7.2.4 Mixtures

100 minutes

146 marks

##

John ground some coffee beans into little pieces. He put them into a coffee filter and poured 800 cm^3 of boiling water over them to make a jug of coffee.

(a) Complete the sentences below. For each sentence, choose **one** of the following words.

insoluble **soluble** **solution** **solvent**

(i) The liquid in the jug is brown because parts of the coffee beans are ..... in water.

1 mark

(ii) Some bits of coffee beans are left on the filter because they are ..... in water.

1 mark

(iii) The brown liquid which drips through the filter is a ..... of coffee.

1 mark

(b) How could John get dry, solid coffee from the brown liquid in the jug of coffee?

.....

.....

1 mark

(c) John tried making coffee in the same way using cold water. He used 800 cm^3 of cold water and the same amount of ground up coffee beans.

(i) The liquid in the jug was a lighter colour. Why was this?

.....

.....

1 mark

(ii) How much solid coffee could John get back from this liquid?

Tick the correct box.

more than before ☐

the same as before ☐

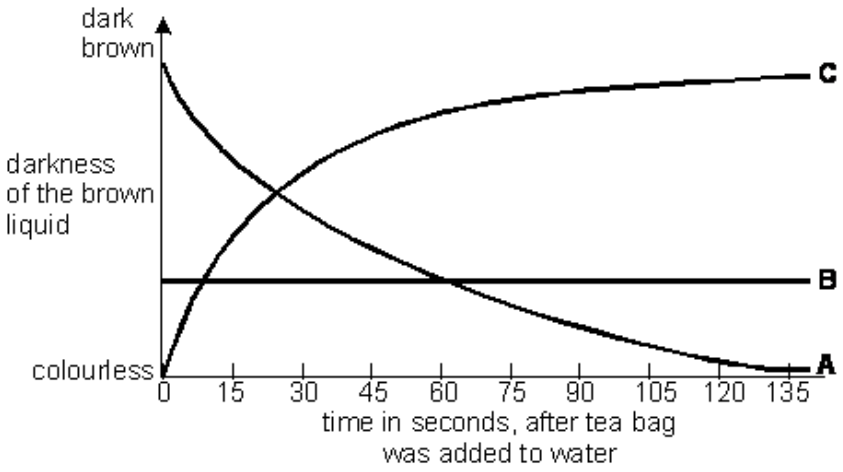
less than before ☐

none ☐

1 mark
Maximum 6 marks

##

Becky puts one tea bag in a beaker and adds 50 cm^3 of warm water. She stirs the liquid slowly. Every 15 seconds she takes out 2 cm^3 of the liquid and measures how dark it is.



(a) Which graph, A, B or C, shows how the colour of the liquid changes?

.....

1 mark

(b) (i) Becky takes out 2 cm^3 samples of the liquid each time. Why must she always put the sample back after she has tested it?

.....

1 mark

(ii) What piece of apparatus can she use to measure the volume of the 2 cm^3 samples of liquid?

.....

1 mark

(iii) Suggest **two** ways Becky could make the tea dissolve more quickly.

1 .....

.....

2 .....

.....

2 marks
Maximum 5 marks

Q3. A scientist investigates the paints used in oil paintings. She takes tiny pieces of yellow, blue and green paint and tries to dissolve them in different solvents.
Her results are shown in the table.

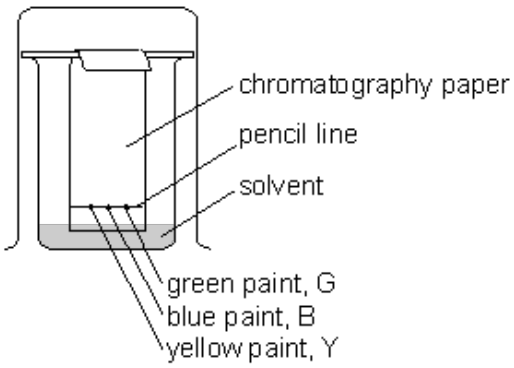
solvent	yellow paint	blue paint	green paint
water	yellow pieces are left	blue pieces are left	green pieces are left
ethanol	yellow pieces are left	clear blue liquid	clear blue liquid but yellow pieces are left
propanone	clear yellow liquid	clear blue liquid	clear green liquid

(a) Which solvent does **not** dissolve the blue paint?

.....

1 mark

She then uses chromatography to investigate the paints.



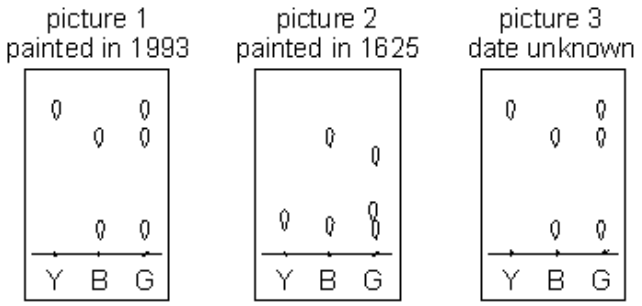
(b) Only **one** of the solvents in the table will make all three paints move up the chromatography paper. Which solvent is this?

.....

1 mark

(c) The scientist then investigates the paint used in three different oil paintings. She takes tiny pieces of yellow, blue and green paint from each picture and uses chromatography to compare them.

Her results are shown below:



Which of the paints in the 1993 picture contains only **one** substance?
Tick the correct box.

yellow, Y ☐ blue, B ☐ green, G ☐

1 mark

The scientist decides that picture 3 is probably recent and not from around 1625.

(d) Look at the chromatography results for the three pictures. Explain how the scientist was able to decide this.

.....

.....

.....

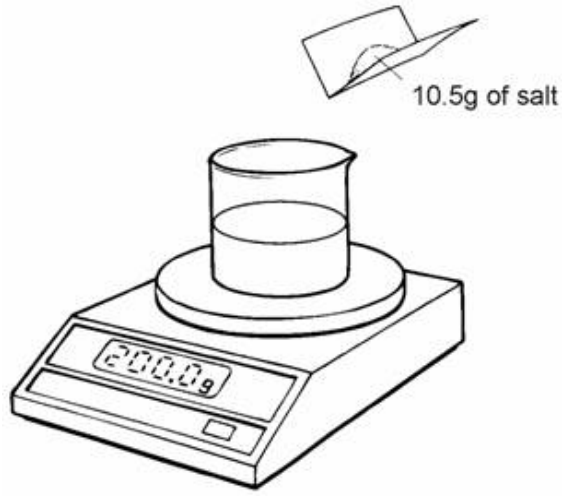
.....

2 marks
Maximum 5 marks

Q4. (a) Complete the following sentence.

When a solid dissolves in a solvent, a ..... is formed.

1 mark



1 mark

A beaker contains water. It is on a balance.
The balance reads 200.0 g.
Patti adds 10.5 g of salt to the water. The salt dissolves.

(b) When all the salt has dissolved, what is the reading on the balance?

..... g

(c) Patti wants to get **all the solid salt** back from the water.

Describe how she could do this.

.....

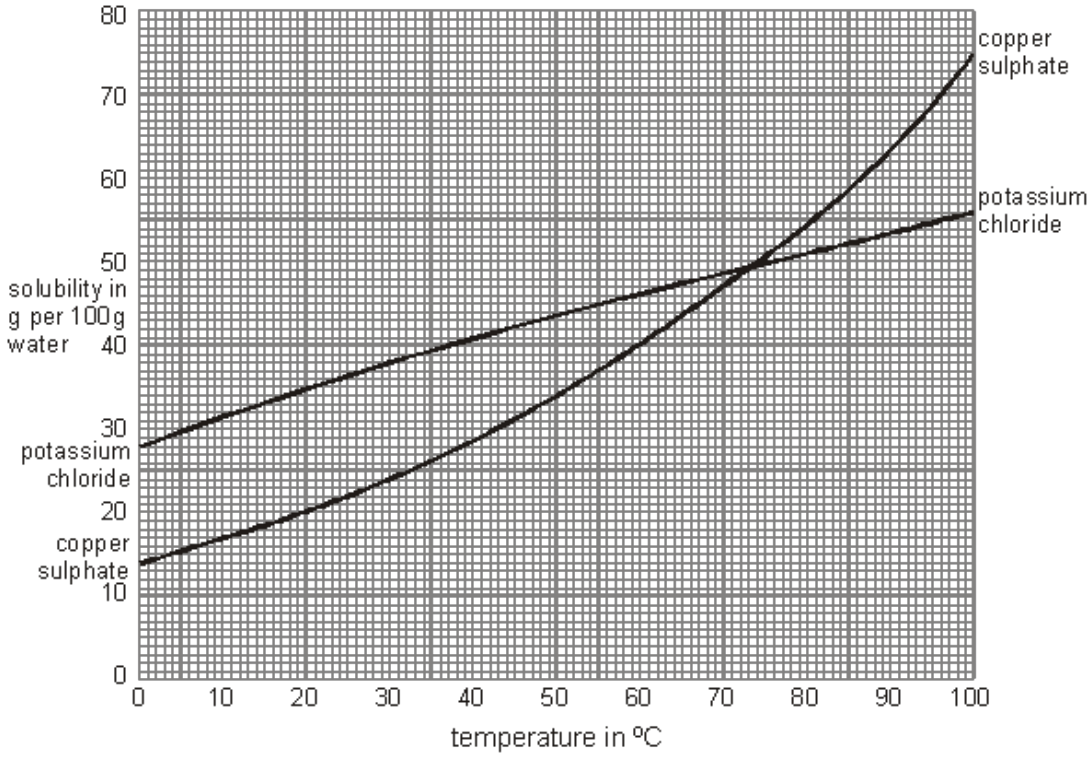
.....

