Q1. Water from a lake in the UK is used to produce drinking water.

(a) What are the two main steps used to treat water from lakes?

Give a reason for each step.

Step 1 .....

Reason .....

Step 2 .....

Reason .....

(2)

(b) Explain why it is more difficult to produce drinking water from waste water than from water in lakes.

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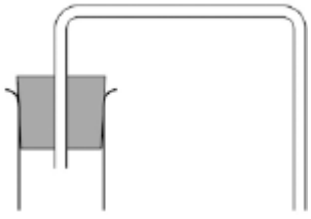
(3)

(c) Some countries make drinking water from sea water.

Complete the figure below to show how you can distil salt solution to produce and collect pure water.

Label the following:

- pure water
- salt solution



(3)

(d) How could the water be tested to show it is pure?

Give the expected result of the test for pure water.

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(2)

(e) Why is producing drinking water from sea water expensive?

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(1)
(Total 11 marks)

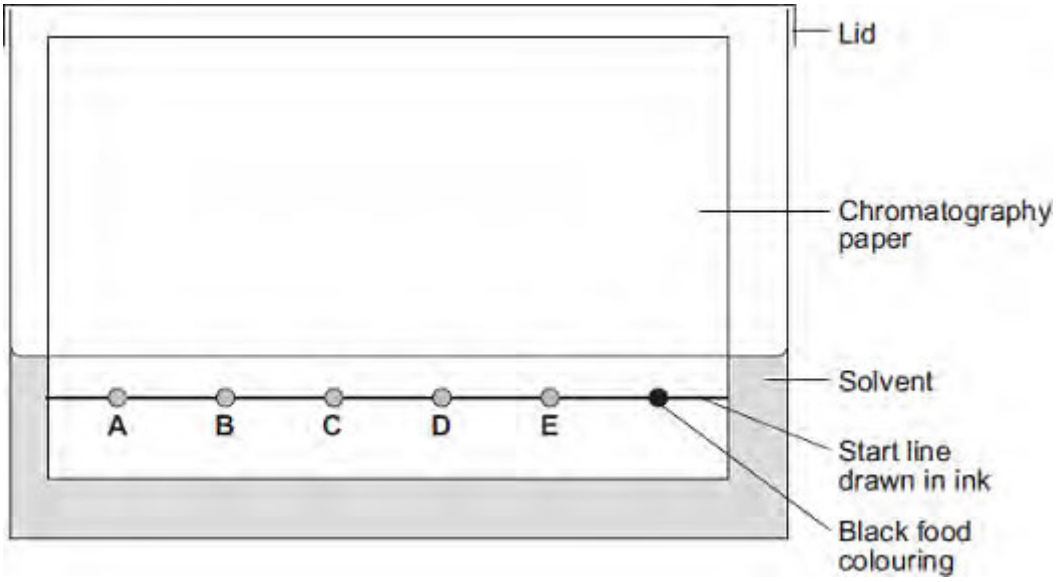
Q2. Chromatography can be used to separate components of a mixture.

(a) A student used paper chromatography to analyse a black food colouring.

The student placed spots of known food colours, **A**, **B**, **C**, **D** and **E**, and the black food colouring on a sheet of chromatography paper.

The student set up the apparatus as shown in **Diagram 1**.

Diagram 1



The student made **two** errors in setting up the apparatus.
Identify the **two** errors and describe the problem each error would cause.

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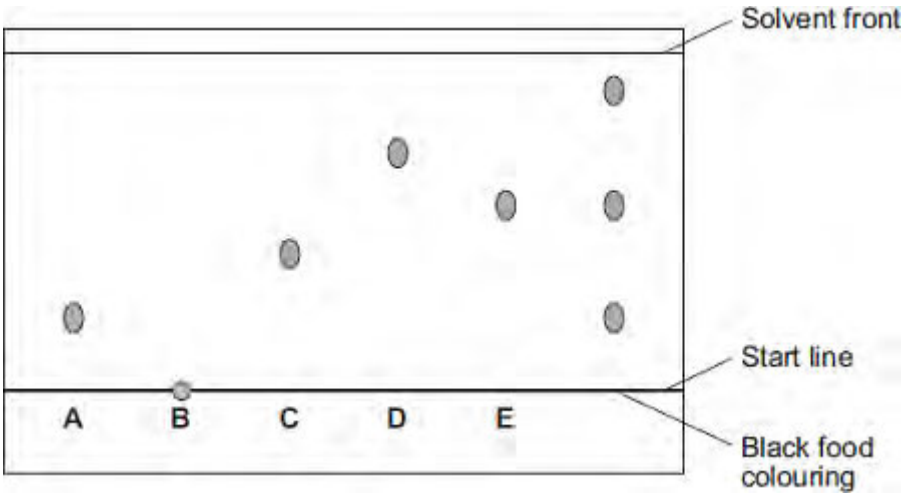
(4)

(b) A different student set up the apparatus without making any errors.

