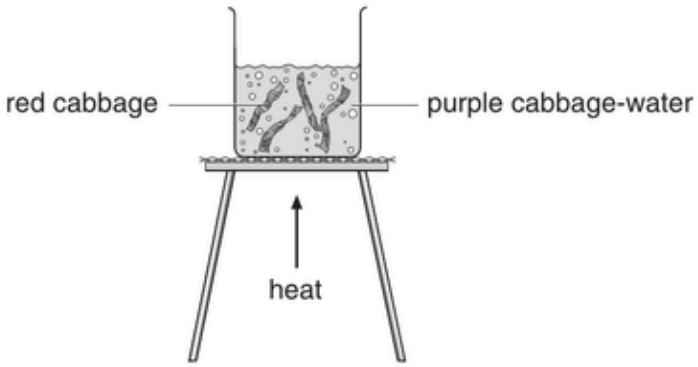
(e) Look at the results presented by group 1 and group 2.
Both groups used the same type of tablet.

Estimate the temperature of water used by group 1.

_____°C

Modern Tuition

5. Sharna boiled some red cabbage in water. The cabbage-water turned purple.



(a) (i) Sharna separated pieces of cabbage from the cabbage-water.

Which method did she use?
Tick the correct box.

chromatography	☐	filtration	☐
condensation	☐	freezing	☐

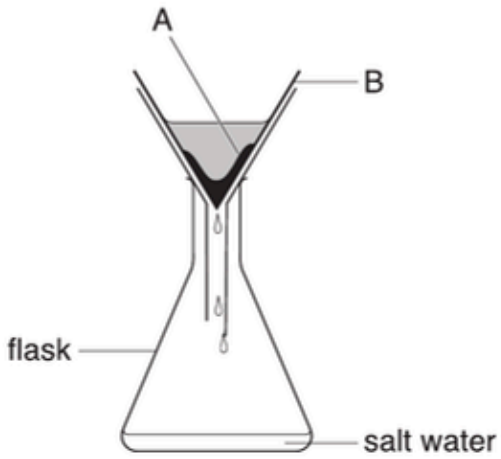
(ii) Sharna wanted to find out if the purple cabbage-water contained more than one **coloured** substance.

Which method did she use?
Tick the correct box.

chromatography	☐	filtration	☐
condensation	☐	freezing	☐

6. Chris collected some sea water near a beach.
The sea water had salt dissolved in it. It had sand mixed in it.

(a) Chris separated the sand from the salt water as shown below.



(i) What is this method of separation called?
Tick the correct box.

chromatography	☐	distillation	☐
filtration	☐	magnetism	☐

(ii) What is substance A?

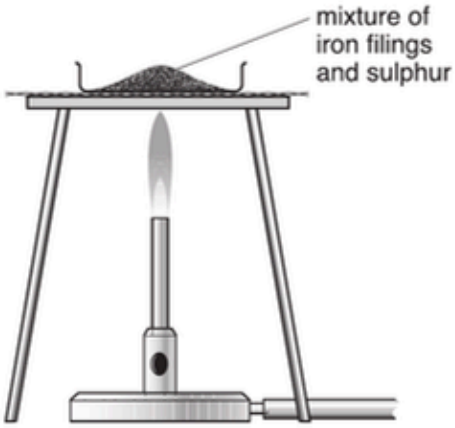
_____

(iii) What is the part labelled B?

_____

Modern Tuition

14. A teacher mixed iron filings with sulphur on a metal tray.
She heated the mixture in a fume cupboard.
Sulphur is yellow. Iron filings are grey.



The mixture glowed very brightly. The teacher turned off the bunsen burner.
The glow spread through the mixture.
When the mixture cooled, a black solid called iron sulphide was left.

(a) From this information, give **one** way you can tell that a chemical reaction took place.

_____

_____

(b) What type of substance is each of the chemicals involved in this reaction?
Choose from:

metallic element	mixture	non-metallic element	compound

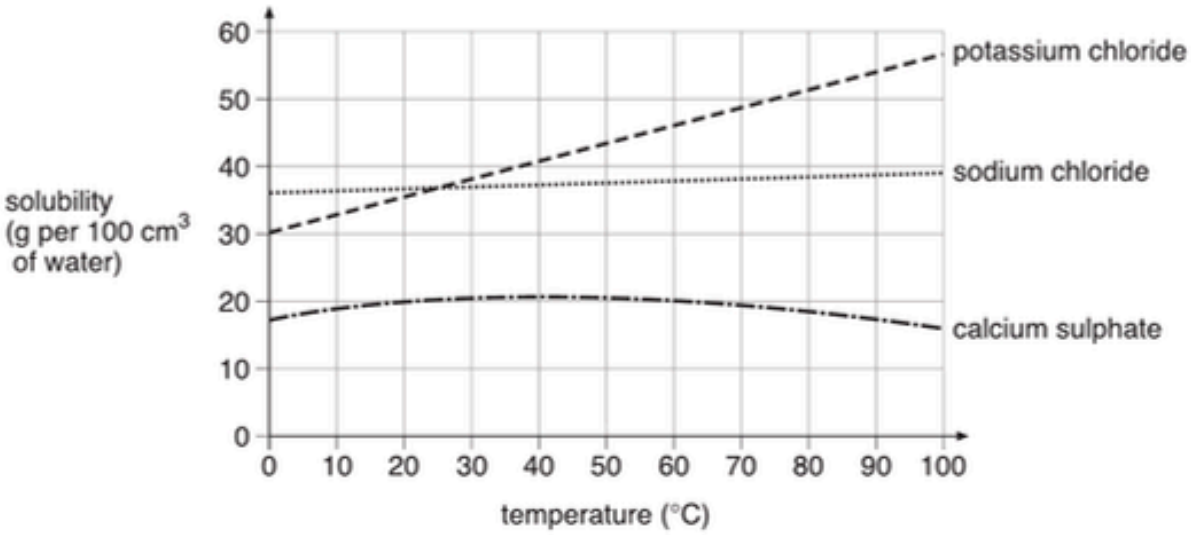
iron _____

sulphur _____

iron sulphide _____

Modern Tuition

11. The graph below shows how the solubility of three salts, sodium chloride, potassium chloride and calcium sulphate, changes as the temperature changes.



(a) (i) Use the graph above to compare the solubility of sodium chloride and potassium chloride in the temperature range 10°C to 90°C.

(ii) Ken had a beaker containing 54 g of potassium chloride dissolved in 100 cm³ of water at 90°C.
He cooled the solution to 40°C.

What would he see in the beaker as the solution cooled to 40°C?
Use the graph to help you.

Explain your answer.

Modern Tuition