.....

.....

2 marks
Maximum 4 marks

Q5. The graph shows how the solubility of two salts in water changes with temperature. The solubility is the number of grams of the salt which will dissolve in 100 g of water.



(a) Describe how the solubility of copper sulphate changes with temperature.

.....

.....

1 mark

(b) Use the information in the graph to answer the questions below.

(i) What is the solubility of potassium chloride at 40°C?

……. g per 100 g of water

1 mark

(ii) At what temperature are the solubilities of the two salts the same?

……. °C

1 mark

(iii) What is the largest mass of copper sulphate which can be dissolved in 50 g of water at 60°C?

.....

.....

.....

1 mark

(c) Why is the solubility of salts in water normally given only for temperatures between 0°C and 100°C?

.....

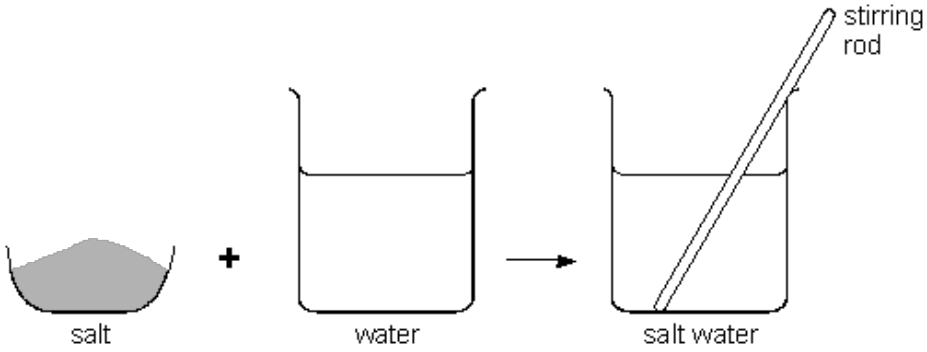
.....

.....

.....

2 marks
Maximum 6 marks

Q6. Emma dissolved some salt in some water to make salt water.



(a) Which words in the list below describe the salt, the water and the salt water?

Write the correct words in the table.

3 marks

solution **solute** **sediment** **filtrate** **solvent**

substance	word from the list
salt	
water	
salt water	

(b) What **two** things could Emma do to make the salt dissolve more quickly?

1. .....

2. .....

2 marks

(c) Emma dissolved 5 g of salt in 50 cm^3 of water. Now she wants to make some salt water which is only half as concentrated.

What should she do? Tick the correct box.

Dissolve 10 g of salt in 100 cm^3 of water.	☐	Dissolve 5 g of salt in 100 cm^3 of water.	☐
Dissolve 10 g of salt in 50 cm^3 of water.	☐	Dissolve 10 g of salt in 25 cm^3 of water.	☐

1 mark
Maximum 6 marks

##

John dropped a glass bottle of blue copper sulphate crystals. The bottle broke and glass was mixed with the crystals.

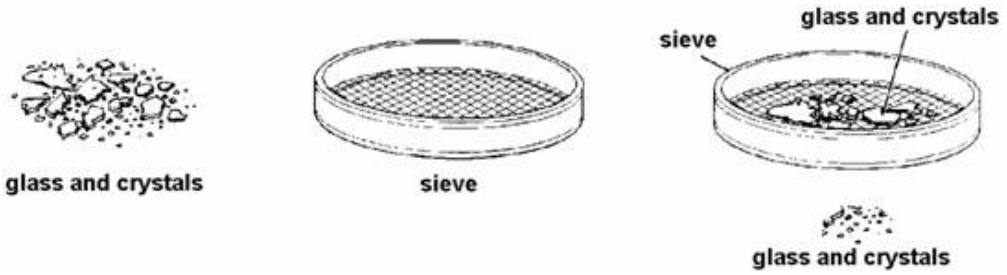
(a) Suggest how John or a teacher could clear up the mixture safely, without cutting themselves.

.....

.....

1 mark

(b) Mari said, "You can separate the glass from the copper sulphate crystals using a sieve".



Most of the crystals went through the sieve. Some of the glass went through as well.

Why did some of the crystals and pieces of glass stay in the sieve?

.....

1 mark

(c) John tried another way to separate the glass from the blue copper sulphate crystals. He put the mixture into water and stirred it.
The water turned blue. Why did the water turn blue?

.....

1 mark

(d) Very carefully, he poured some of the blue liquid into a dish and gently heated it. The volume of the liquid decreased.
Why did the volume decrease?

.....

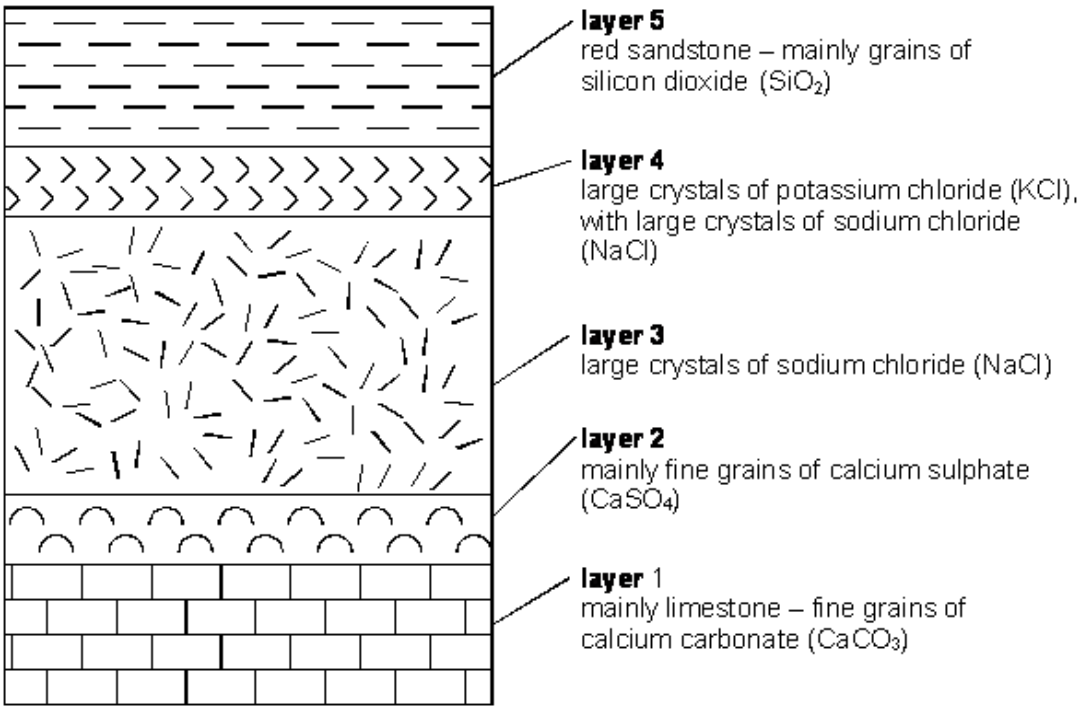
1 mark

(e) John put the dish by a window. The next day there was no liquid left.
What would be left in the dish?

.....

1 mark
Maximum 5 marks

Q8. The diagram shows a section through a formation of rocks. The rocks formed as sediments on the bed of an inland sea. The sea was surrounded by a hot, rocky desert. It rarely rained, but when it did the rain was very heavy.



(a) Suggest how the limestone in layer 1 was formed

.....

.....

1 mark

Potassium chloride and sodium chloride are both more soluble than calcium sulphate.

(b) (i) Suggest how the crystals of potassium chloride and sodium chloride were formed in layers 3 and 4.

.....

.....

1 mark

(ii) Why are the crystals in these rock layers large?

.....

.....

1 mark

(iii) Layer 3 contains very little potassium chloride but layer 4 contains quite a lot of both salts. Why is this?

.....

.....

1 mark

(c) All of the rocks contain insoluble particles of clay. Suggest how these particles got into the rocks.

.....

.....

1 mark

(d) Suggest how layer 5 was formed.

.....

