



# **KS3 Science**

## **Solubility**

### **Question Paper**

**Time available: 35 minutes**

**Marks available: 49 marks**

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1.

- (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.	<input type="checkbox"/>	<input type="checkbox"/>
Sand sinks in water because water is more dense than sand.	<input type="checkbox"/>	<input type="checkbox"/>
When a solid dissolves in water, the solid is called a solute.	<input type="checkbox"/>	<input type="checkbox"/>

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.

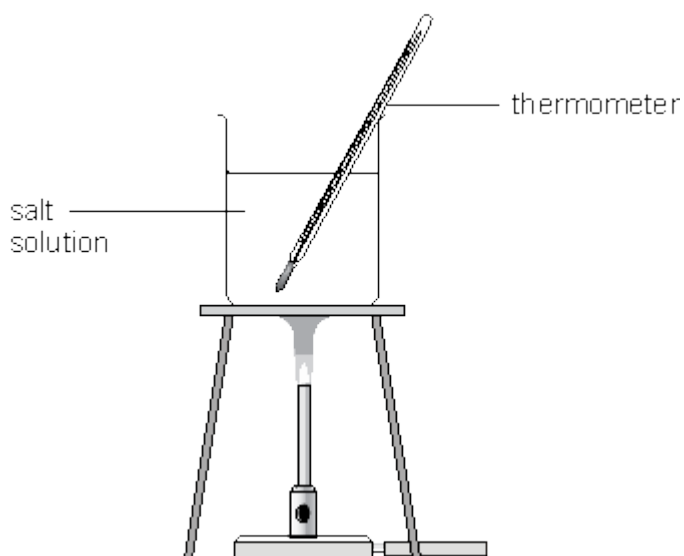
Draw a line from each **group** to the correct **description**.  
Draw only **three** lines.

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

2.

Neera and Tom dissolved different masses of salt in 500 cm<sup>3</sup> of water.  
They measured the temperature at which each salt solution boiled.



(a) They wrote down the variables that might affect the investigation.

temperature of the laboratory

mass of salt dissolved in water

starting temperature of the water

boiling point of salt solution

volume of water

type of salt used

(i) What is the independent variable (the variable they changed) in their investigation?

.....

1 mark

(ii) What is the dependent variable (the variable they measured) in their investigation?

.....

