7.2.7 Analytical Techniques

55 minutes

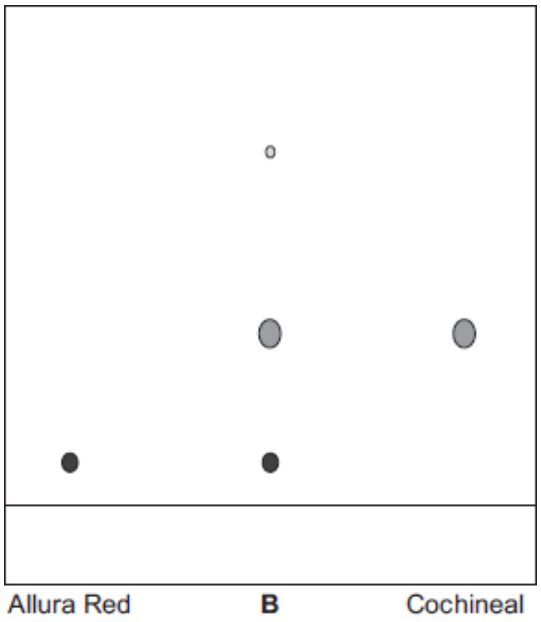
59 marks

Q1. A company making sweets uses different colour additives in different countries. In some countries the company uses Allura Red to colour sweets red.

Some European countries recommend children do **not** eat Allura Red. In Europe the company uses Cochineal instead of Allura Red to colour sweets red.

A different red food colouring, **B**, was compared with Cochineal and Allura Red using paper chromatography.

The diagram shows the results.



(a) (i) How can you tell from the diagram that the three food colourings are **not** the same?

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(2)

(ii) The red food colouring, **B**, is **not** suitable for use in sweets sold in European countries.

Suggest **one** reason why.

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(1)

(b) Give **two** reasons why food scientists use instrumental methods instead of paper chromatography to analyse food colourings.

1 .....

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2 .....

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(2)
(Total 5 marks)

Q2. Good quality water is needed for a healthy life.

In the United Kingdom, obtaining safe water for drinking is as simple as turning on a tap. The water is made safe to drink by water companies.

However, in many parts of Africa and Asia, water used for drinking is contaminated and untreated. It is estimated that 2.2 million people die each year as a result of drinking contaminated water.

DADA DANESHANANDA, Man with filtered water from the Mafi-Zongo water project. www.amurt.net/africa/ghana/2005

(a) Sea water is **not** used as drinking water.

Suggest why.

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(1)

(b) Explain why water for drinking is filtered and then treated with chlorine.

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(2)

(Total 3 marks)

Q3.

Why blue sweets are turning white

A recent study identified a possible harmful effect on chlidren's nervous systems by some artificial colours. Two of these colours are Brilliant Blue (E133) and Quinoline Yellow (E104). Both are artificial colours because they are made from coal. The company is to stop producing the blue sweets because it is removing all artificial colours and there is no natural blue alternative.

(a) Suggest why it is important to be able to identify the colour additives in food.

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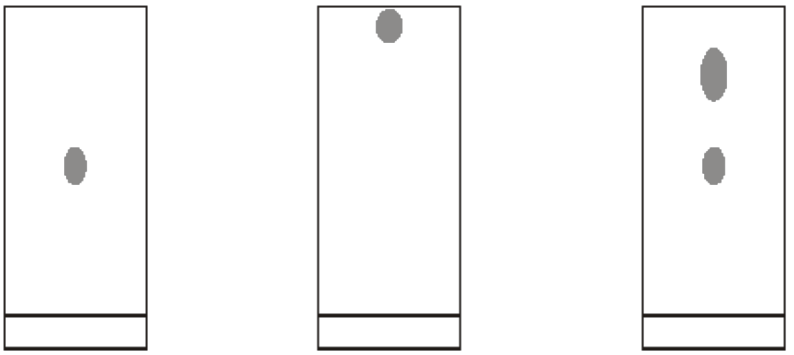
(1)

(b) A brown colour used in sweets was analysed using chromatography. The results were compared with those from E104 and E133.



What do the results tell you about the brown colour and its suitability for use in sweets?

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(3)

(c) Once all the unsuitable colours are removed, the company claims that its sweets are now 'free from artificial colours'.

Does this mean that the sweets contain no additives? Explain your answer.

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(2)
(Total 6 marks)

Q4. Read the following information and then answer the questions.

Chlorine – for better, for worse?

Chlorine is used to make bleaches, plastics and medicines. Swimming pool water is often treated with chlorine.

Chlorine is used to make water safe to drink. It is relatively cheap and easy to use. People who drink untreated water risk dying from typhoid and cholera.