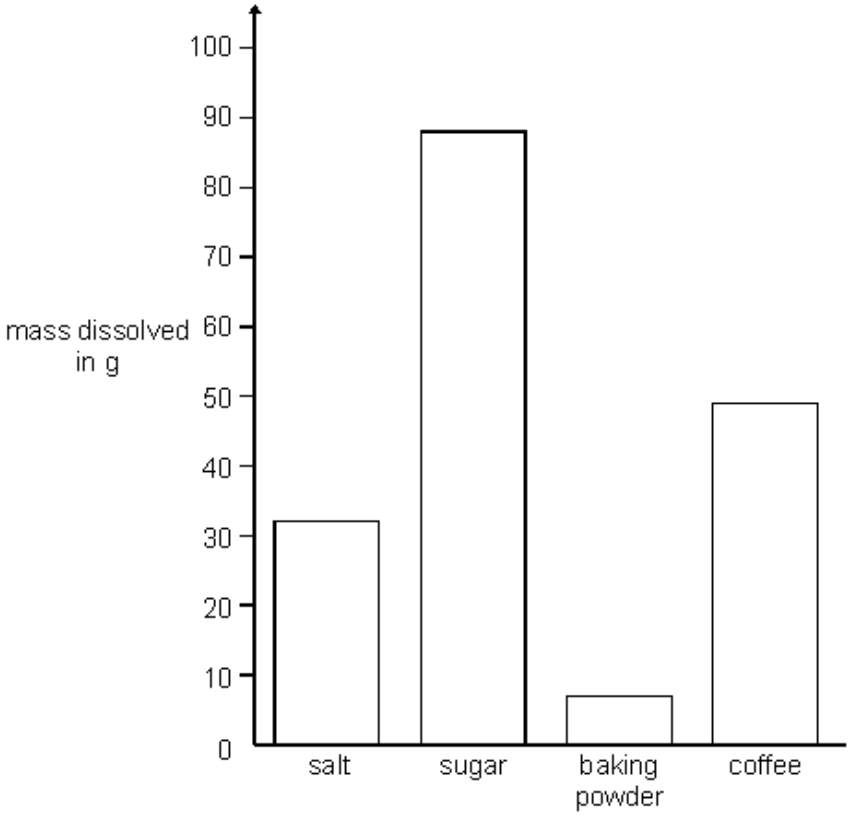
.....

1 mark

Maximum 6 marks

Q9. Simon added some salt to 100 cm^3 of cold water in a beaker.
He stirred the water to dissolve the salt. He added more salt until no more would dissolve.
He repeated his experiment with sugar, baking powder and instant coffee powder.
Each time, he used a different beaker containing 100 cm^3 of cold water.

He drew a bar chart of his results.



(a) Describe **two** ways in which Simon made this experiment a fair test.

1. .....

2. .....

2 marks

(b) Which **one** of the four solids was most soluble in water?

.....

1 mark

(c) How could Simon make more salt dissolve in 100 cm^3 of water?

.....

1 mark
Maximum 4 marks

Q10. (a) Sunil picked yellow, red and purple primula flowers from his garden.

He dipped the different flower petals into water and into two different solutions.
The pH of one solution was 1 and the pH of the other was 10.
The table shows the results.

colour of flower petals	in solutions of pH 1	in water pH 7	in solution of pH 10
yellow	stayed yellow	stayed yellow	stayed yellow
red	stayed red	stayed red	turned green
purple	turned pink	stayed purple	turned blue

Which colour of flower petal would be most useful to make an indicator for **both** acids **and** alkalis? Explain your answer.

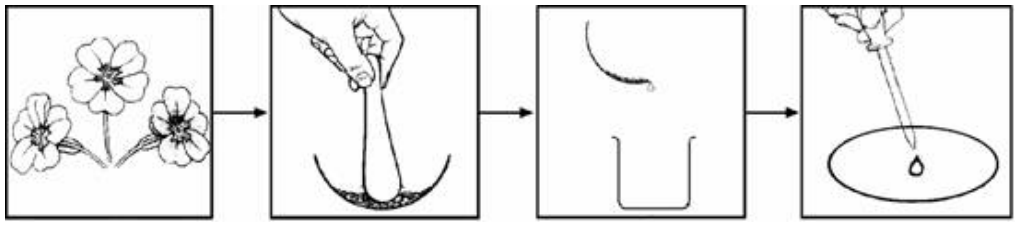
.....

.....

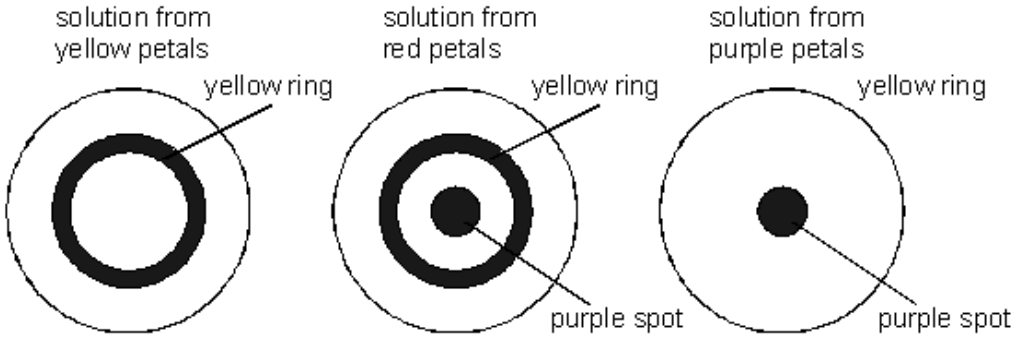
.....

2 marks

Sunil crushed petals from each flower separately in some liquid and poured off the coloured solutions. Then he put drops of each coloured solution into the middle of different pieces of filter paper.



The solutions spread out on the filter paper. The diagrams show his results.



(b) What is the name of this method of investigating coloured substances?

.....

1 mark

(c) Sunil made notes on his experiment. Some words are missing.
Complete the sentences.

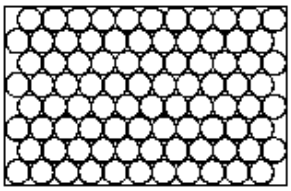
When I crushed a flower in a liquid it produced a coloured solution.

This is because a coloured substance had .....…….. in the liquid. This shows that the liquid is a ..... for these coloured substances.

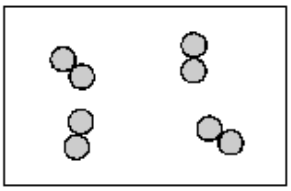
My experiment shows that one of the flowers probably contained two coloured substances. This was the .....…….. flower.

3 marks
Maximum 6 marks

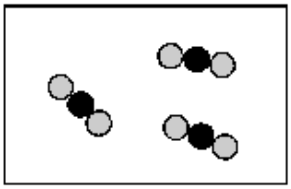
Q11. The diagrams represent the arrangement of atoms or molecules in four different substances, A, B, C and D.



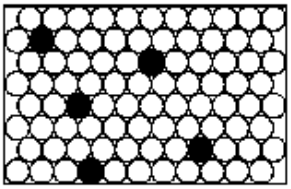
A



B



C



D

not to scale

Each of the circles, ○, ◌ and ● represents an atom of a different element.

(a) (i) Which substance is a compound?

……

1 mark

(ii) Which substance is a mixture?

……

1 mark

(iii) Which **two** substances are elements?

…… and …….

1 mark

(iv) Which **two** substances could be good thermal conductors?

…… and …….

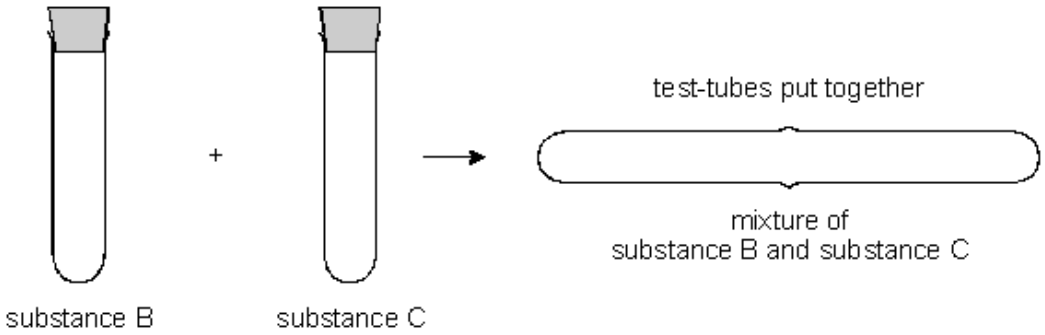
1 mark

(v) Which substance could be carbon dioxide?

…….

1 mark

(b) The following experiment was set up. Test-tubes containing substances B and C were placed together as shown. The substances did **not** react.
They were left for five minutes.

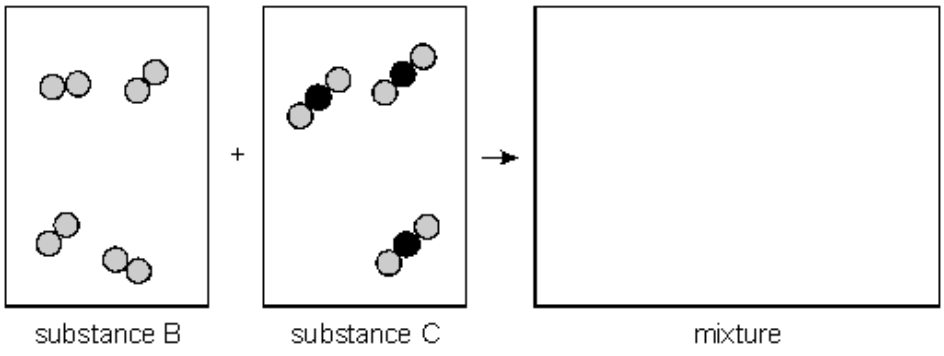


(i) How many molecules are there in the mixture compared to the total number in substances B and C?

