AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.8.1.3

Chromatography

Past-paper questions

Tier	**Foundation**
Question groups	**28**
Available paper years	**2007–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.8.1.3 Chromatography

Question 01

March 2007 | CHY1B | Original Q8 | Legacy

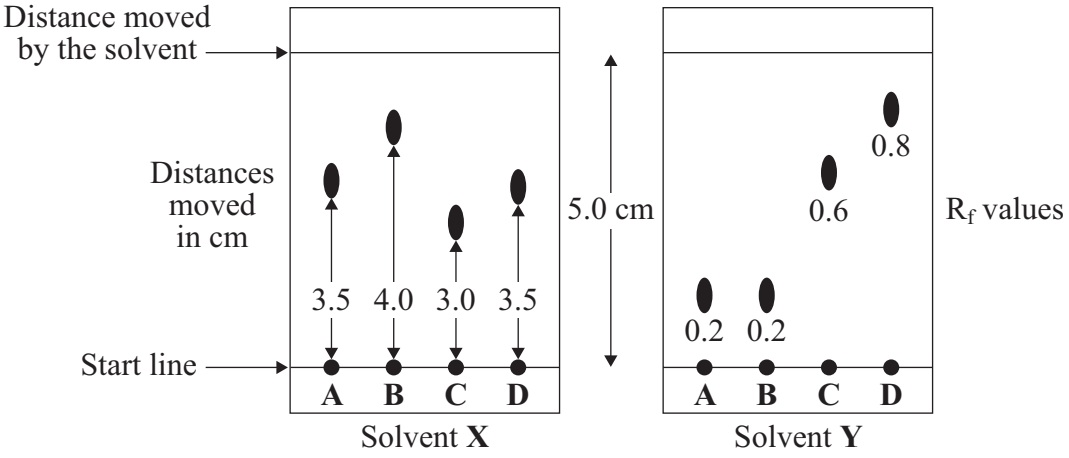
QUESTION EIGHT

In chromatography, substances can be identified by their R_f value.

The R_f value can be calculated using the formula:

$$R_f = \frac{\text{distance moved by the substance}}{\text{distance moved by the solvent}}$$

The R_f value for a substance is different in different solvents.



Four red substances, **A**, **B**, **C** and **D**, were tested. The test was done using two different solvents, **X** and **Y**.

For solvent **X**, the distances the substances moved and the distance the solvent moved are shown (in cm). For solvent **Y**, the R_f values are shown.

8A What is the R_f value of substance **B** in solvent **X**?

1 0.6

2 0.7

3 0.8

4 1.25

4.8.1.3 Chromatography

Question 01 · continued

8B Which statement is true?

1 Substances **A** and **B** are the same.

2 Substances **A** and **D** are the same.

3 Substances **B** and **D** are the same.

4 The four substances are different.

8C Which statement about chromatography is true?

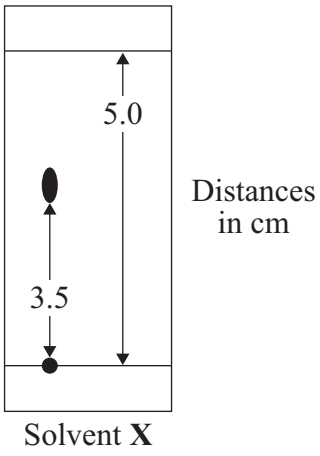
1 Chromatography works only on added artificial colouring.

2 Chromatography works only on added natural colouring.

3 Chromatography works only on natural colouring already in the food.

4 Chromatography works on any soluble colouring.

8D A red substance was tested. The chromatography strip using solvent **X** is shown.



The R_f value in solvent **Y** is 0.2.

Which statement is true?

1 The red substance could be **A**.

2 The red substance could be **B**.

3 The red substance could be **C**.

4 The red substance could be **D**.

4.8.1.3 Chromatography

Question 02

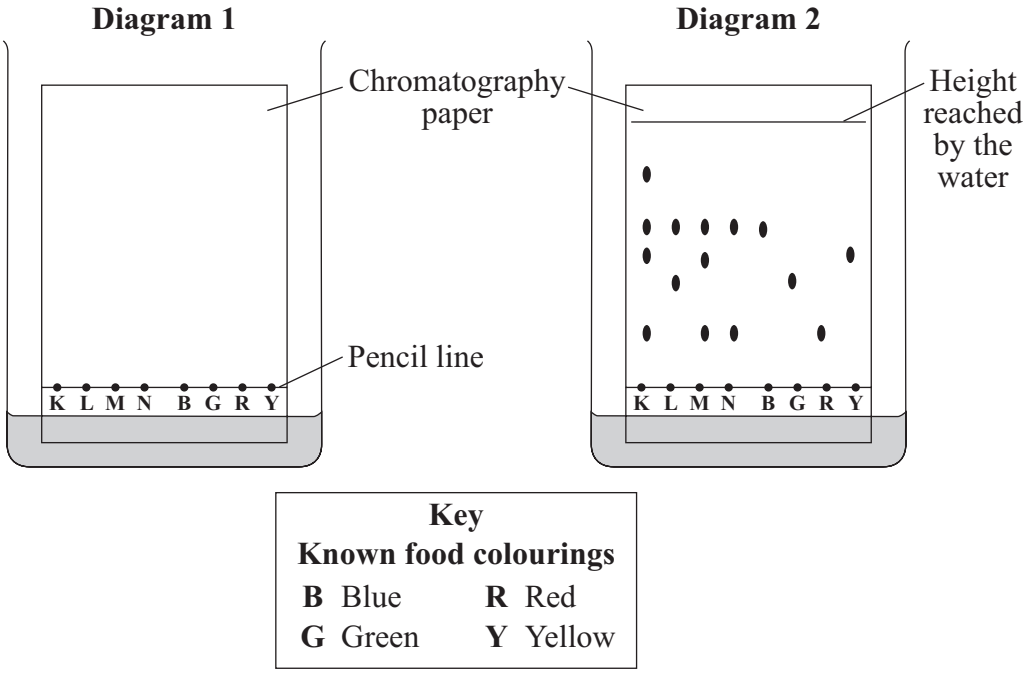
June 2007 | CHY1B | Original Q7 | Legacy

QUESTION SEVEN

A student investigated the coloured substances used in making four different fruit drinks, **K**, **L**, **M** and **N**.

- A spot of each drink was placed on a pencil line on chromatography paper.
- Spots of four single known food colourings, **B**, **G**, **R** and **Y**, permitted in foods, were also placed on the pencil line.
- The paper was then left to stand in water in a beaker.