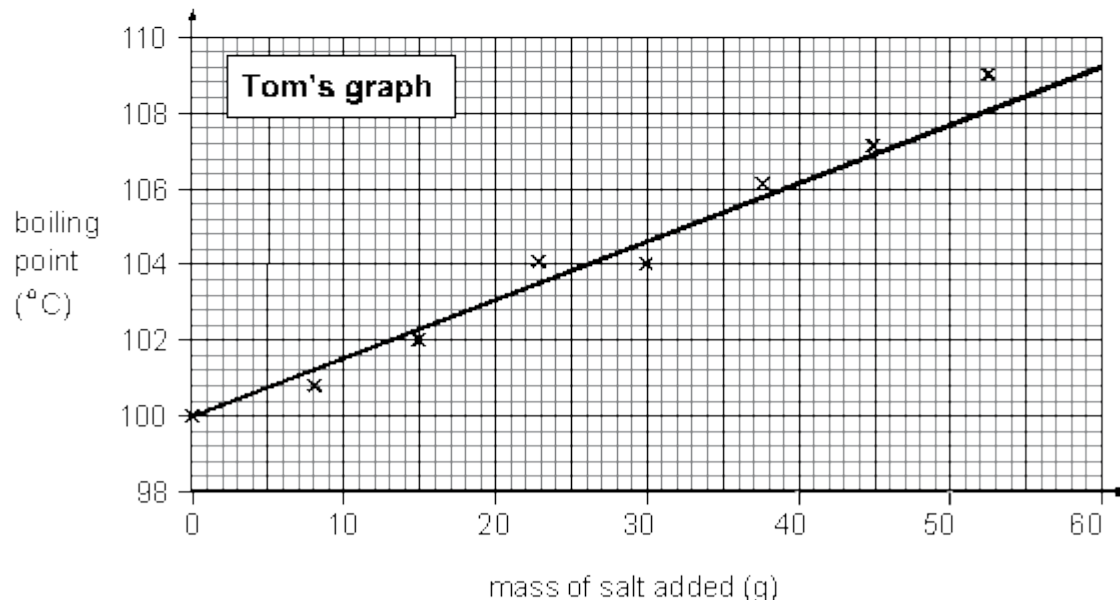
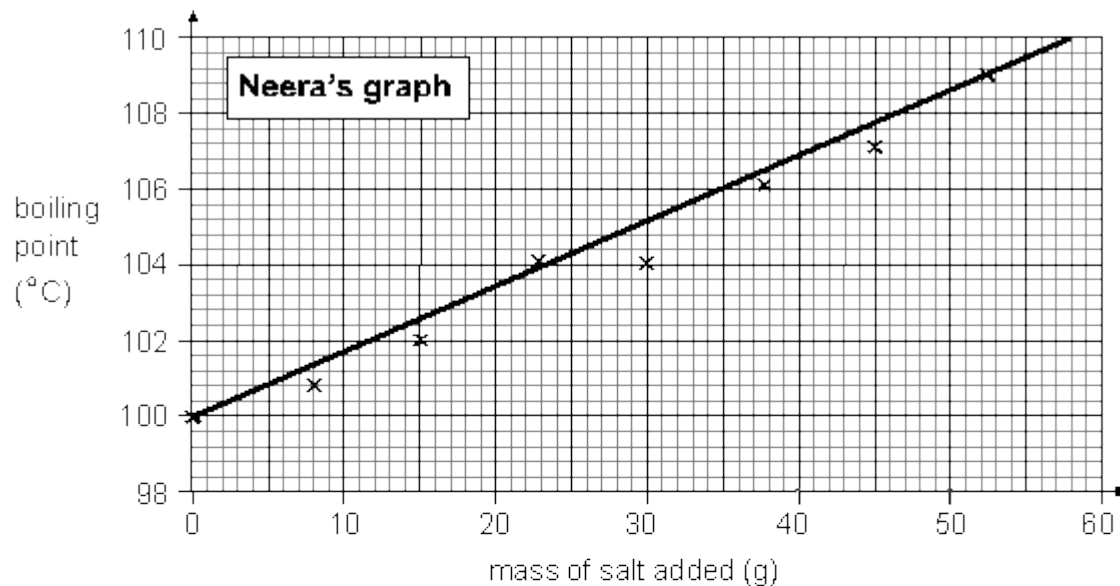
1 mark

(iii) Which variable above would affect the experiment the least?

.....

1 mark

(b) Neera and Tom plotted their results and drew the graphs shown below.



(i) How can you tell from the graphs that Neera and Tom started with pure water?

.....  
 .....

1 mark

(ii) Why is Tom's line of best fit better than Neera's line of best fit?

.....  
 .....