However, chlorine is a poisonous chemical. It causes breathing difficulties and can kill people. Some people are also allergic to chlorine.

(a) How does chlorine make water safe to drink?

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(1)

(b) The amount of chlorine in swimming pool water should be carefully monitored and controlled.

Explain why.

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(2)

(c) Developing countries are likely to choose chlorination as their method of making water safe to drink.

Suggest why.

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(1)

(d) A government is setting up an enquiry into the safety of using chlorine.

(i) Suggest why people from all political parties should be represented.

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(1)

(ii) Suggest why the opinion of a well-respected scientist might change the outcome of any discussion.

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(1)

(iii) The decision taken about the safety of using chlorine should be based on evidence and data rather than on hearsay and opinion.

Suggest why.

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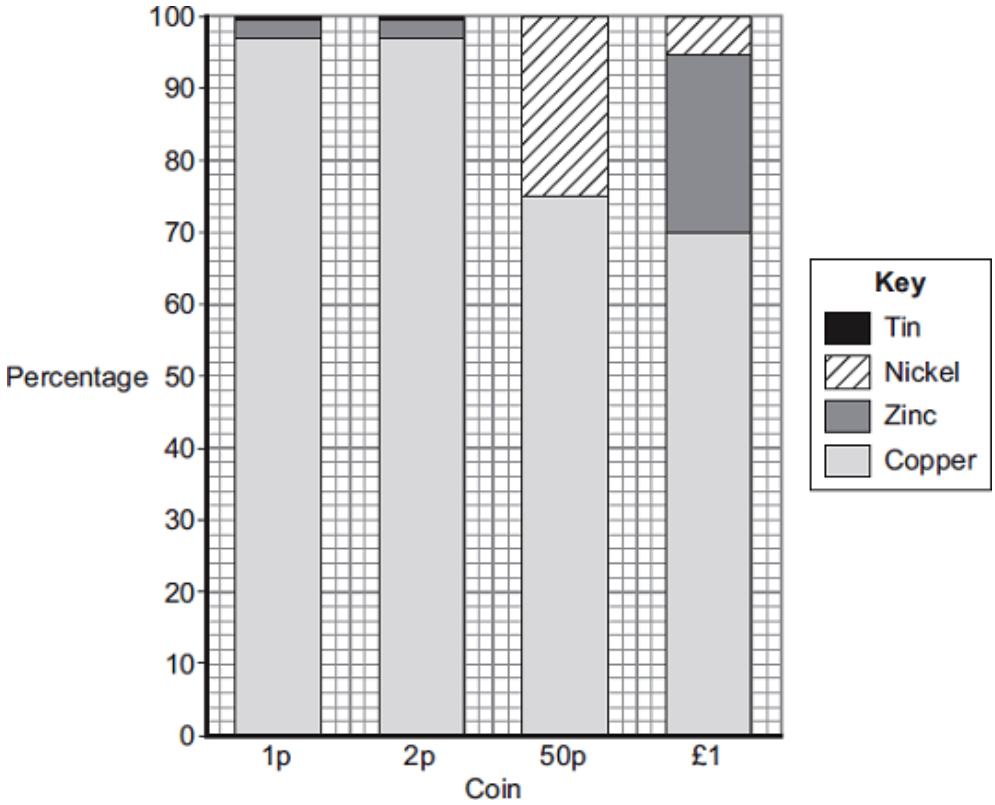
(1)

(Total 7 marks)

Q5. This is the headline from a newspaper:

(a) The bar chart shows the percentage of metals in UK coins in 1991.



Use the bar chart to answer these questions.

(i) Which metal is in all of these coins?

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(1)

(ii) Which coin does **not** contain zinc?

.....

(1)

(iii) What is the percentage of nickel in a 50 p coin?

Percentage = ... %

(1)

(iv) Draw a ring around the correct metal to complete the sentence.

Pure copper is too soft to be used for 1 p and 2 p coins.

Copper is mixed with zinc and | iron / nickel / tin | for 1 p and 2 p coins.

(1)

(b) The value of the metal in 2 p coins, made in 1991, is now 3.3 p.

Suggest why a 2 p coin made in 1991 is worth 3.3 p.

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(1)
(Total 5 marks)

Q6. Most water contains dissolved compounds.

The concentrations of these dissolved compounds are higher in sea water than in drinking water.

(a) (i) Draw a ring around the correct answer to complete the sentence.

Pure water can be obtained from sea water by | distillation. / filtration. / neutralisation. |

(1)

(ii) What is the boiling point of pure water? ..... °C

(1)

(b) A student wanted to find out how much solid was dissolved in sea water.