Diagram 1 shows how the apparatus was arranged. **Diagram 2** shows the result after a short time.



7A Which of the drinks contains the green colouring?

1 drink **K**

2 drink **L**

3 drink **M**

4 drink **N**

4.8.1.3 Chromatography

Question 02 · continued

7B From the evidence on the chromatography paper, the student could conclude that . . .

1 red, blue, green and yellow are the only food colourings allowed in fruit drinks.

2 all four drinks contain the same number of food colourings.

3 red, blue, green and yellow food colourings are soluble in water.

4 fruit drink **L** is a lighter colour than the other drinks.

7C Why should the student make further checks on fruit drink **K**?

1 It is too dark in colour.

2 It contains too many food colourings.

3 Its colour may mean that consumers will not buy the drink.

4 It contains a colour that he has not identified.

7D A fruit drink that is on sale in the shops is found to contain a food colouring that may be harmful.

What immediate action should the manufacturers take?

1 stop production of all fruit drinks

2 stop production of this particular fruit drink

3 in future, make this fruit drink without the potentially harmful food colouring

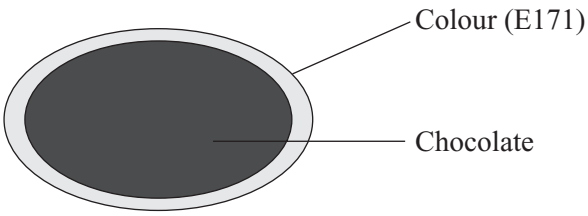
4 withdraw the fruit drink from all shops and advise the public not to drink it

4.8.1.3 Chromatography

Question 03

June 2007 | CHY1F | Original Q2 | Legacy

2 A packet contains colour-coated, chocolate sweets. The label on the packet lists the ingredients. Some of these are given E-numbers.



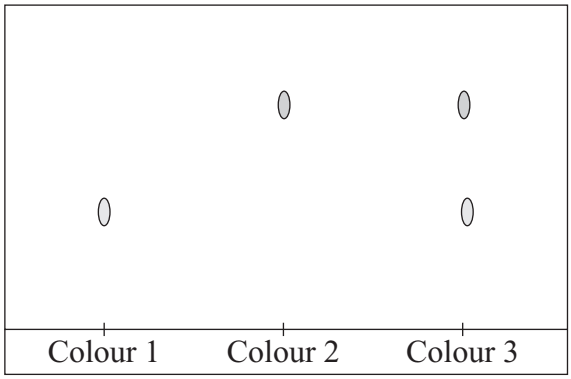
(a) Use the correct word from the box to complete the sentence.

additive	**element**	**fuel**

An E-number is used to identify a permitted food ..... .

(1 mark)

(b) Chromatography was used to compare three of the colours used to coat the chocolate sweets.



What do these results tell you about these three colours?

.....

.....

.....

.....

.....

.....

(3 marks)

4

4.8.1.3 Chromatography

Question 04

January 2008 | CHY1F | Original Q2 | Legacy

2 There are six main groups of food additives.

(a) Use the correct food additive from the box to complete the sentences below.

acidity regulators	**antioxidants**	**colours**
emulsifiers	**flavourings**	**preservatives**

(i) To make orange drinks look orange we would add ..... .

(1 mark)

(ii) To improve the coating ability of salad creams we would add ..... .

(1 mark)

(iii) To make the food 'stay fresh' as long as possible we would add ..... .

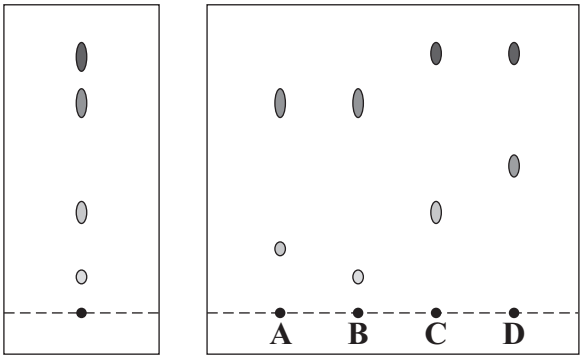
(1 mark)

4.8.1.3 Chromatography

Question 04 · continued

BLANK

(b) Chromatography was carried out on a sample of soft drinks to check that they contained only colours that were safe. This is the result.



Safe colours Colours from the soft drinks

What conclusions about the safety of the colours in the soft drinks **A**, **B**, **C** and **D** can be made from the results shown by chromatography?

.....

.....

.....

.....

(2 marks)