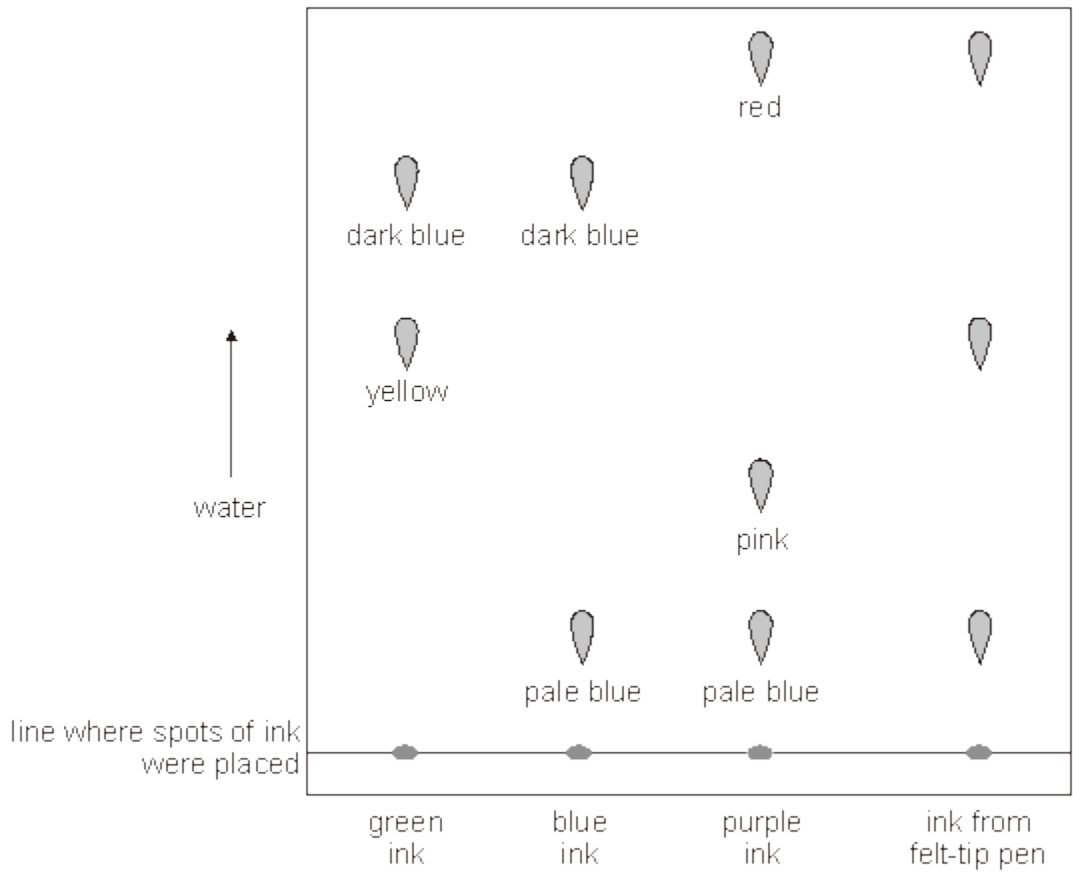
1 mark  
 maximum 5 marks

**3.** 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?

.....

1 mark

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

.....

How can you tell?

.....  
.....

1 mark

(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.

.....  
.....

1 mark

(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.

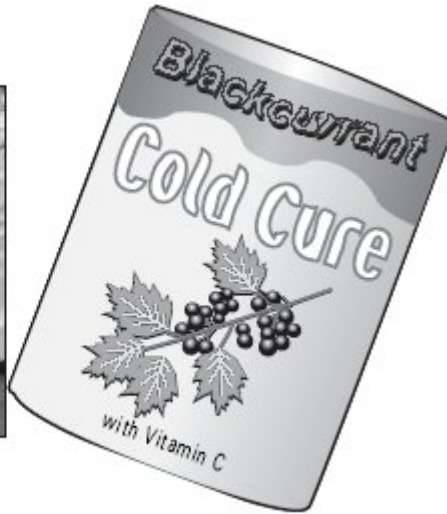
She then used ethanol instead of water.

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

.....  
.....

1 mark  
maximum 4 marks

4. Emma and Philip wanted to see if changing the temperature of the water affected the time taken for a cold cure powder to dissolve in water.



Philip recorded their results.

Water at 40°C took 74 seconds.  
 20°C took 144 seconds.  
 It took 34 seconds for water  
 at 57°C.

- (a) (i) Write the heading for the first column in the table below.

..... (°C)	time to dissolve (s)

- (ii) Write their results correctly in the table above.

3 marks

- (b) Give the names of **two** pieces of measuring equipment they would need.

1. ....

1 mark

2. ....

1 mark



(c) Why did they put the same amount of water in each beaker?

.....  
.....

1 mark

(d) Emma wrote, 'My investigation was good', as her conclusion.

Philip said this was **not** a scientific conclusion.

Explain why Emma's conclusion is **not** scientific.

.....  
.....

1 mark

(e) Look at their results above.