This is the method the student used:

- measure the mass of an empty evaporating basin
- measure 25 cm^3 of sea water and pour it into the evaporating basin
- heat the evaporating basin gently until all of the water has evaporated
- measure the mass of the evaporating basin containing the solid residue.

(i) What piece of apparatus would be suitable for measuring 25 cm^3 of sea water?

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(1)

(ii) How could the student check that all of the water had evaporated?

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(2)

(iii) The results the student obtained using 25 cm^3 of sea water are:

mass of empty evaporating basin = 23.21 g
mass of evaporating basin and dry solid residue = 24.04 g

Calculate the mass of solid dissolved in 1000 cm^3 of the sea water.

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Mass dissolved in 1000 cm^3 = ... g

(2)

(c) In many countries chlorine is added to drinking water supplies.

Why is chlorine added to drinking water?

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(1)

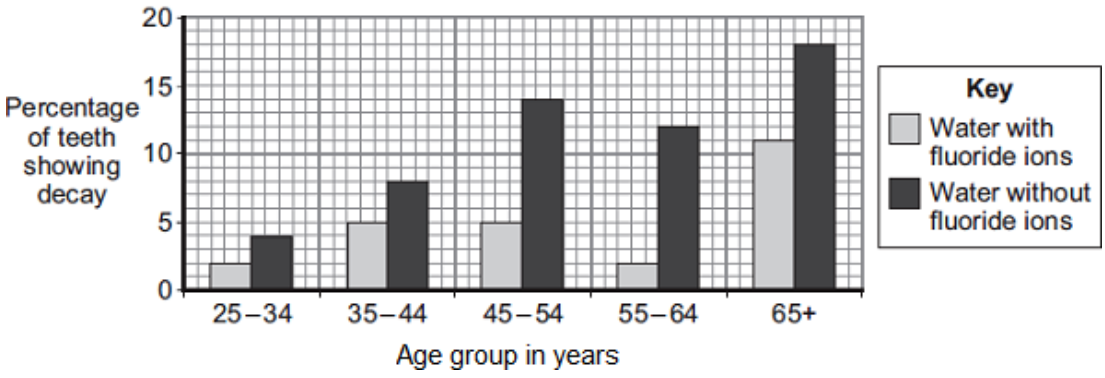
(d) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Compounds containing fluoride ions are added to some drinking water supplies.

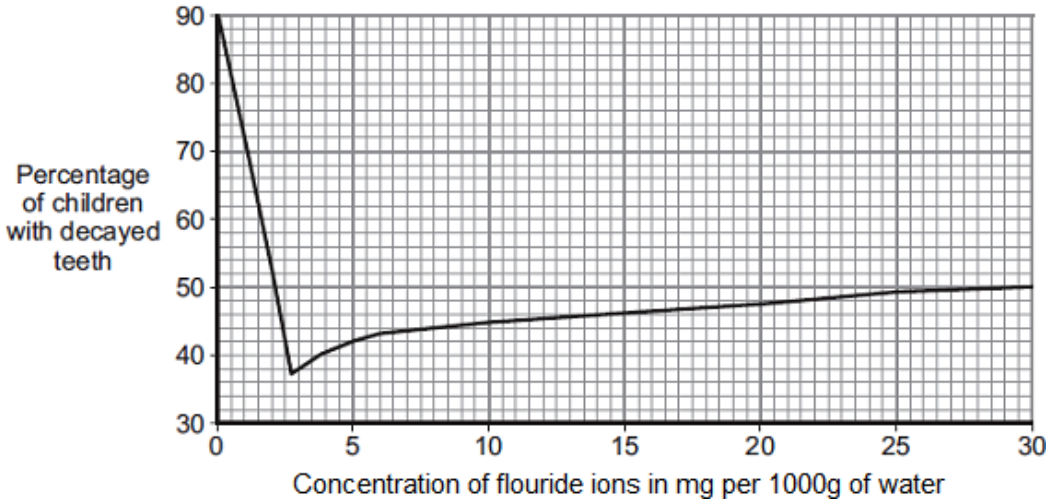
Many scientists have done research into the effects of fluoride ions in drinking water.

Graphs 1, **2** and **3** show some of the results obtained.