5

4.8.1.3 Chromatography

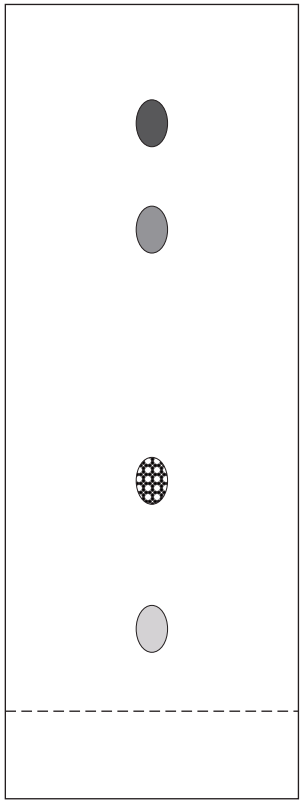
Question 05

November 2008 | CHY1BP | Original Q6 | Legacy

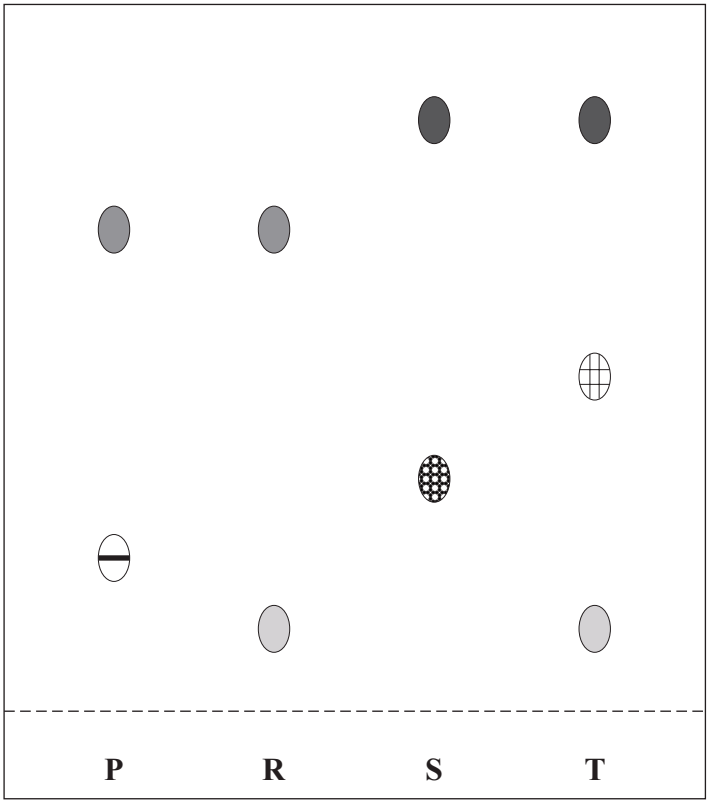
QUESTION SIX

The colour pigments in four fruit drinks, **P**, **R**, **S** and **T**, were examined using chromatography to see if the drinks were safe.

The results are shown below.



Safe colour pigments



Colours in the fruit drinks

6A Which fruit drink contains the greatest number of colour pigments?

1 **P**

2 **R**

3 **S**

4 **T**

4.8.1.3 Chromatography

Question 05 · continued

6B The chromatogram shows that . . .

1 all the fruit drinks are safe.

2 only fruit drink **R** is safe.

3 only fruit drinks **R** and **S** are safe.

4 only fruit drinks **P** and **T** are safe.

6C Manufacturers add colour pigments to fruit drinks to . . .

1 make the fruit drinks more attractive to consumers.

2 make sure that the fruit drinks contain additives with E-numbers.

3 increase the energy content of the fruit drinks.

4 make the fruit drinks more healthy.

6D A company is told that one of the fruit drinks it manufactures contains a colour pigment that is **not** safe.

What action should the company immediately take?

1 Order supplies of a safe colour pigment to use in its place in the fruit drink.

2 Tell all shops to stop selling the fruit drink and tell the public **not** to drink it.

3 Warn its employees to take precautions when handling the colour pigment.

4 Sack the manager of the factory that makes the fruit drink.

4.8.1.3 Chromatography

Question 06

June 2009 | CHY1BP | Original Q7 | Legacy

QUESTION SEVEN

A manufacturer of sugar-coated sweets stopped using the colour blue. This was because of concerns about the effect of artificial colours on children's health.

They replaced the blue colour with another dye extracted from plants.

7A The sweets are now labelled as 'free of all artificial colours and flavours'.

What information does this give the consumer?

1 Scientists have shown that the sweets are free of health risks.

2 It has been found that the sweets can be stored for a long time.

3 Naturally occurring chemicals have been used to make the sweets.

4 There has been no cruelty to animals in experiments to make the sweets.

7B Some of the ingredients in the sweets have an *E-number*.

What does this mean?

1 They are permitted additives.

2 They are natural ingredients.

3 They have been made from an emulsion.

4 They are eco-friendly.

7C Chromatography can be used to identify coloured ingredients.

Which statement about chromatography is true?

1 Chromatography works on any soluble colouring.

2 Chromatography works only on natural colouring.

3 Chromatography works only on artificial colouring.

4 Chromatography works on any insoluble colouring.

4.8.1.3 Chromatography

7D What should scientists do to help to reduce the risks from food additives?

1 remove food containing additives from supermarkets

2 investigate the links between additives and health problems

3 advise food manufacturers about clear labelling

4 explain to people the risks of eating sugar-coated sweets

Turn over for the next question

4.8.1.3 Chromatography

Question 07

June 2009 | CHY1F | Original Q3 | Legacy

3 This is part of a food label.

'A diet low in fat, particularly saturated fat, could help to maintain a healthy heart.'

Nutritional information table:

	Per 100 g
Total fat	77.6 g
of which: saturated	11.2 g
unsaturated	66.4 g

Also contains colourings

3 (a) (i) Why is this food described as 'healthy'?

.....

.....

(1 mark)

3 (a) (ii) Draw a ring around the correct word in the box to complete the sentence.

Unsaturated fat can be detected by reacting it with

bromine.
hydrogen.
sulfur.

(1 mark)

3 (b) Liquid fats are called oils. Oil and water can be shaken together to make a mixture.

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

3 (b) (i) The mixture of oil and water can be prevented

from separating by adding

a colouring.
an emulsifier.
a preservative.

(1 mark)

3 (b) (ii) Compared with either oil or water the mixture has a better

shelf life.
smell.
texture.

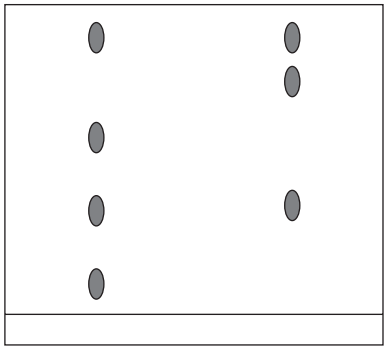
(1 mark)

4.8.1.3 Chromatography

Question 07 · continued

for mark

3 (c) The result of a process used to detect and identify the colours in two foods, **A** and **B**, is shown.



3 (c) (i) Describe the differences between the colours used in food **A** and food **B**.

.....

.....

.....

.....

(2 marks)

3 (c) (ii) Tick (✓) the name of the process used to detect and identify colours in food.

Process	(✓)
chromatography	
extraction	
hardening	

(1 mark)