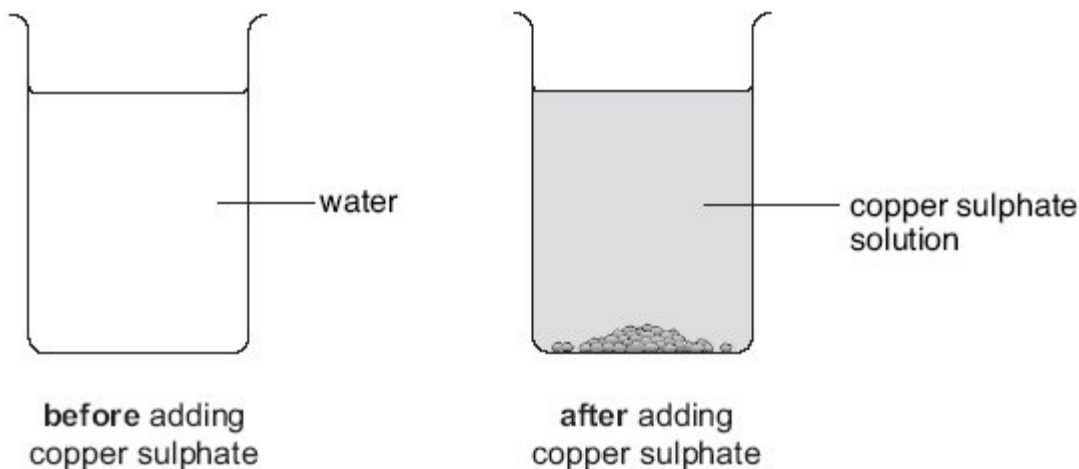
Write a scientific conclusion for their investigation.

.....  
.....

1 mark  
maximum 8 marks

5.

(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

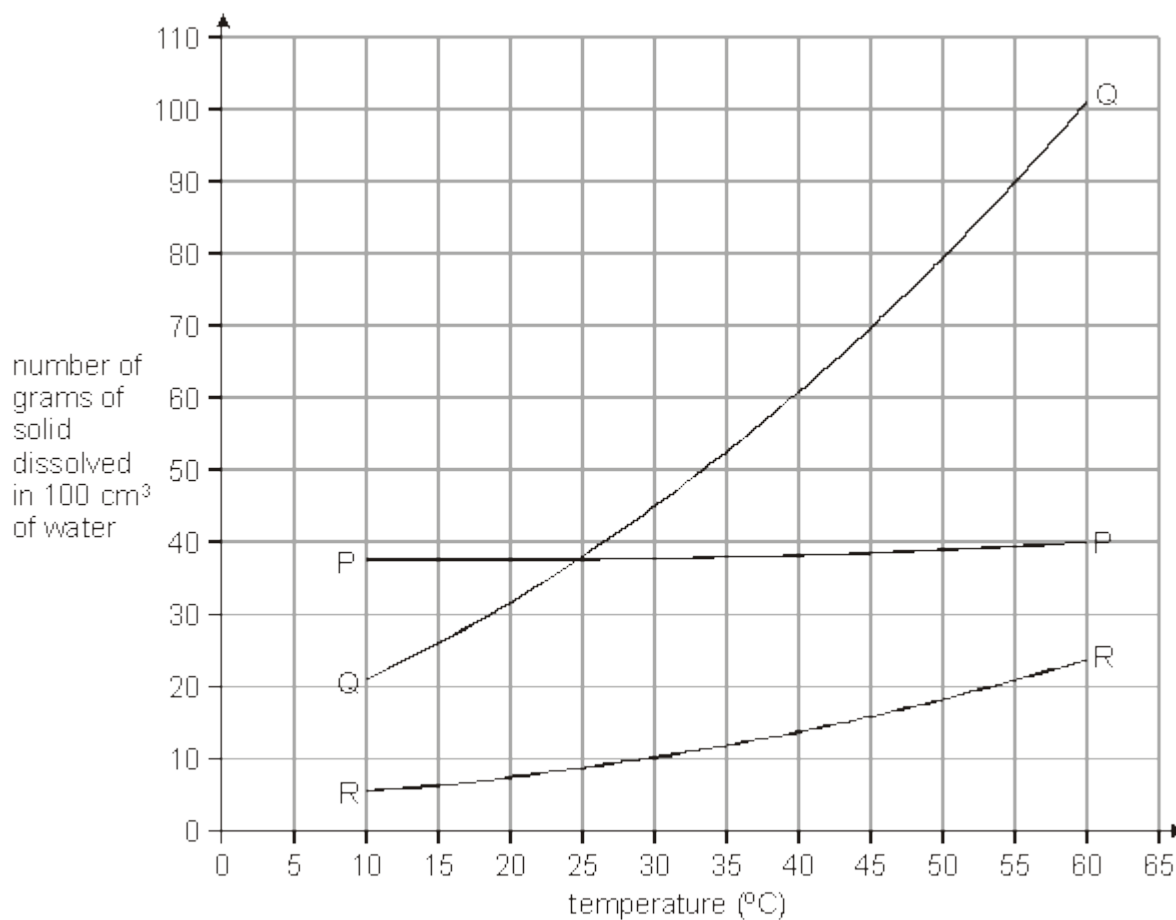
(b) Ruth poured some of the copper sulphate solution into a dish. She left it in a warm room for five days.