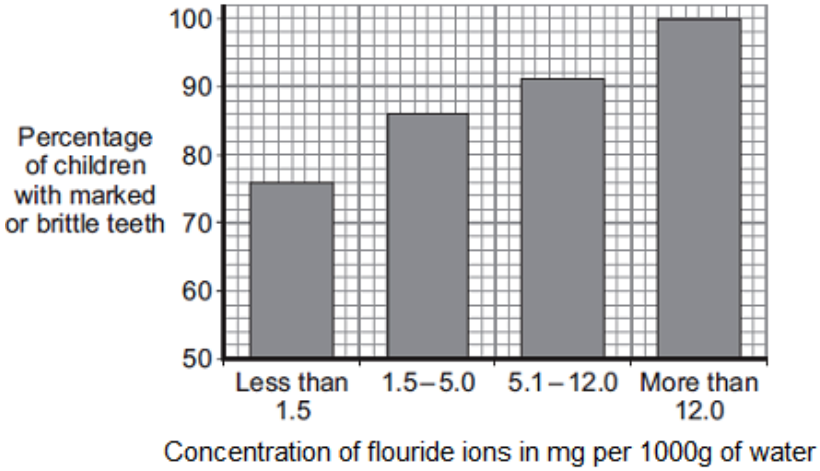
Graph 1



Graph 2



Graph 3



Evaluate the advantages and disadvantages of adding fluoride ions to drinking water.

You should support your answer with evidence from **all three** graphs.

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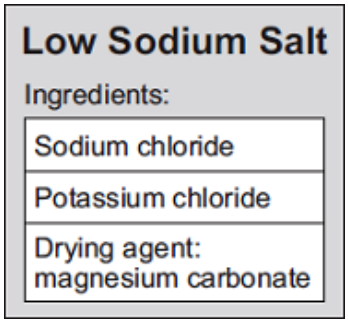
(6)
(Total 14 marks)

Q7. Low sodium salt is used on food. This label is from a packet of low sodium salt.



A chemist tests the low sodium salt for the substances on the label.

(a) The chemist tests for sodium ions and potassium ions using a flame test.

Draw a ring around the correct answer to complete each sentence.

(i) In a flame test, sodium ions produce a [lilac / red / yellow] colour.

(1)

(ii) In a flame test, potassium ions produce a [lilac / red / yellow] colour.

(1)

(b) The chemist added hydrochloric acid to low sodium salt. Carbon dioxide gas was produced.

Describe the test for carbon dioxide and give the result of the test.

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(2)

(c) The chemist made a solution of low sodium salt.

(i) Tick (✓) **one** box to show the chemical used to test for chloride ions.

	Tick (✓)
Barium chloride solution	
Silver nitrate solution	
Sodium sulfate solution	

(1)

(ii) Sodium hydroxide solution is used to test for magnesium ions.

Draw a ring around the colour of precipitate produced by this test.

brown **green** **white**

(1)
(Total 6 marks)

Q8. 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?

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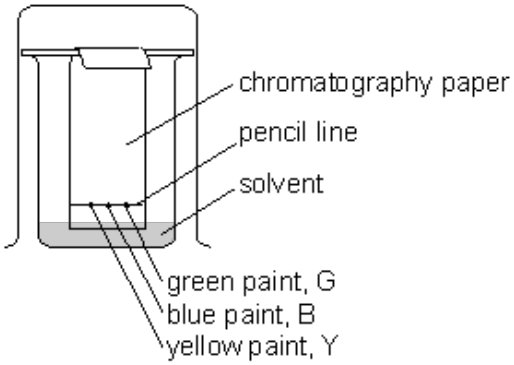
1 mark

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?

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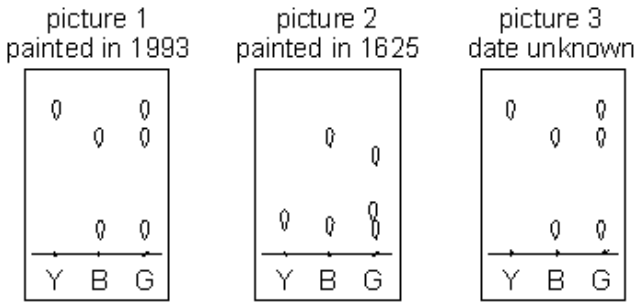
1 mark

(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.