7

4.8.1.3 Chromatography

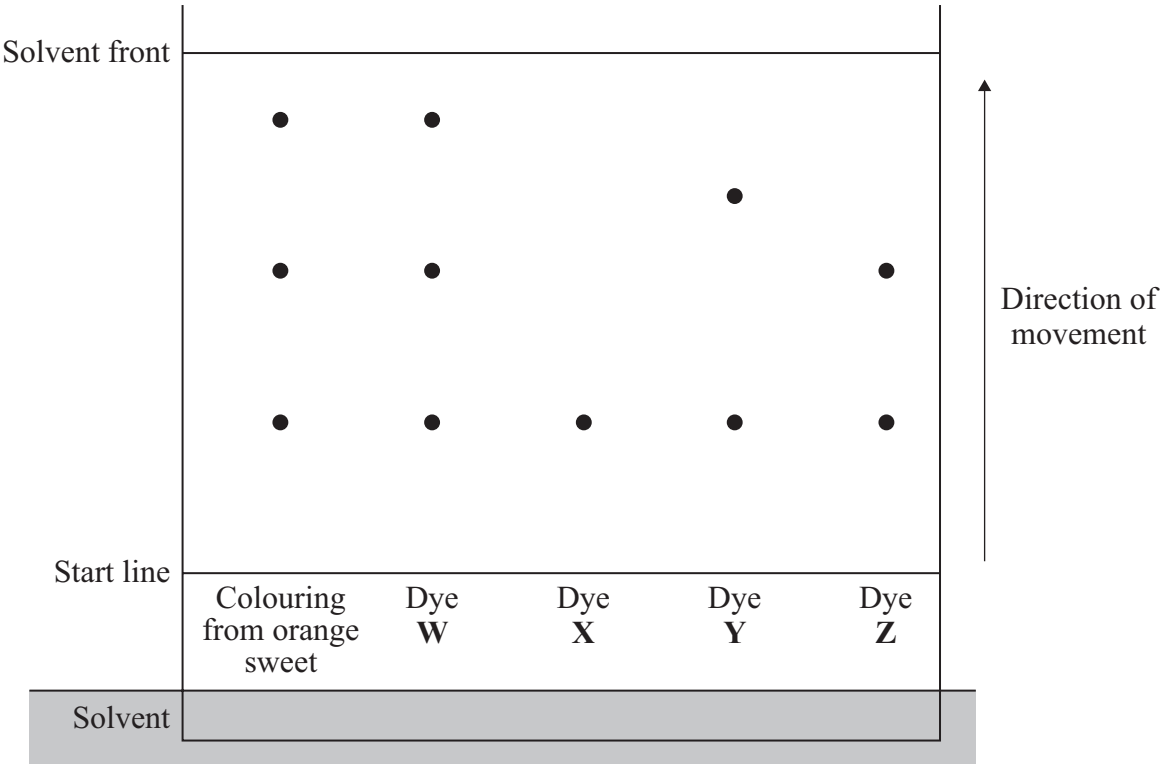
Question 08

November 2009 | CHY1BP | Original Q7 | Legacy

QUESTION SEVEN

A chromatogram of an orange colouring from a sweet was made and this was compared with various orange dyes, **W**, **X**, **Y** and **Z**.

The results are shown below.



7A Which dye contains the most colours?

1 dye **W**

2 dye **X**

3 dye **Y**

4 dye **Z**

7B Which statement about the orange colouring in the sweet could be true?

1 It contains dyes **W** and **Z** only.

2 It contains dyes **X** and **Z** only.

3 It contains dyes **Y** and **Z** only.

4 It contains dye **Z** only.

4.8.1.3 Chromatography

Question 08 · continued

7C Dye **Z** was found to cause an allergic reaction in some people.

What should the orange sweet manufacturer do?

1 replace dye **Z** with dye **Y**

2 reduce the amount of dye **Z** in the sweets

3 stop the sale of these orange sweets

4 use only dye **W**

7D Which of these statements are reasons for putting additives into food?

Statement **K** – Increase the shelf-life of the food
Statement **L** – Improve the taste of the food
Statement **M** – Raise the cost of the food

1 **L** only

2 **K** and **L**

3 **K** and **M**

4 **K**, **L** and **M**

4.8.1.3 Chromatography

Question 09

2 Read the article about strawberry milkshakes.

'Strawberry milkshakes without strawberries!'



To make strawberry milkshakes at home, all you need is ice-cream, strawberries and milk.

Fast-food strawberry milkshakes could contain 60 additives but no strawberries.
The fast-food strawberry milkshakes:

- are cheap
- keep for a long time
- have an enhanced flavour. For example they may taste sweet.

2 (a) (i) Suggest **one** reason why the strawberry milkshakes made at home may also contain additives.

.....

.....

(1 mark)

2 (a) (ii) State **one** reason why some fast-food strawberry milkshakes do **not** contain strawberries.

.....

.....

(1 mark)

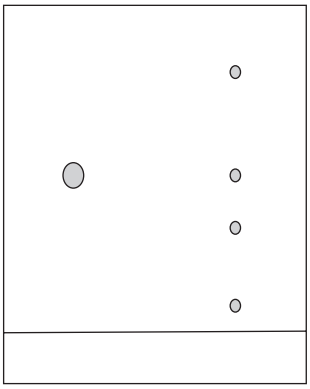
4.8.1.3 Chromatography

Question 09 · continued

for mark

2 (b) The additive E129, allura red, is often added to enhance the colour of strawberry milkshakes.

A student used chromatography to test if a strawberry milkshake contained E129. The result is shown.



2 (b) (i) How many colours are in this milkshake?

.....

(1 mark)

2 (b) (ii) The student concluded that the strawberry milkshake contained E129.

What evidence did the student use to make this conclusion?

.....

.....

(1 mark)

2 (b) (iii) Suggest why this conclusion may **not** be correct.

.....

.....

.....

(1 mark)

5

4.8.1.3 Chromatography

Question 10

June 2010 | CHY1F | Original Q4 | Legacy

4 An article had the following headline.

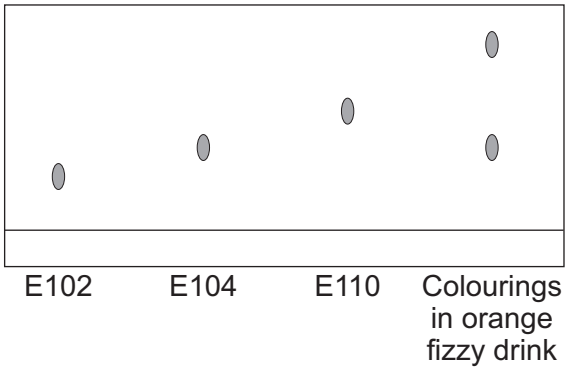
NEW FEAR OVER DRINK ADDITIVES

Some children get headaches and skin problems that are possibly caused by some types of fizzy orange drinks.

These fizzy drinks all contain water, carbon dioxide, artificial flavourings and colourings.

Three artificial colourings that have been used in fizzy orange drinks are tartrazine (E102), quinoline yellow (E104) and sunset yellow (E110).

4 (a) Colourings can be detected by chromatography.
The results of chromatography for the colourings in one fizzy orange drink are shown.



4(a) (i) How many colourings are there in the fizzy orange drink? .....

(1 mark)

4 (a) (ii) Which one of the colourings, E102, E104 or E110, does the fizzy orange drink contain?

Explain your answer.

E..... because .....

.....

.....

(2 marks)

4 (b) (i) Why are artificial colourings added to some fizzy orange drinks?

.....

.....