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

**6.**

Two groups of pupils investigated the factors affecting the time taken for an indigestion tablet to dissolve in 100 cm<sup>3</sup> of water.



Group 1 recorded their results in the table below.

**results of group 1**

<b>tablet</b>	<b>time taken to dissolve (s)</b>
whole tablet	34
broken tablet	28
finely crushed tablet	22

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

.....

1 mark

- (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?

.....  
.....

1 mark

- (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?

.....  
.....

1 mark

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

.....  
.....

1 mark

- (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.

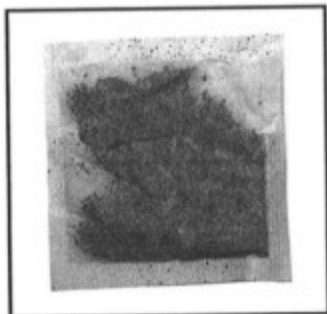
.....°C

1 mark  
maximum 5 marks

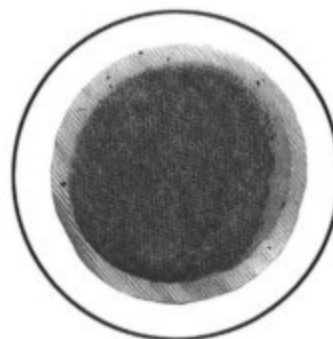
**7.** Tea bags are made in different shapes.



**triangle**



**square**



**circle**

Some pupils want to find out which shape of tea bag lets tea dissolve most quickly. They make two plans for their investigation as shown below.

FIRST PLAN <i>We will use 3 tea bags and 3 beakers</i>
---

SECOND PLAN <i>Collect three beakers.</i>
<i>Collect three different tea bags.</i>
<i>Put one tea bag in each beaker.</i>
<i>Add 150 cm<sup>3</sup> of water at 65°C.</i>
<i>Keep the temperature of the water the same.</i>
<i>Measure the time taken for the tea to dissolve.</i>
<i>Find out which is the quickest for making tea.</i>

(a) How is the second plan better than the first plan?

.....  
.....