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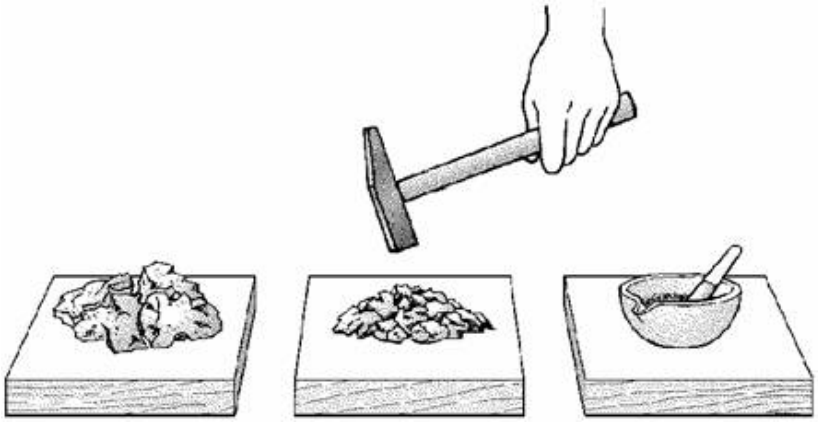
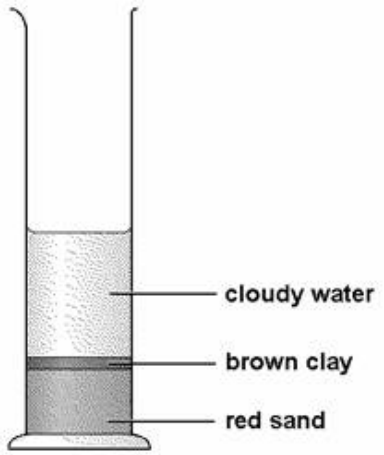
2 marks
Maximum 5 marks

Q9. 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?

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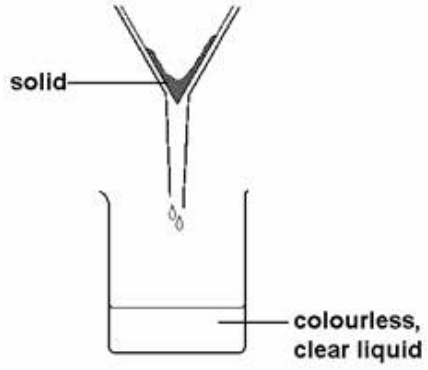
1 mark

(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?

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1 mark

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

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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 .....

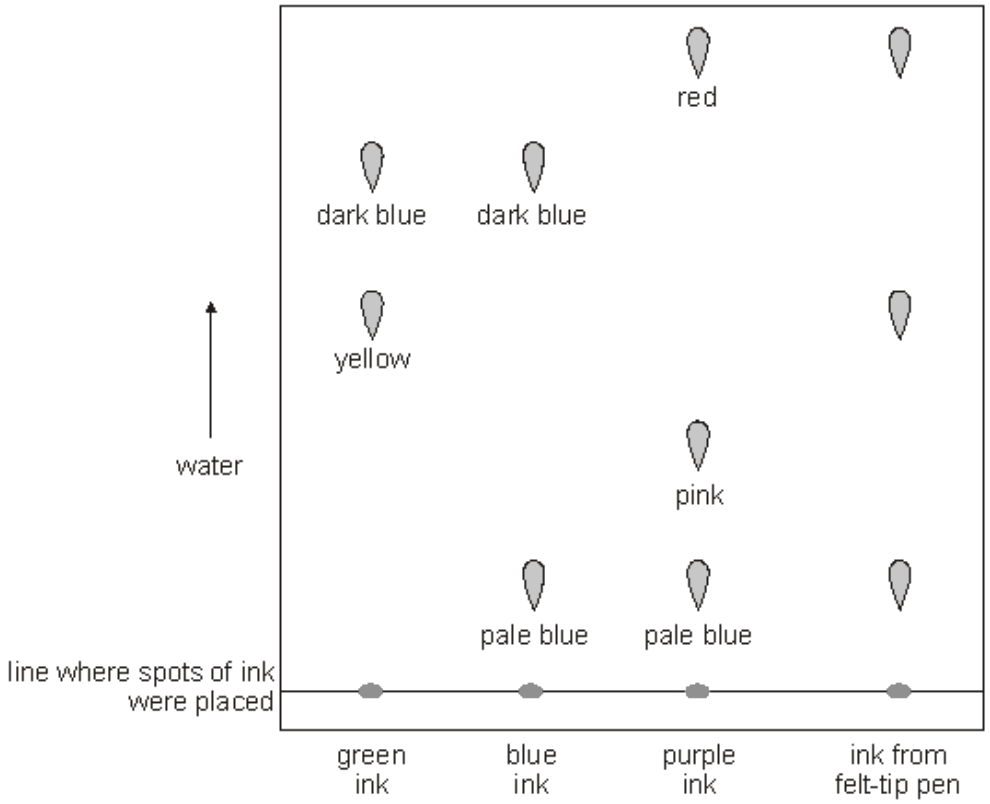
1 mark
Maximum 4 marks

Q10. 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?

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1 mark

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

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How can you tell?

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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?

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Give the reason for your answer.

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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.

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1 mark
maximum 4 marks