(1 mark)

4.8.1.3 Chromatography

Question 10 · continued

4 (b) (ii) Some people believe that artificial colourings cause headaches and skin problems.

Suggest **one** other substance in the fizzy orange drink that may cause these problems.

.....

(1 mark)

4 (c) Plastic bottles are often used as drink containers.

4 (c) (i) Draw a ring around the correct word in each box to complete the sentence.

The plastic is made by joining together many small molecules called

fractions
metals
monomers

to form very large molecules called

alloys.
polymers.
gases.

(2 marks)

4 (c) (ii) Used plastic bottles should **not** be dumped in landfill sites.

Give **two** reasons for this.

1 .....

.....

2 .....

.....

(2 marks)

9

4.8.1.3 Chromatography

Question 11

November 2010 | CHY1BP | Original Q5 | Legacy

QUESTION FIVE

This question is about vegetable oils.

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A chromatography

B combustion

C hydrogenation

D unsaturation

Vegetable oils are important foods and fuels.

Artificial colours in foods are usually detected by . . . **1** . . . .

Reacting oils with bromine will show the degree of . . . **2** . . . in the oil.

The melting points of vegetable oils can be increased by . . . **3** . . . .

Oils release heat energy by the process of . . . **4** . . . .

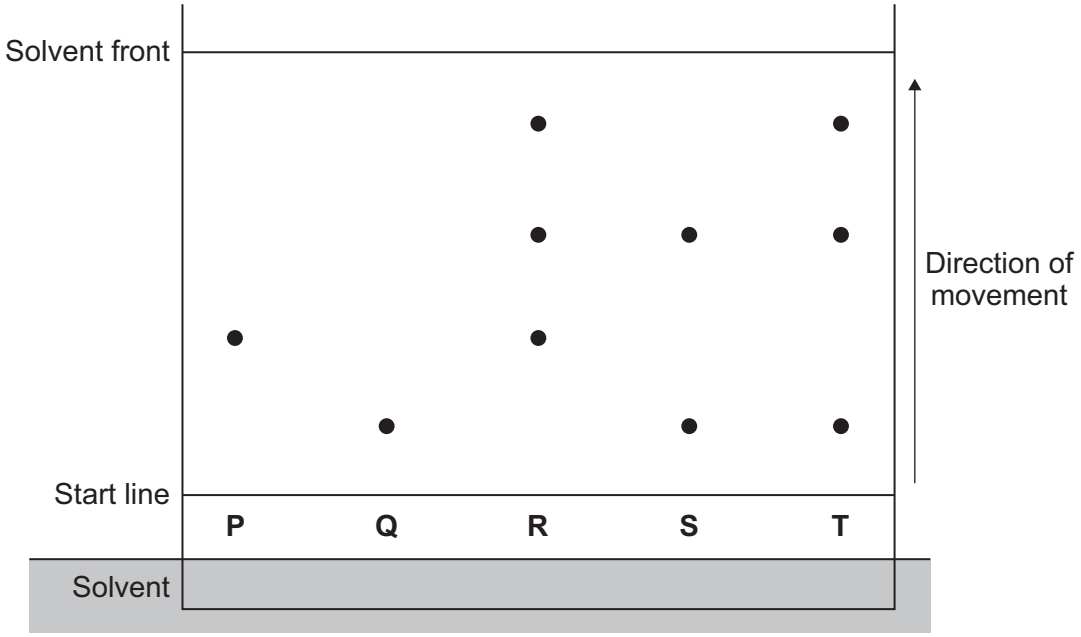
4.8.1.3 Chromatography

Question 12

November 2010 | CHY1BP | Original Q7 | Legacy

QUESTION SEVEN

Chromatography is used to identify and compare five food colourings, **P**, **Q**, **R**, **S** and **T**.
The five food colourings are used to coat chocolate sweets.



7A Which food colourings are mixtures of three colours?

1 **P** and **R**

2 **Q** and **S**

3 **R** and **T**

4 **S** and **P**

7B Food colouring **P** was analysed and was found to be toxic.

Which other food colouring is toxic?

1 **Q**

2 **R**

3 **S**

4 **T**

4.8.1.3 Chromatography

Question 12 · continued

7C Food colourings are used to coat chocolate sweets . . .

1 to make the sweets cost more.

2 to increase the shelf-life.

3 to make the sweets more attractive.

4 to increase the number of additives.

7D An E-number is used to identify a permitted food . . .

1 additive.

2 element.

3 mixture.

4 oil.

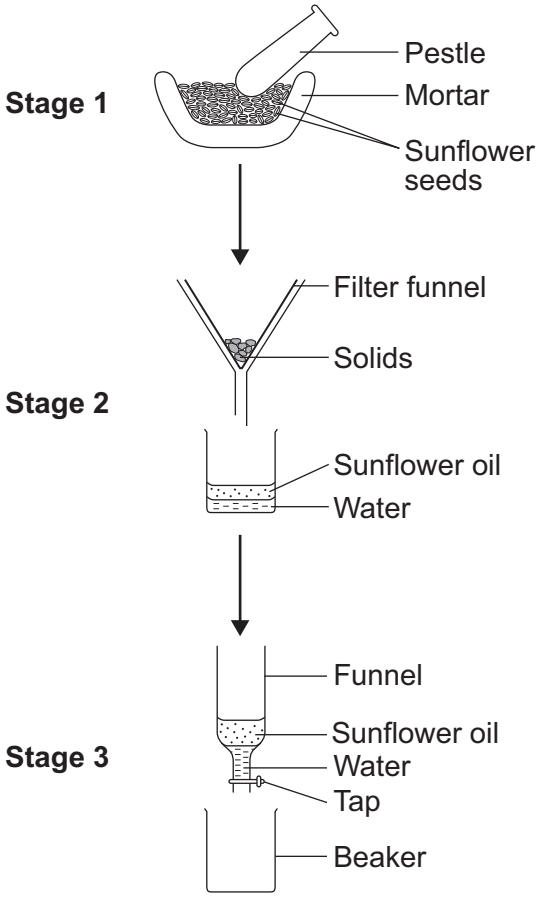
Turn over for the next question

4.8.1.3 Chromatography

Question 13

January 2011 | CHY1F | Original Q5 | Legacy

5 (a) The diagram shows how sunflower oil can be extracted from sunflower seeds in three stages.



5 (a) (i) Complete the sentences.

To release the oil and water in **stage 1** the sunflower seeds

are ..... .

To remove any solids in **stage 2** the mixture is ..... .