……

1 mark

(ii) Complete the diagram which is a model of this experiment.

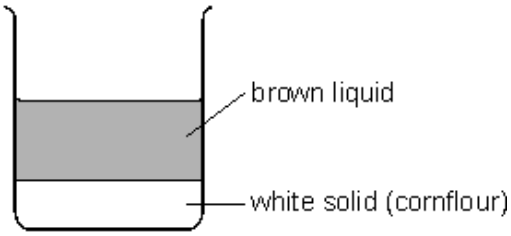


1 mark
Maximum 7 marks

Q12. Gravy powder contains:

- a brown substance to make the gravy brown;
- cornflour to make the gravy thick.

Dan mixed some gravy powder with cold water in a beaker.
An hour later, the contents of the beaker looked like this:



(a) Use the words in the list below to fill the gaps in the following sentences.

solvent **solution** **soluble** **insoluble**

The brown substance dissolves in water to form a brown …… .

The cornflour settles at the bottom of the beaker because

it is …… in water.

Water is the …… in this experiment.

3 marks

(b) Dan wanted to separate the brown liquid from the white solid.
What could he do to separate them?

……..…….

1 mark

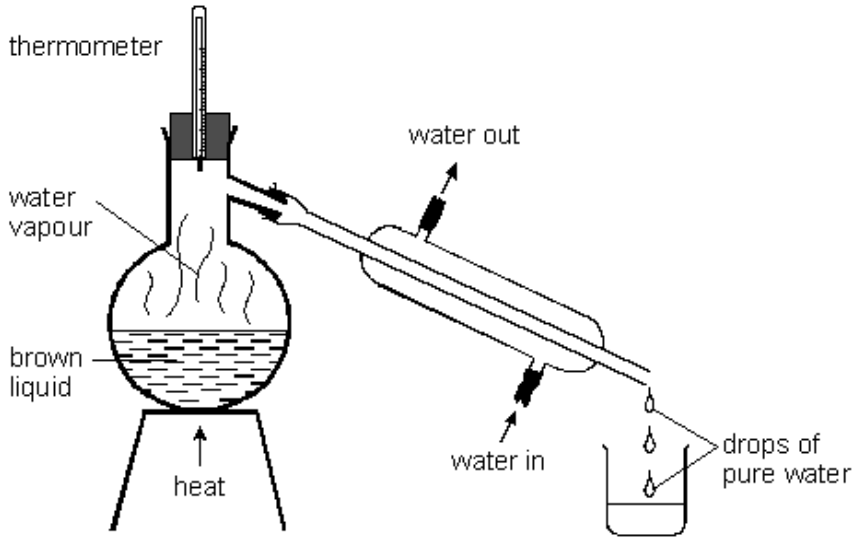
(c) Dan put a little of the brown liquid in a dish. The next day there was only a brown solid left in the dish. What had happened to the water?

……..…….

……..…….

1 mark

(d) Dan wanted to get pure water from the rest of the brown liquid.
He set up the apparatus shown below.

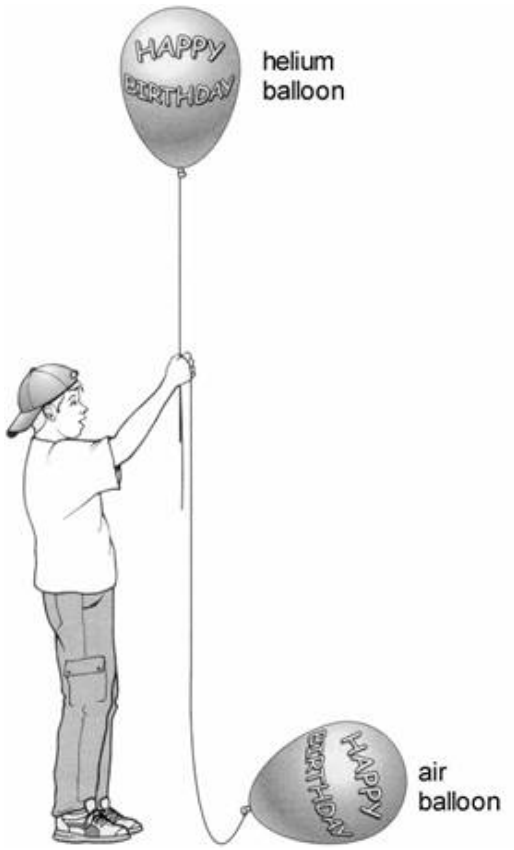


Water vapour from the brown liquid changed into drops of pure water which were collected in the beaker. What process caused the drops of water to form from the vapour? Tick the correct box.

boiling	☐	condensing	☐
dissolving	☐	melting	☐

1 mark
Maximum 6 marks

Q13. Chris has two rubber party balloons. One is filled with air and the other is filled with helium. Both balloons contain the same volume of gas.



(a) (i) Explain why the helium balloon rises.

.....

.....

1 mark

(ii) Explain why the air balloon drops to the ground.

.....

.....

1 mark

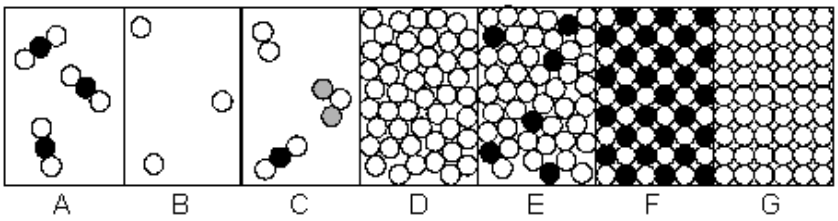
(b) The chemical symbol for helium is He.
Explain why air does **not** have a chemical symbol or formula.

.....

.....

1 mark

(c) The diagram below shows seven arrangements of particles.



The two party balloons are coated with a thin layer of aluminium.
Give the letter of the diagram which best represents the particles in:

(i) the helium gas; .....

1 mark

(ii) the air; .....

1 mark

(iii) the thin layer of aluminium. .....

1 mark

(d) Over several days, the balloons shrink because the particles of gas diffuse through the balloon and escape. The helium balloon shrinks more quickly than the air-filled balloon. Answer the following questions in terms of particles.

(i) Why does helium escape more quickly than air from a balloon?

.....

.....

1 mark

(ii) A rubber balloon coated with aluminium takes longer to shrink than a rubber balloon **without** an aluminium coating.
Suggest a reason why gas particles diffuse more slowly through aluminium than through rubber.

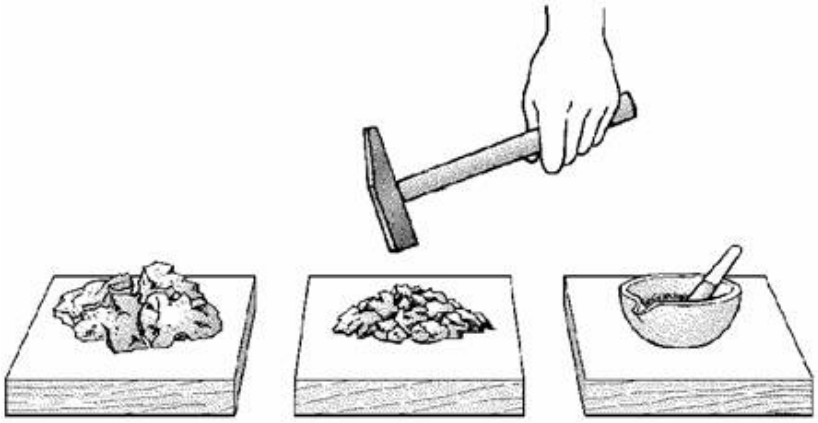
.....

.....

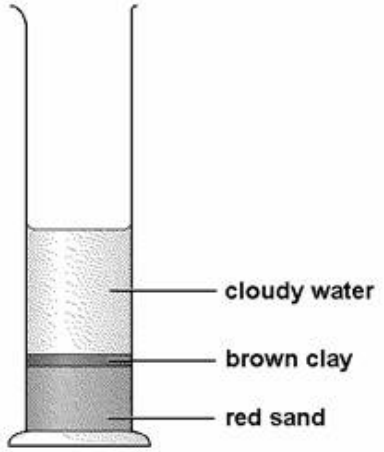
1 mark
Maximum 8 marks

Q14. Linda had a piece of red sandstone.

She hammered it into pieces and then ground them into a powder using a pestle and mortar.



She put the powder into a measuring cylinder with water and shook the mixture. The contents settled.



(a) Linda said her results showed that sandstone is a mixture of two substances.

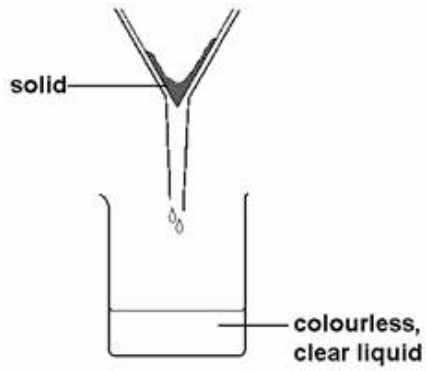
How could she tell, from the results, that sandstone is a mixture of substances?