The chromatogram in **Diagram 2** shows the student's results.

Diagram 2



(i) What do the results tell you about the composition of the black food colouring?

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(2)

(ii) Use **Diagram 2** to complete **Table 1**.

Table 1

	Distance in mm
Distance from start line to solvent front	.....
Distance moved by food colour **C**	.....

(2)

(iii) Use your answers in part **(b) (ii)** to calculate the R_f value for food colour **C**.

.....

.....

R_f value = ...

(1)

(c) **Table 2** gives the results of chromatography experiments that were carried out on some known food colours, using the same solvent as the students.

Table 2

Name of food colour	Distance from start line to solvent front in mm	Distance moved by food colour in mm	R_f value
Ponceau 4R	62	59	0.95
Carmoisine	74	45	0.61
Fast red	67	27	0.40
Erythrosine	58	17	0.29

Which of the food colours in **Table 2** could be food colour **C** from the chromatogram?

Give the reason for your answer.

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(2)

(d) Two types of chromatography are gas chromatography and paper chromatography.

Give **one** advantage of gas chromatography compared with paper chromatography.

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(1)

(Total 12 marks)

Q3. The label shows the ingredients in a drink called Cola.

Cola

Ingredients:

Carbonated water
Sugar
Colouring
Phosphoric acid
Flavouring
Caffeine

(a) (i) The pH of carbonated water is 4.5.

The pH of Cola is 2.9.

Name the ingredient on the label that lowers the pH of Cola to 2.9.

.....

(1)

(ii) Which ion causes the pH to be 2.9?

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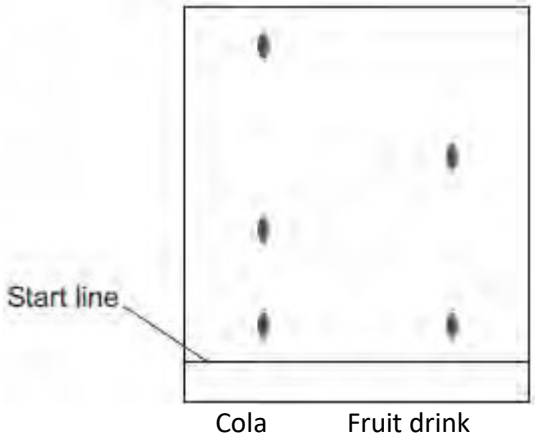
(1)

(b) A student investigated the food colouring in Cola and in a fruit drink using paper chromatography.

The chromatogram in the figure below shows the student's results.



(i) Complete the sentence.

The start line should be drawn with a ruler and ..... .

Give a reason for your answer.

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(2)

(ii) Suggest **three** conclusions you can make from the student's results.

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(3)

(c) Caffeine can be separated from the other compounds in the drink by gas chromatography.

Why do different compounds separate in a gas chromatography column?

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(1)

(d) Caffeine is a stimulant.

Large amounts of caffeine can be harmful.

(i) Only **one** of the questions in the table **can** be answered by science alone.

Tick (✓) **one** question.

Question	**Tick** (✓)
Should caffeine be an ingredient in drinks?	
Is there caffeine in a certain brand of drink?	
How much caffeine should people drink?	

(1)

(ii) Give **two** reasons why the other questions **cannot** be answered by science alone.

Reason 1 .....

.....

Reason 2 .....

.....