(2 marks)

4.8.1.3 Chromatography

Question 13 · continued

5 (a) (ii) Describe how the funnel with a tap in **stage 3** is used to separate the oil from the water.

.....

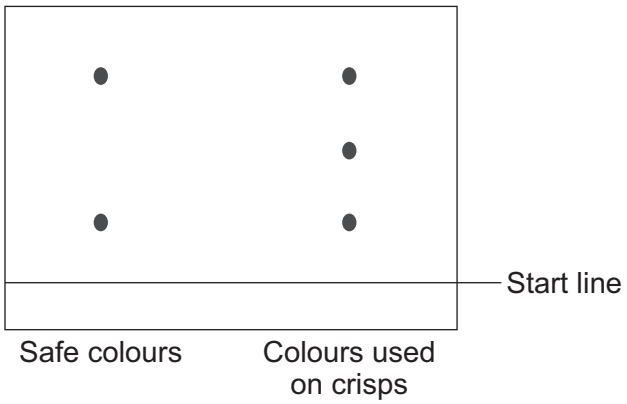
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(2 marks)

5 (b) Some crisps are made by frying thin slices of potato in sunflower oil.
Colours can be added to improve the appearance of the crisps.
Chromatography is used to check if these colours are safe to eat.
One result is shown below.



Use the results to help you to answer these questions.

5 (b) (i) How many colours were added to the crisps? .....

(1 mark)

5 (b) (ii) Are the crisps safe to eat? Explain your answer.

.....

.....

.....

(1 mark)

5 (b) (iii) Why would a manufacturer want to improve the appearance of their crisps?

.....

.....

(1 mark)

7

4.8.1.3 Chromatography

Question 14

June 2011 | CHY1F | Original Q3 | Legacy

3 This is part of an article about food additives.

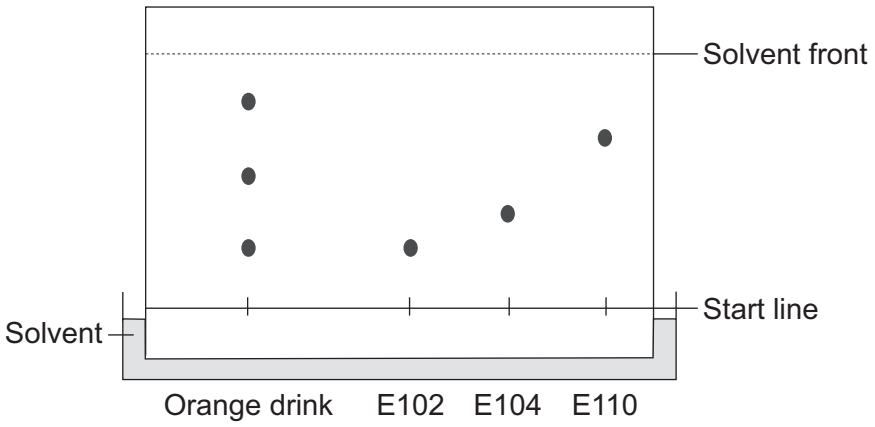
> **THE PERIL OF FOOD ADDITIVES**
>
> Some orange drinks contain the additives E102 (Tartrazine), E104 (Quinoline Yellow) and E110 (Sunset Yellow).
> These three additives are thought to cause hyperactivity in children.

3 (a) Tick (✓) **two** reasons why a manufacturer of orange drinks uses these additives.

Reason	Tick (✓)
to make the drink healthier	
to improve the appearance of the drink	
because they are permitted colours	
because they are expensive	

(2 marks)

3 (b) A scientist tested an orange drink to find out if it contained these additives.
The result of the test is shown.



4.8.1.3 Chromatography

Question 14 · continued

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

The test that the scientist did is called

chromatography.

cracking.

distillation.

(1 mark)

3 (b) (ii) How many coloured additives are there in the orange drink? .....

(1 mark)

3 (b) (iii) The scientist concluded that the orange drink contained only **one** of the additives E102, E104 and E110.

Explain why.

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(2 marks)

6

4.8.1.3 Chromatography

Question 15

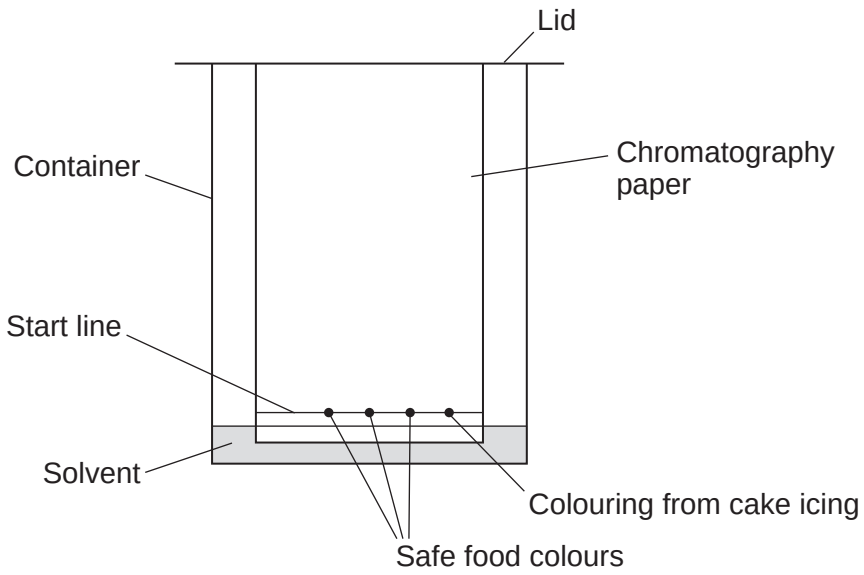
June 2012 | CH2FP | Original Q6 | Legacy

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



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

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



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

.....

.....

(1 mark)

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

.....

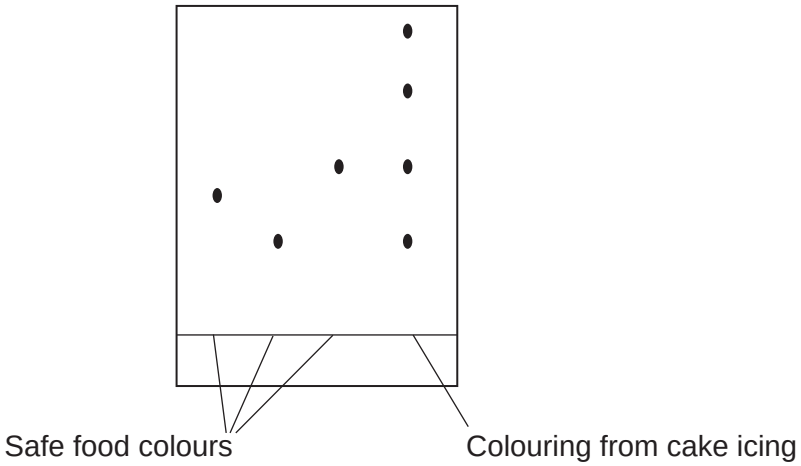
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(1 mark)

4.8.1.3 Chromatography

Question 15 · continued

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



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

.....