.....

.....

1 mark

(b) Linda then poured the cloudy water from the measuring cylinder through filter paper in a filter funnel.



She said there might be salts dissolved in the colourless, clear liquid that came through the filter.

(i) What could Linda do to find out if there were salts dissolved in the colourless, clear liquid?

.....

.....

1 mark

(ii) What would she see if there had been salts dissolved in the colourless, clear liquid?

.....

.....

1 mark

(c) Sandstone is a sedimentary rock. Four stages in the formation of sedimentary rock are listed below.
They are **not** in the correct order.

compacted **deposited** **weathered** **transported**

Put these stages in the correct order. One has been done for you.

stage 1 .....**weathered**.....

stage 2 .....

stage 3 .....

stage 4 .....

1 mark
Maximum 4 marks

Q15. The drawing shows a gold mask from a tomb in Egypt. The gold is still shiny after thousands of years.

(a) What is pure gold? Tick the correct box.

a compound	☐	a mixture	☐
an element	☐	a solution	☐

1 mark

(b) The list shows some of the properties of gold.

It conducts electricity. **It melts at 1064°C.** **It is yellow.**

It is easily scratched. **It stays shiny.** **It conducts heat.**

(i) Which **one** of these properties shows that gold does **not** react with oxygen in the air?

.....

1 mark

(ii) Which **two** of the properties above are properties of **all** metals?

1. .....

2. .....

2 marks

(c) Old iron objects from tombs in Britain are often covered with rust.
Iron reacts with oxygen when it rusts.

What else is needed for iron to go rusty? Choose **one** substance from the list below.

lead **nitrogen** **carbon dioxide** **water**

.....

1 mark

(d) A box contains a collection of metal objects from a tomb.

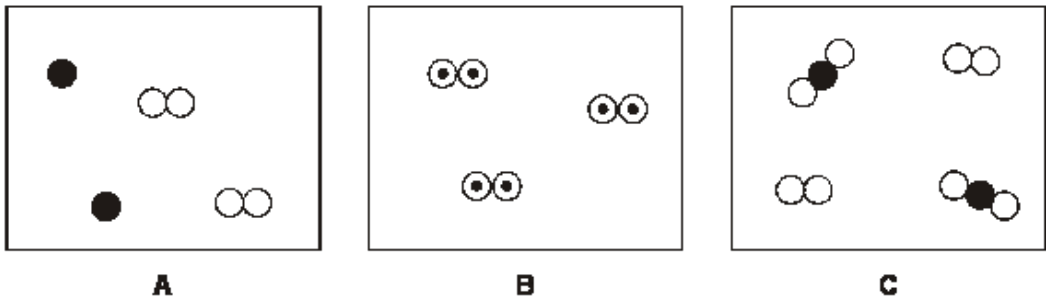
What piece of equipment would you use to separate the iron objects from the other metal objects?

.....

1 mark
Maximum 6 marks

Q16. In the 19th Century, a scientist called John Dalton used symbols to represent atoms. The symbols he used for atoms of three different elements are shown below.

The diagrams below show different combinations of these atoms.



(a) (i) Give the letter of the diagram which shows a mixture of **two** elements.

.....

1 mark

(ii) Give the letter of the diagram which shows a mixture of **two** compounds.

.....

1 mark

(iii) Give the letter of the diagram which shows a mixture of an element and a compound.

.....

1 mark

(b) Give **one** difference between a compound and a mixture.

.....

.....

.....

1 mark

(c) (i) Suggest a name and formula for the substance represented in diagram B.

name .....

formula .....

1 mark

(ii) Suggest a name and formula for the substance represented in diagram D.

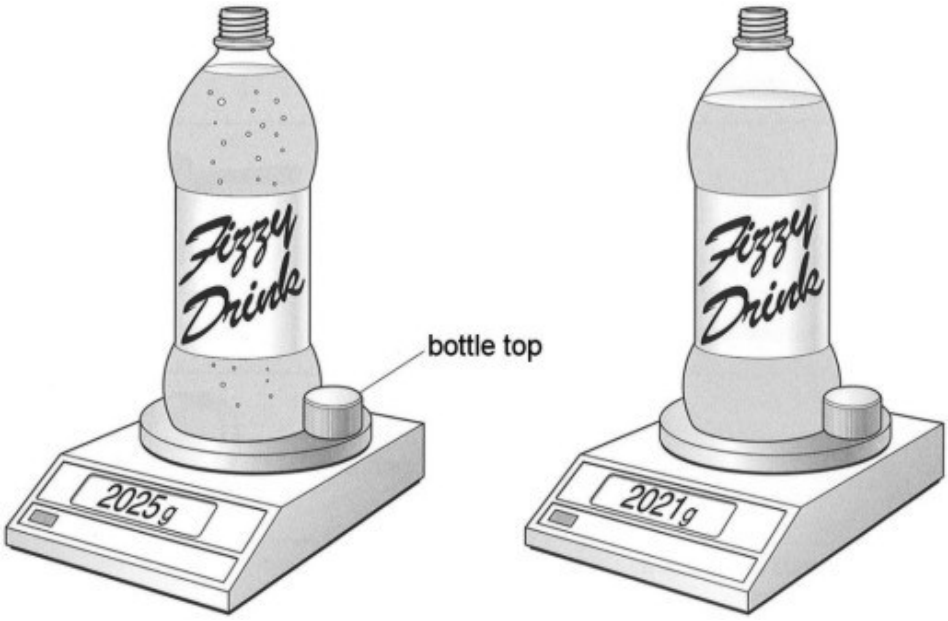
name .....

formula .....

1 mark

maximum 6 marks

Q17. (a) Jenny put a bottle of fizzy drink on a balance.
She removed the bottle-top, and the drink began to fizz.
She left the open bottle of drink and the bottle-top on the balance for five days in a warm room.



at the start **five days later**

Five days later the drink was no longer fizzy. It's mass had decreased and the level of the liquid had gone down.

(i) Look at the drawings of the balance.
Work out the decrease in **mass** after five days.

..... g

1 mark

(ii) The fizzy drink contained sugar, colouring, a gas and water. The mass decreased because two of these substances were lost into the air.

Which **two** substances were lost into the air?

1. .....

1 mark

2. .....

1 mark

(b) The sugar, colouring and the gas were all dissolved in the water.
Which word describes the **water**?
Tick the correct box.

alkali	☐	indicator	☐
solute	☐	solvent	☐

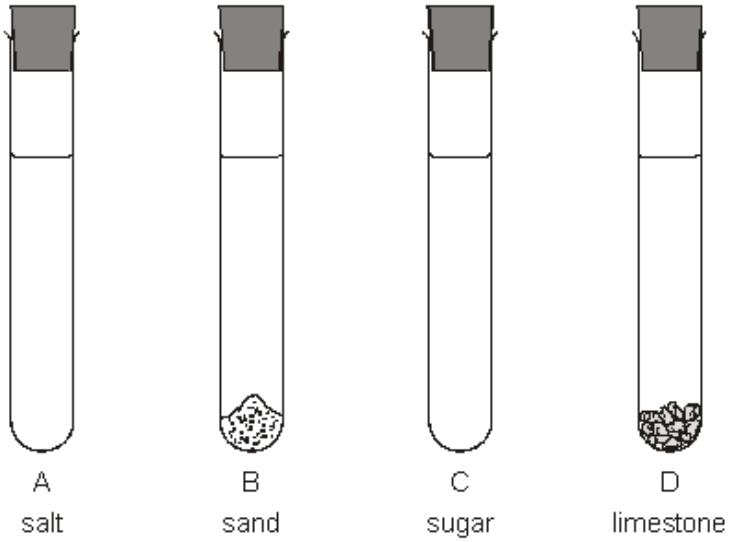
1 mark
maximum 4 marks

Q18. (a) Reshma had a mixture of iron filings and sand. What could she use to separate the iron filings from the mixture?

.....

1 mark

(b) Reshma put 10 cm^3 of water and 2 g of a different solid into each of four test-tubes.
She shook each test-tube.
The drawings show the test-tubes after 10 minutes.



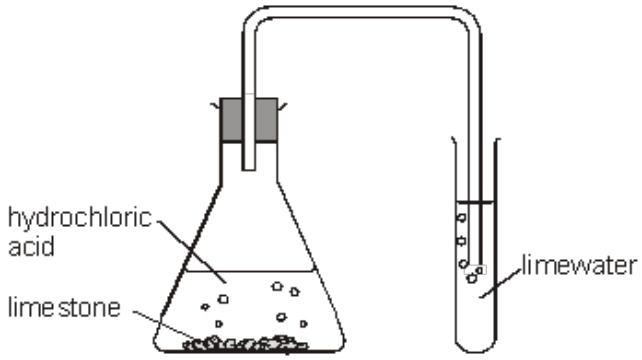
Why can the salt and sugar **no** longer be seen in test-tubes A and C?

.....

.....

1 mark

(c) Reshma added hydrochloric acid to some pieces of limestone as shown below.