(2)

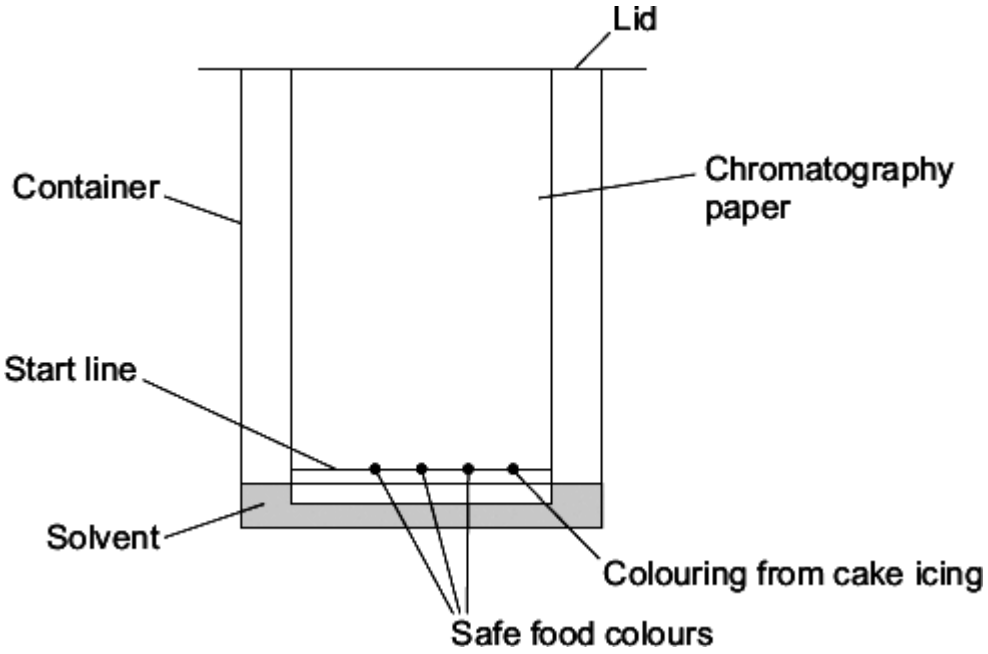
(Total 11 marks)

Q4. Icing on cakes is tested to check that safe colours were used when they were made.

By Megan Chromik [CC-BY-SA-2.0], via Wikimedia Commons

Paper chromatography is one method of testing which colours are in cake icing.

(a) The diagram shows an experiment a student did.



(i) Suggest why there is a lid on the container.

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(1)

(ii) The start line should be drawn in pencil **not** in ink.
Suggest why.

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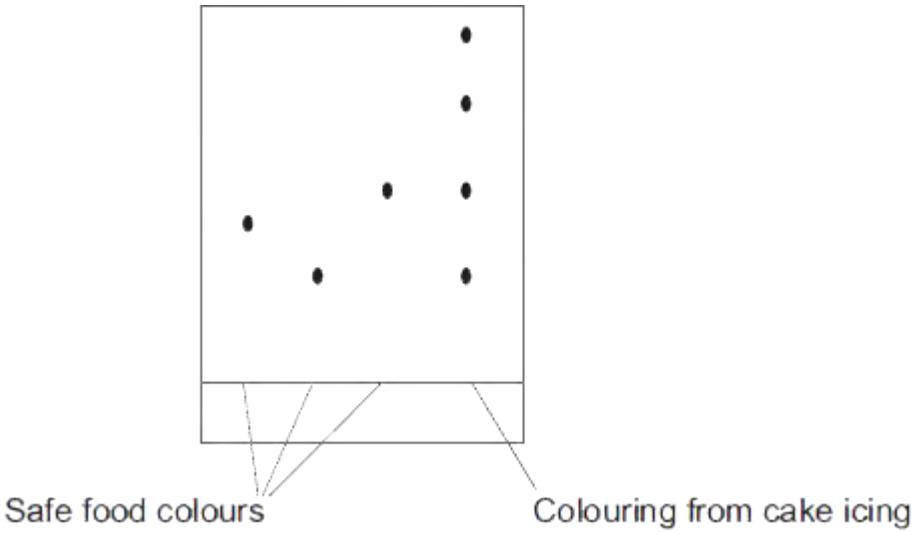
(1)

(b) The diagram shows the results of the paper chromatography experiment.



(i) How many different food colours were used in the colouring from the cake icing?

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(1)

(ii) Is the cake icing safe to eat?

Give a reason for your answer.

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(1)

(c) Gas chromatography linked to mass spectroscopy is an example of an instrumental method. This method was used on a mixture of solvents.

(i) Give **two** advantages of gas chromatography compared with paper chromatography.

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(2)

(ii) What does gas chromatography do to the mixture of solvents?

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(1)

(iii) What information does mass spectroscopy give?

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(1)
(Total 8 marks)

Q5. Read the article.