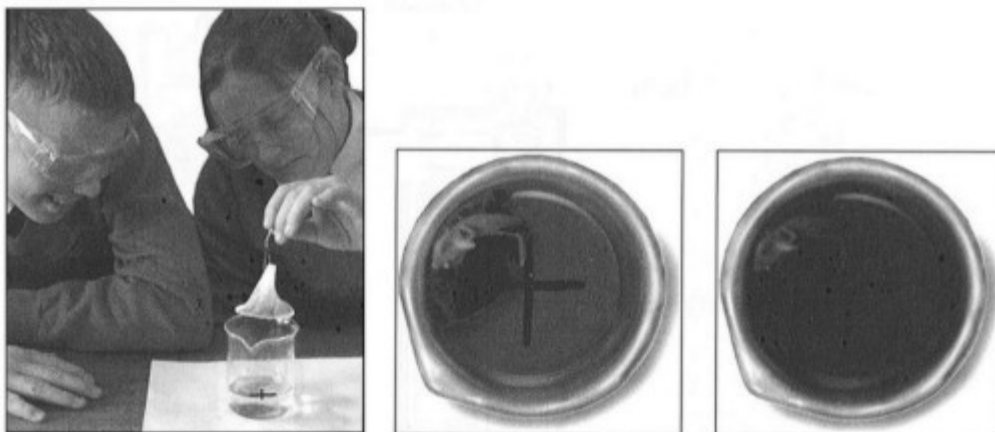
1 mark

(b) Why should they take care when they add hot water at 65°C to the tea bags?

.....  
.....

1 mark

- (c) Ben and Vicky drew a cross on some paper. They put each beaker, in turn, over the cross. They poured hot water into the beaker, dropped in the tea bag and watched the water change colour.



To see which shape of tea bag let the tea dissolve the quickest, they measured the time until the liquid was too dark for them to see the cross.

How did the cross help to make their test more accurate?

.....

1 mark

- (d) (i) They recorded their measurements in a table as shown below.

shape of tea bag	time taken until cross cannot be seen (minutes)
triangle	8
square	15
circle	10

Which part of their investigation was recorded in the table?

Tick the correct box.

explanations	<input type="checkbox"/>	results	<input type="checkbox"/>
conclusions	<input type="checkbox"/>	plans	<input type="checkbox"/>

1 mark

- (ii) Give the **three** shapes of tea bags in the order in which the tea dissolved. Use the table above to help you.

quickest \_\_\_\_\_ slowest



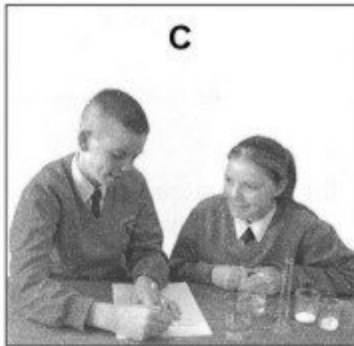
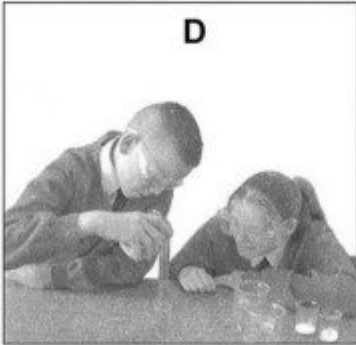

1 mark

maximum 5 marks

8.

Some pupils carried out an investigation to find out whether more sugar or more salt dissolved in water at 60°C.

Here are some of the steps in their investigation.  
They are **not** in the correct order.

 <p><b>A</b></p>	 <p><b>B</b></p>	 <p><b>C</b></p>
<p>They added salt to one beaker of water at 60°C and sugar to the other beaker of water at 60°C.</p>	<p>They stirred the mixtures.</p>	<p>They recorded their results.</p>
 <p><b>D</b></p>	 <p><b>E</b></p>	
<p>They put 20 cm<sup>3</sup> of water at 60°C into two beakers.</p>	<p>They collected this equipment.</p>	

(a) Put the letters **A**, **B**, **C**, **D** and **E** in the boxes below to show the correct order of the steps in their investigation.

1st  2nd  3rd  4th  5th

1 mark

(b) Why did they use a measuring cylinder?

.....