(i) Look at the diagram above. How can you tell that a gas is given off in this experiment?

.....

.....

1 mark

(ii) Reshma passed the gas through limewater. This showed that the gas was carbon dioxide.

What happened to the limewater?
Tick the correct box.

It stayed clear. ☐

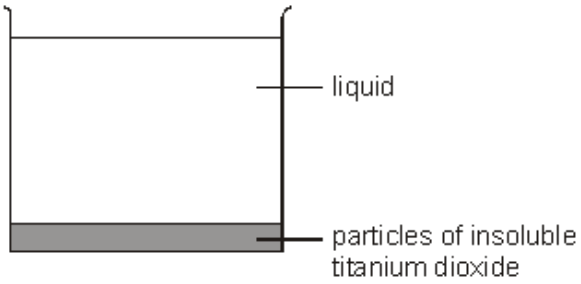
It turned blue. ☐

It turned cloudy. ☐

It turned red. ☐

1 mark
maximum 4 marks

Q19. (a) Samantha opened a tin of white paint. The paint consisted of a liquid and particles of titanium dioxide that are insoluble in the liquid.
The paint had separated into two layers, as shown below.



(i) What type of substance is the paint?
Tick the correct box.

a compound ☐ an element ☐ a mixture ☐

1 mark

(ii) What type of substance is titanium dioxide?
Tick the correct box.

a compound ☐ an element ☐ a mixture ☐

1 mark

(iii) Why did the particles of insoluble titanium dioxide sink to the bottom?

.....

.....

1 mark

(b) Samantha stirred the paint and used it to paint a window frame.
She got some of the paint on the glass.

Samantha could **not** get the paint off the glass with water.
When she used a different liquid called white spirit the paint came off.

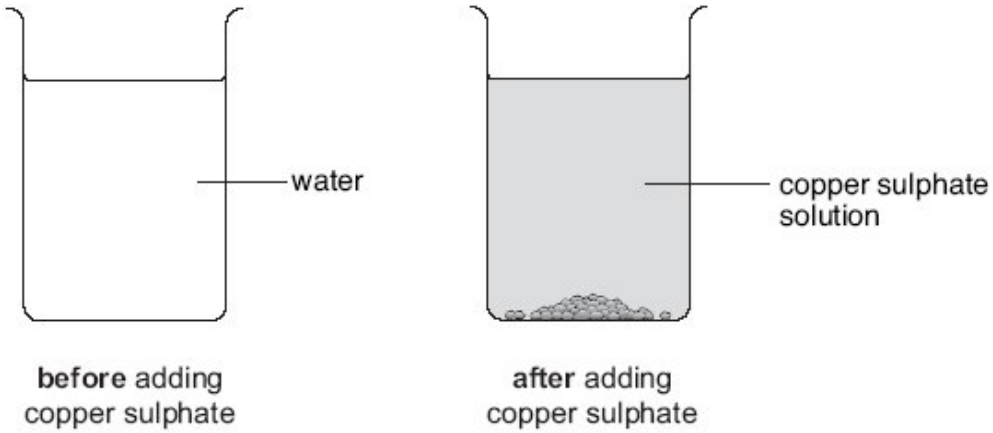
Why could she remove the paint with white spirit but **not** with water?

.....

.....

1 mark
maximum 4 marks

Q20. (a) Ruth added some blue copper sulphate crystals to a beaker of water.



(i) How could Ruth **see** that some of the copper sulphate crystals had dissolved in the water?

.....

.....

1 mark

(ii) How could Ruth make the copper sulphate crystals dissolve more quickly?

.....

1 mark

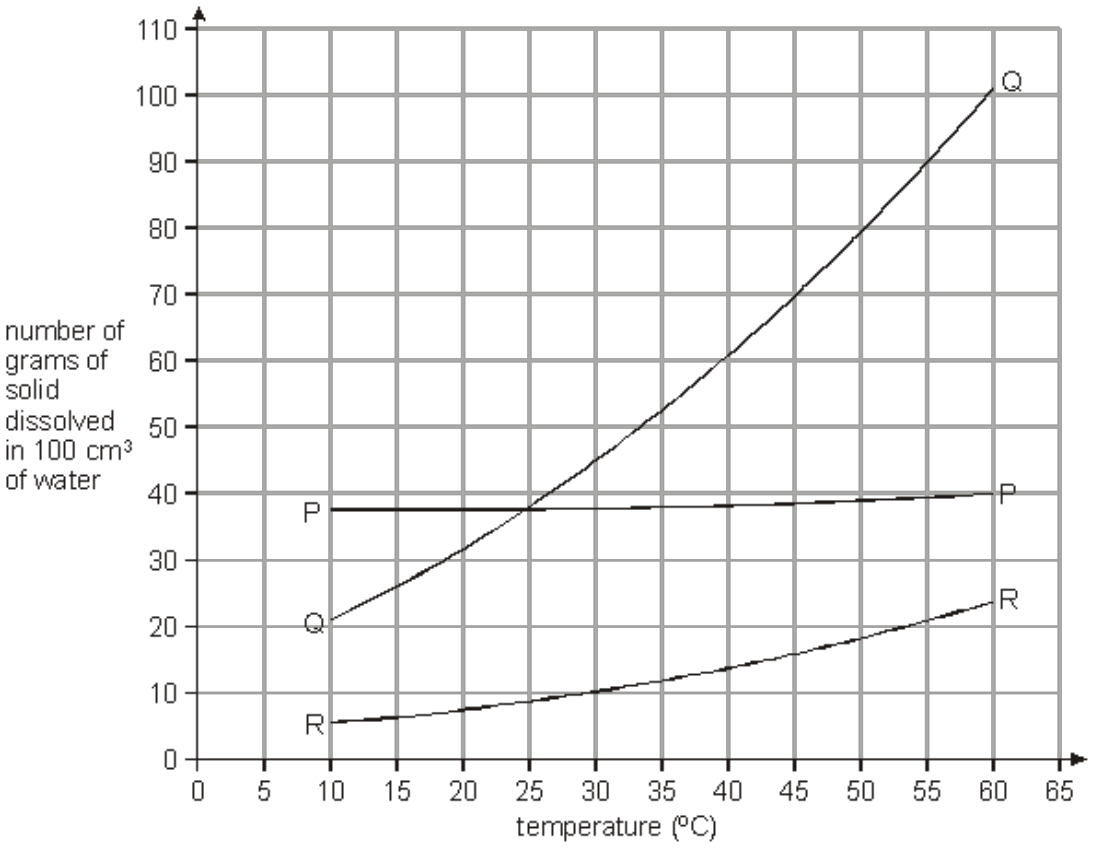
(b) Ruth poured some of the copper sulphate solution into a dish.
She left it in a warm room for five days.

All the water evaporated from the solution in the dish.
What was left in the dish?

.....

1 mark

(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

1 mark

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

.....

1 mark

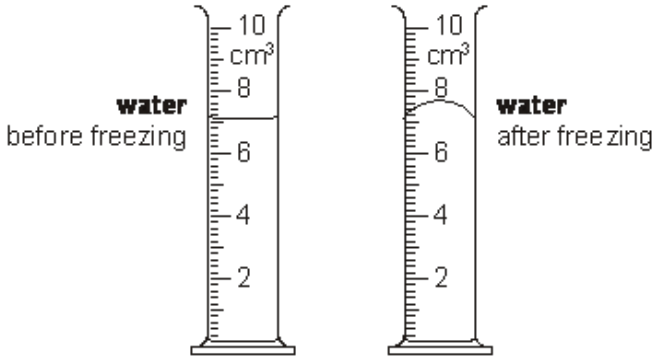
(iii) Which **two** solids were equally soluble at 25°C? Give the letters.

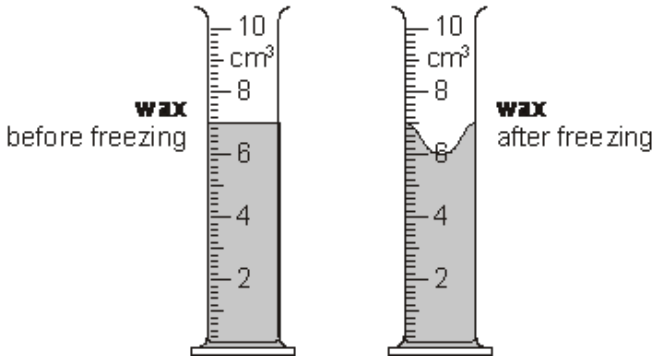
..... and .....

1 mark
maximum 6 marks

Q21. Meera poured 7 cm^3 of water into a measuring cylinder.

She poured 7 cm^3 of melted wax into another measuring cylinder.
She put both measuring cylinders into a freezer for 24 hours.





(a) Look at the measuring cylinders.
What happened to the volume of the water and the wax after freezing?

the volume of water .....

the volume of wax .....

1 mark

(b) The measuring cylinders were taken out of the freezer and left in a room at 20°C.

- Frozen water melts at 0°C.
- Wax melts at 53°C.

What would the physical state of each substance be at 20°C?