(1 mark)

6 (b) (ii) Is the cake icing safe to eat?

Give a reason for your answer.

.....

.....

(1 mark)

Question 6 continues on the next page

4.8.1.3 Chromatography

Question 15 · continued

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

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

.....

.....

.....

.....

(2 marks)

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

.....

.....

(1 mark)

6 (c) (iii) What information does mass spectroscopy give?

.....

.....

(1 mark)

8

4.8.1.3 Chromatography

Question 16

January 2013 | CH2FP | Original Q4 | Legacy

4 Thermosoftening polymers can be used to make plastic bottles and food packaging.

4 (a) Why are thermosoftening polymers **not** suitable for storing very hot food?

.....

.....

(1 mark)

4 (b) The reaction to produce the polymers uses a catalyst.

Why are catalysts used in chemical reactions?

.....

.....

(1 mark)

4 (c) Compounds from food packaging must not get into food.

Gas chromatography can be used to separate compounds in food.

The output from the gas chromatography column can be linked to an instrument which can identify the compounds.

4 (c) (i) Name the instrument used to identify the compounds.

.....

.....

(1 mark)

4 (c) (ii) Give **one** reason why instrumental methods of analysis are used to identify the compounds.

.....

.....

(1 mark)

4 (d) Poly(ethene) is a thermosoftening polymer.

Poly(ethene) can be made with different properties. The properties depend on the conditions used when poly(ethene) is made.

Suggest **two** conditions which could be changed when poly(ethene) is made.

.....

.....

(2 marks)

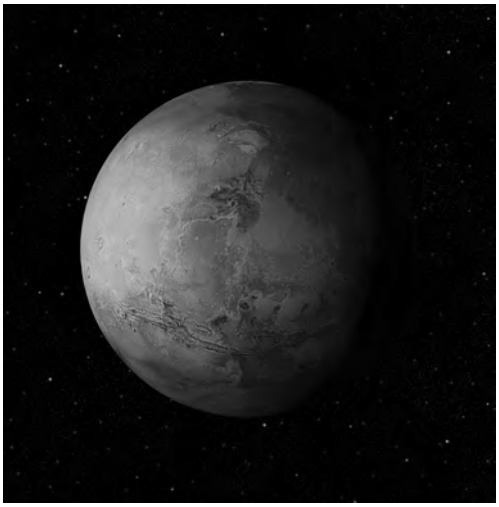
6

4.8.1.3 Chromatography

Question 17

June 2013 | CH2FP | Original Q5 | Legacy

5 This question is about the planet Mars.



5 (a) Mars is a red colour in the sky at night.

The red colour of Mars is because of iron oxide.

Iron oxide is an ionic compound.

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

Ionic compounds are made of

- giant lattices.
- polymer chains.
- simple molecules.

(1 mark)

5 (b) Many spacecraft have been sent to Mars. Parts of these spacecraft are made from polymers.

5 (b) (i) Polymers that behave like shape memory alloys are used in spacecraft.

The shape memory polymers are cooled and compressed. These polymers are stored on the spacecraft until needed.

Suggest how the polymers could be made to return to their original shape.

.....

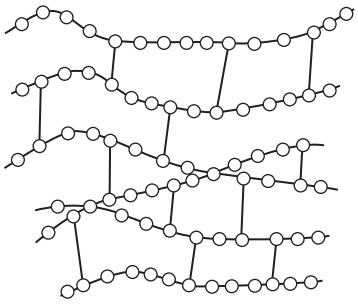
(1 mark)

4.8.1.3 Chromatography

Question 17 · continued

5 (b) (ii) Thermosetting polymers are used for the tiles on the outside of spacecraft.

The diagram shows the structure of a thermosetting polymer.



Explain, in terms of structure, why some polymers are thermosetting.

.....

.....

.....

.....

(2 marks)

5 (c) Instrumental methods such as GC–MS are used to analyse substances found on Mars.

In GC–MS, gas chromatography columns are linked to mass spectrometers.

5 (c) (i) What does gas chromatography do to the substances?

.....

.....

(1 mark)

5 (c) (ii) Give **two** reasons for using instrumental methods for analysis.

1 .....

.....

2 .....

.....

(2 marks)

7

4.8.1.3 Chromatography

Question 18

June 2014 | CH2FP | Original Q6 | Legacy

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

Cola

Ingredients:

Carbonated water
Sugar
Colouring
Phosphoric acid
Flavouring
Caffeine

6 (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 mark]

.....

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

[1 mark]

.....

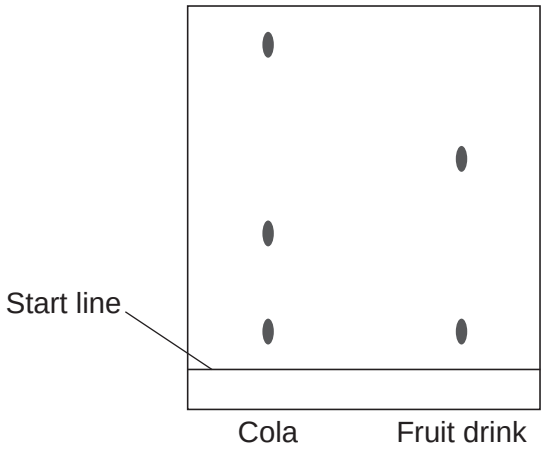
4.8.1.3 Chromatography

Question 18 · continued

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

The chromatogram in **Figure 8** shows the student's results.

Figure 8



6 (b) (i) Complete the sentence.

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

Give a reason for your answer.

[2 marks]

.....

.....

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

[3 marks]

.....

.....

.....

.....

.....

.....

4.8.1.3 Chromatography

Question 18 · continued

6 (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?

[1 mark]

.....

.....

6 (d) Caffeine is a stimulant.

Large amounts of caffeine can be harmful.

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

Tick (✓) **one** question.

[1 mark]

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

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

[2 marks]

Reason 1 .....