1 mark

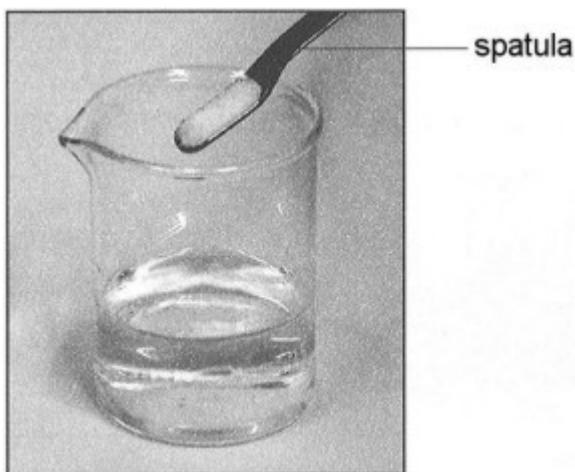
(c) They used water at 60°C in both beakers.

What else did they do to make their investigation fair?

.....  
.....

1 mark

(d) They counted the number of spatulas of sugar or salt added to the water until **no** more would dissolve.



(i) Why was this **not** an accurate method of measuring how much sugar or salt they added?

.....  
.....

1 mark

(ii) Suggest a more accurate method of measuring how much sugar or salt they added.

.....  
.....

1 mark

(e) Jane predicted that more sugar than salt would dissolve.

Complete the table to show a result which would support Jane's prediction.

	sugar	salt
number of spatulas	32	

1 mark  
maximum 6 marks



9.

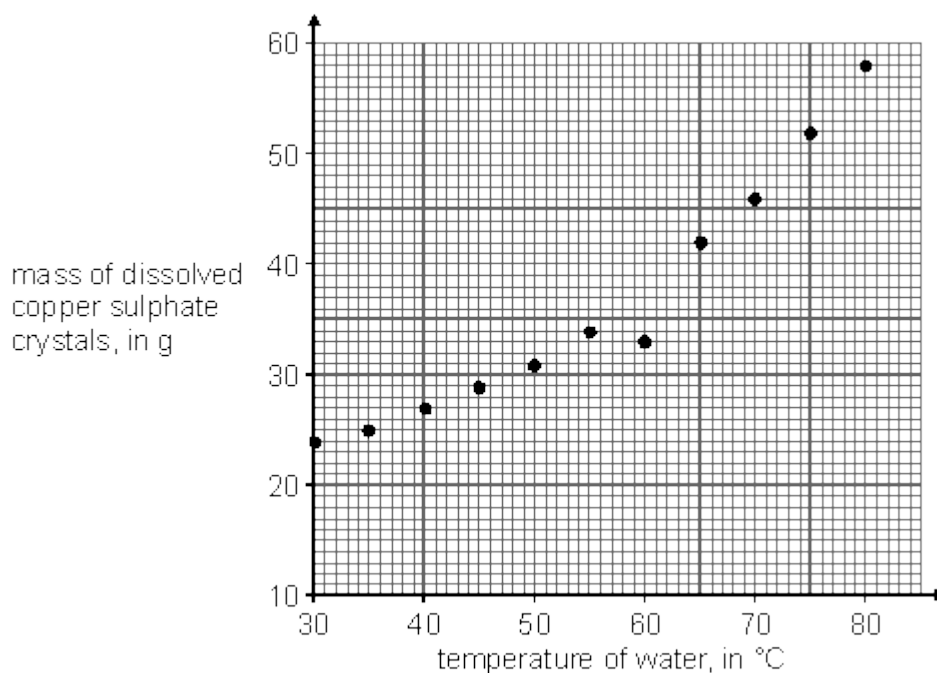
Sarah and Jim investigated the effect of temperature on the solubility of copper sulphate.

They dissolved copper sulphate crystals in the same volume of water until **no** more would dissolve. This means the solution was saturated.

They measured the mass of copper sulphate needed to make a saturated solution using water at different temperatures.



They plotted their results on a grid.



(a) (i) One of the mass readings appears to be wrong (anomalous).

Circle the anomalous result on the graph.

1 mark

(ii) Draw a smooth curve of best fit on the graph.

1 mark

(iii) Use the graph to predict a more likely measurement of mass for the anomalous result.

..... g

1 mark

(b) Suggest **one** mistake Sarah might have made to produce this anomalous result.

.....

.....

1 mark

Maximum 4 marks