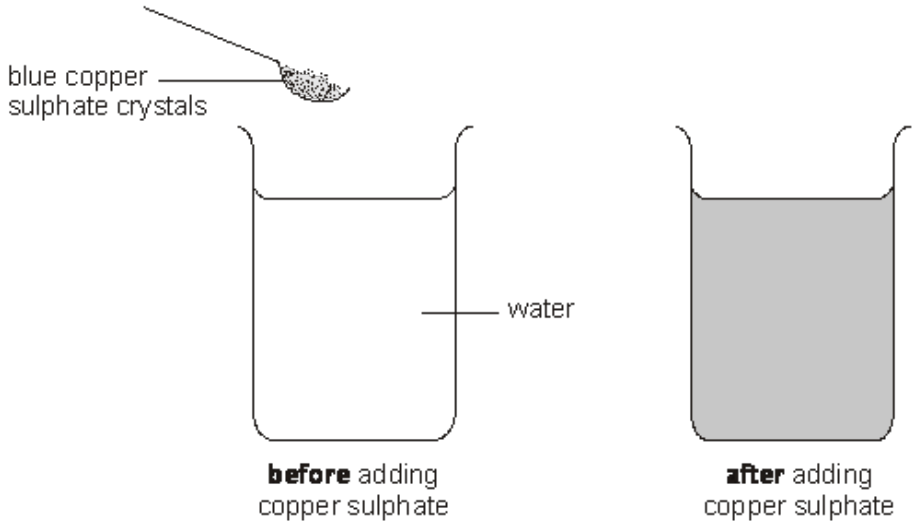
Choose from **gas** or **liquid** or **solid.**

water .....

wax .....

2 marks

(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.

.....

1 mark

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

.....

1 mark

(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?

.....

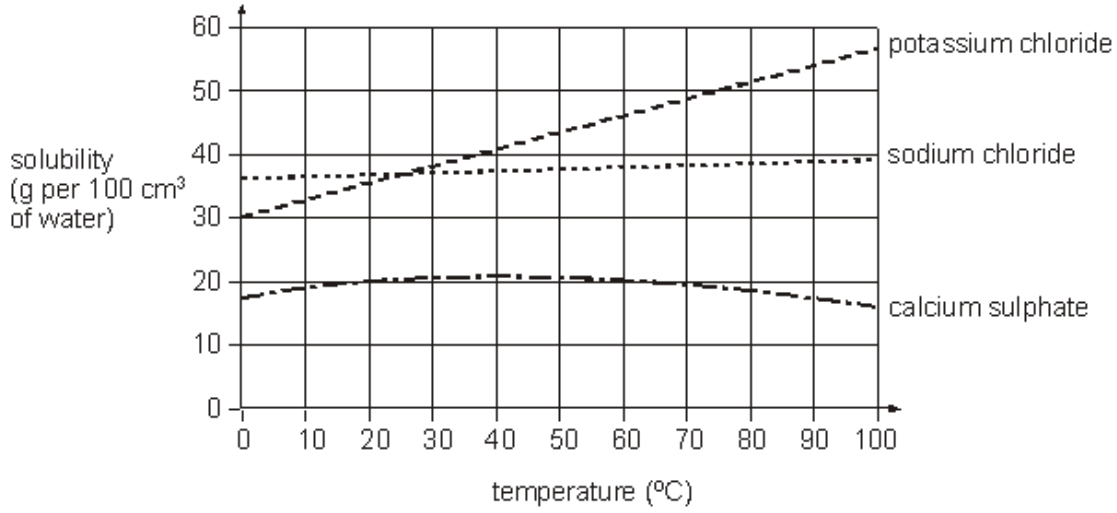
1 mark

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

.....

1 mark
maximum 7 marks

Q22. 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.

.....

.....

.....

.....

2 marks

(ii) Ken had a beaker containing 54 g of potassium chloride dissolved in 100 cm^3 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.

.....

1 mark

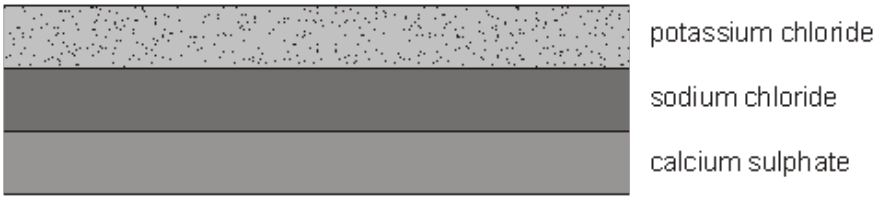
Explain your answer.

.....

.....

1 mark

(b) The water in a lake had the three salts dissolved in it. The water evaporated from the lake and the salts were deposited in layers in the order shown below.



Look at the graph above.

(i) What evidence is there that these three salts were deposited at a temperature above 25°C?

.....

1 mark

(ii) In what order would the salts be deposited at 10°C?

top.....

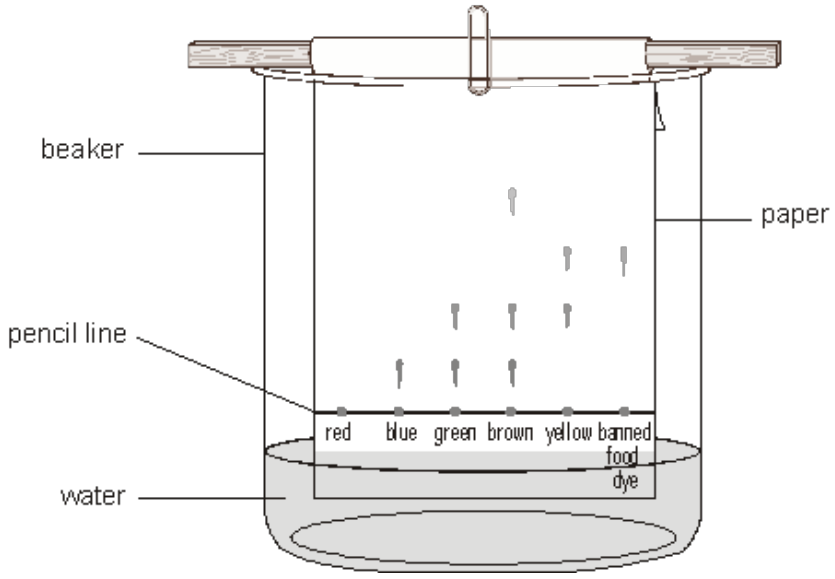
middle.....

bottom.....

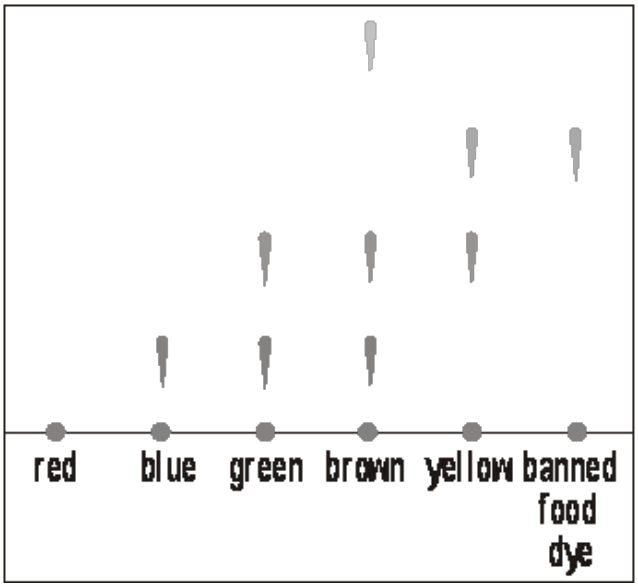
1 mark
maximum 6 marks

Q23. 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.



(a) Gary wrote the labels on the paper in pencil.
Why should he **not** write them in ink?

.....

.....

1 mark

(b) Look at Gary's results.
The different dyes in some of the food colourings had moved up the paper.

(i) Which food colouring contained the banned food dye?

.....

1 mark

(ii) Which food colouring contained the most dyes?

.....

1 mark

(c) Which food colouring did **not** dissolve in the water?

.....