Problem food colourings

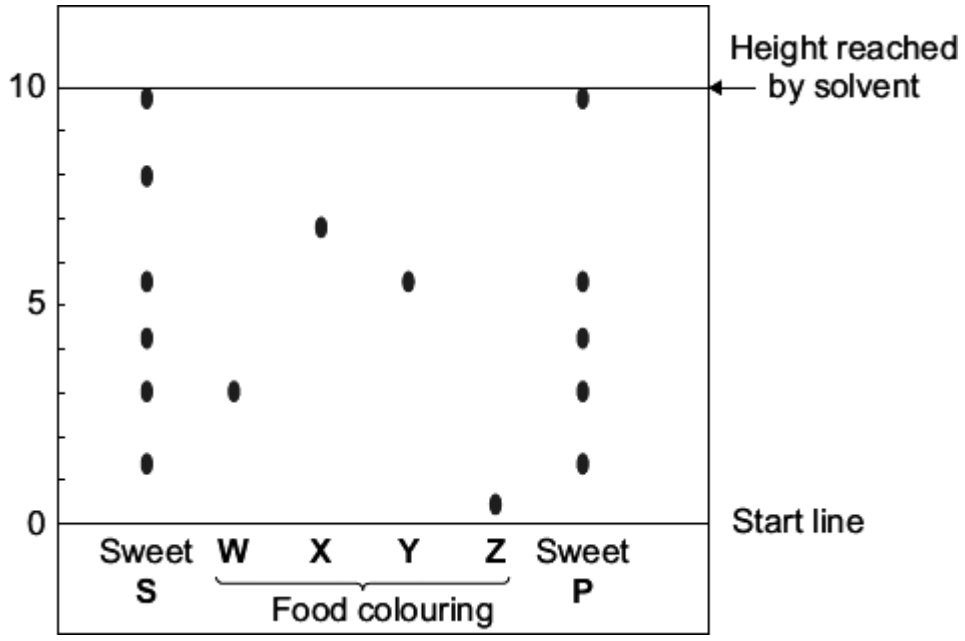
Scientists say they have evidence that some food colourings cause hyperactive behaviour in young children.

These food colourings are added to some sweets.

W, **X**, **Y** and **Z** are food colourings that may cause hyperactive behaviour in young children.

A scientist used chromatography to see if these food colourings were used in two sweets, **S** and **P**.

The results are shown on the chromatogram.



(a) Food colourings, such as **W**, **X**, **Y** and **Z**, are added to some sweets.

Suggest **one** reason why.

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(1)

(b) In chromatography, the R_f value = $\frac{\text{distance moved by the colouring}}{\text{distance moved by the solvent}}$

Use the scale on the chromatogram to help you to answer this question.

Which food colouring, **W**, **X**, **Y** or **Z**, has an R_f value of 0.7?

(1)

(c) From the chromatogram, what conclusions can the scientist make about the colourings in sweets **S** and **P**?

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(3)
(Total 5 marks)

Q6. Some farmed salmon have a coloured additive in the food that they are given. This is a permitted additive that improves the colour of the fish meat.

A sample of the colour is extracted from a salmon.

Explain how paper chromatography could be used to confirm that this is the permitted additive.

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(Total 3 marks)

Q7.

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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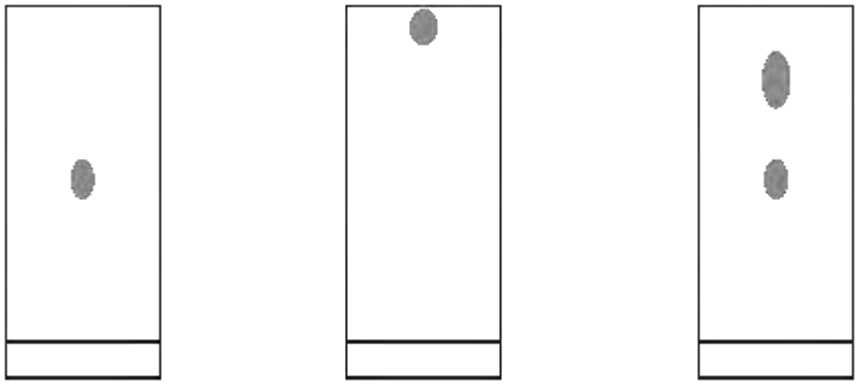
(1)

(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)