1 mark

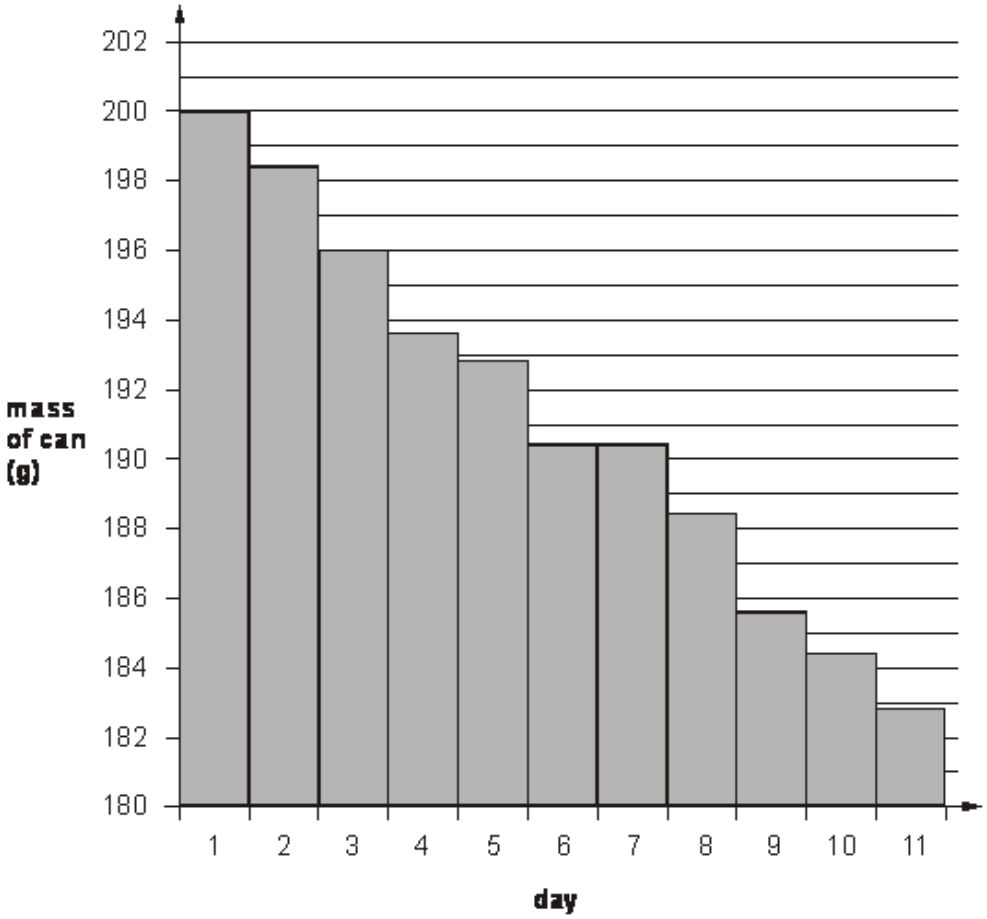
(d) Which method did Gary use to separate the dyes?
Tick the correct box.

chromatography	☐	distillation	☐
evaporation	☐	filtration	☐

1 mark
maximum 5 marks

Q24. Anna has a can of deodorant that she uses once each day.
Before she uses the deodorant she measures the mass of the can.

(a) Her results are shown in the graph below.



(i) What was the mass of the can of deodorant on day 1?

..... g

1 mark

(ii) How did the mass change as Anna used the deodorant?

.....

1 mark

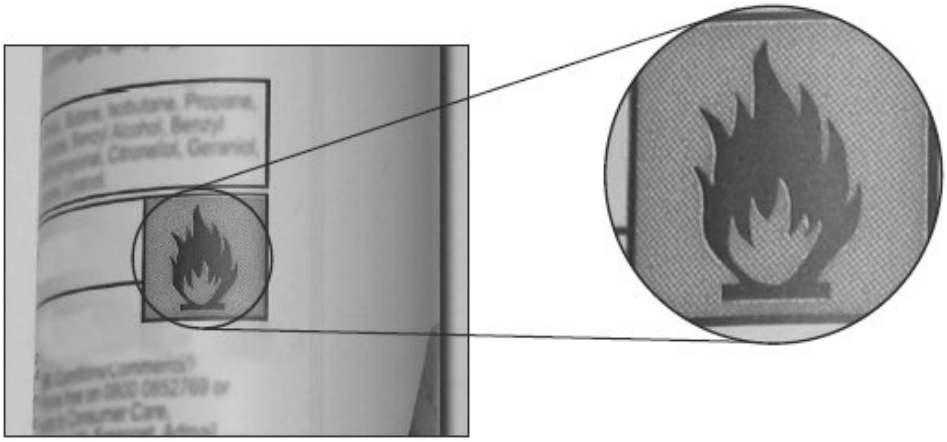
(iii) Anna did **not** use the deodorant on day 6.
How can you tell this from the graph?

.....

.....

1 mark

(b) The deodorant can has a warning sign on it.



What does this warning sign mean?

.....

1 mark

(c) A deodorant contains a solution of perfume and alcohol.

What happens to the perfume when it is mixed with the alcohol?
Tick the correct box.

It boils.	☐	It dissolves.	☐
It freezes.	☐	It melts.	☐

1 mark

(d) Anna sprayed the liquid deodorant under her arms.
After a few minutes, her skin had dried.

What happened to the liquid?
Tick the correct box.

It evaporated.	☐	It dissolved.	☐
It boiled.	☐	It condensed.	☐

1 mark
maximum 6 marks

Q25. (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.	☐	☐

2 marks

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

.....

.....

2 marks

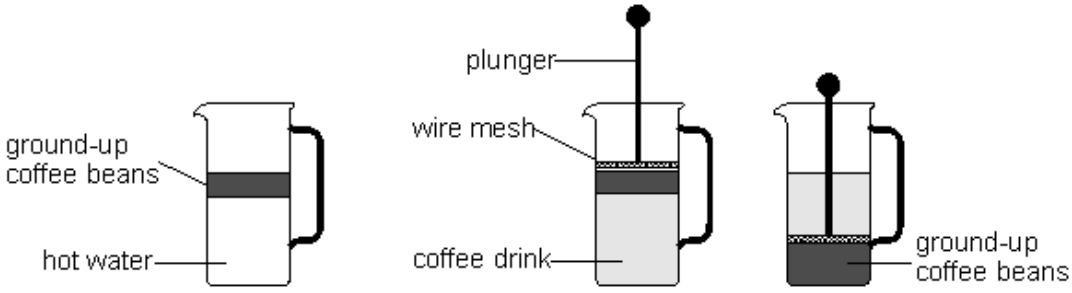
(c) Draw a line from each of the **substances** below to the **group** that it belongs to.
Draw only **three** lines.

Draw a line from each **group** to the correct **description**.
Draw only **three** lines.

substance	group	description
seawater	compound	It contains two or more types of atoms or molecules which can be physically separated.
salt	mixture	It contains only one type of atom.
oxygen	element	Two or more types of atoms are chemically joined together.

2 marks
maximum 6 marks

Q26. Russell put ground-up coffee beans in a coffee maker and added hot water.



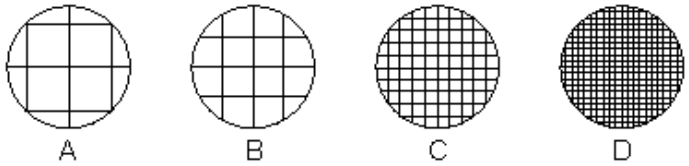
He pushed the plunger down.
This separated the coffee drink from the ground-up coffee beans.

(a) How could Russell see that some coffee had dissolved in the water?

.....

1 mark

(b) The end of the plunger is a circle of wire mesh.

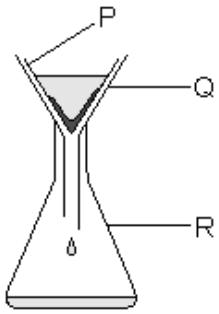


(i) Which mesh would be best to separate the coffee drink from all the ground-up coffee beans? Write the letter.

.....

1 mark

(ii) This method of making coffee uses a type of filter.
The apparatus used for filtration in a school laboratory is drawn below.

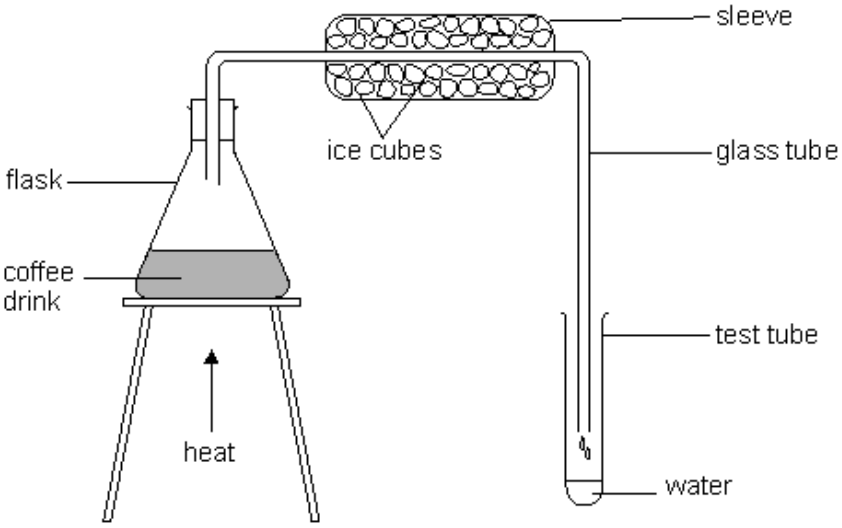


Which part of the apparatus above works in the same way as the wire mesh? Write the letter.

.....

1 mark

(c) Russell wanted to separate the water from the coffee drink.
He set up the apparatus shown below.



(i) Why did Russell put ice cubes around the glass tube?

.....

1 mark

(ii) Choose words from the box below to fill the gaps in the following sentences.

an acid	**a gas**	**a liquid**	**a solid**
condensation	**crystallisation**	**evaporation**	**filtration**

Russell heats the water. Water in the drink changes from

..... into ..... .

This change of state is called ..... .

Water vapour changes into liquid. This change of state is called

..... .

4 marks
maximum 8 marks