.....

Reason 2 .....

.....

11

4.8.1.3 Chromatography

Question 19

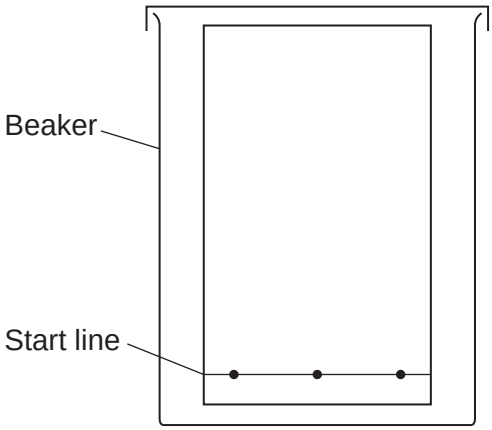
June 2017 | CH2FP | Original Q1 | Legacy

1 This question is about methods of analysis.

1 (a) A student used paper chromatography to identify colours in an ink.

Figure 1 shows the apparatus the student used.

Figure 1



1 (a) (i) Why should the student use a pencil and not a pen to draw the start line?

[1 mark]

_____

1 (a) (ii) The student put water in the beaker.

Use the correct answer from the box to complete the sentence.

[1 mark]

above	**below**	**on**

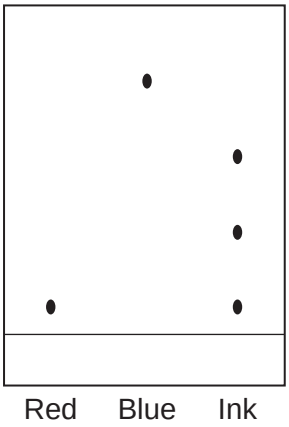
The water level should be _____ the start line drawn by the student.

4.8.1.3 Chromatography

Question 19 · continued

1 (a) (iii) **Figure 2** shows the student's results.

Figure 2



Give **two** conclusions about the colours in the ink.

[2 marks]

Question 1 continues on the next page

4.8.1.3 Chromatography

Question 19 · continued

1 (b) Gas chromatography is an instrumental method of analysis.

1 (b) (i) Use the correct answer from the box to complete the sentence.

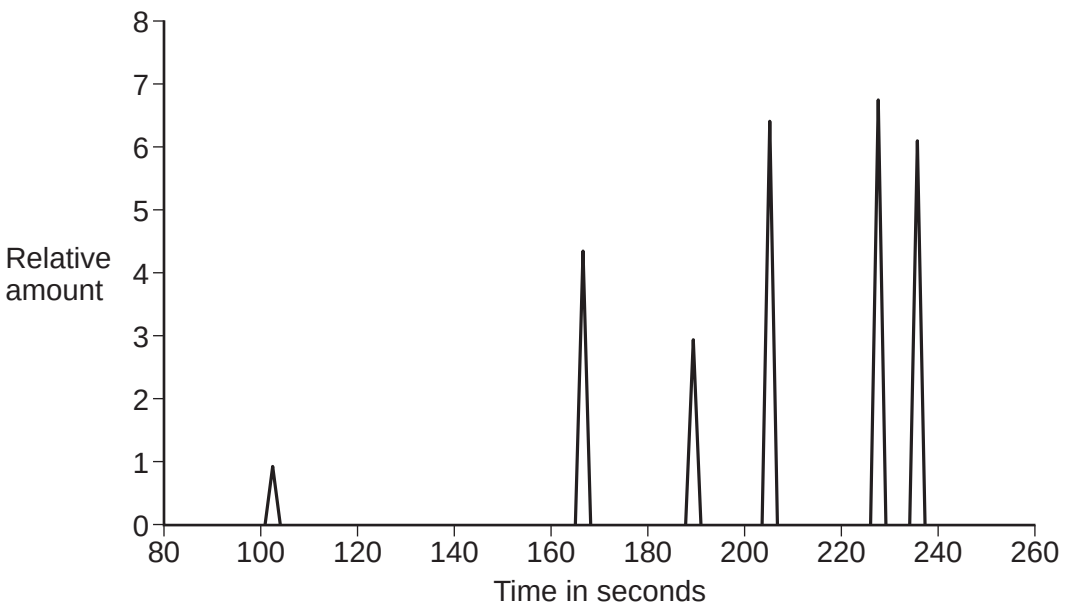
[1 mark]

neutralised	reduced	separated

The mixture of compounds in gas chromatography is _____ .

1 (b) (ii) **Figure 3** shows the results from a gas chromatograph.

Figure 3



How many compounds were in the sample?

[1 mark]

_____

1 (b) (iii) Give **one** advantage of using instrumental methods of analysis.

[1 mark]

_____

7

4.8.1.3 Chromatography

Question 20

June 2018 | 8462/1F | Original Q1

0 1 This question is about mixtures.

0 1 . 1 Substances are separated from a mixture using different methods.

Draw **one** line from each substance and mixture to the best method of separation.

[3 marks]

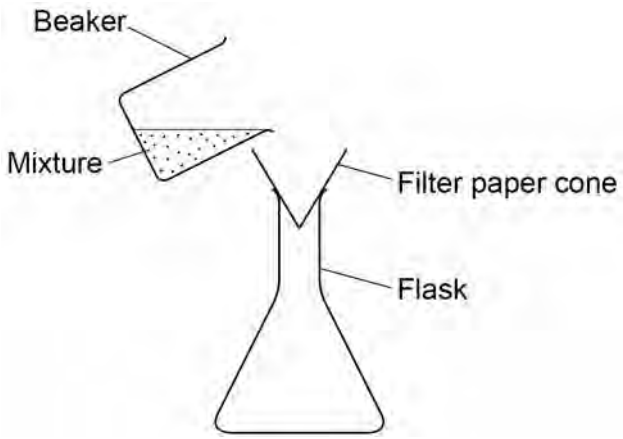
Substance and mixture	Method of separation
	Chromatography
Ethanol from ethanol and water	
	Crystallisation
Salt from sea water	Electrolysis
	Filtration
The different colours in black ink	
	Fractional distillation

Question 20 · continued

0 1 . 2 A student filters a mixture.

Figure 1 shows the apparatus.

Figure 1



Suggest **one** improvement to the apparatus.

[1 mark]

_____

_____

0 1 . 3 Complete the sentences.

Choose answers from the box.

[2 marks]

condense	**evaporate**	**freeze**	**melt**	**solidify**

In simple distillation, the mixture is heated to make the liquid _____.

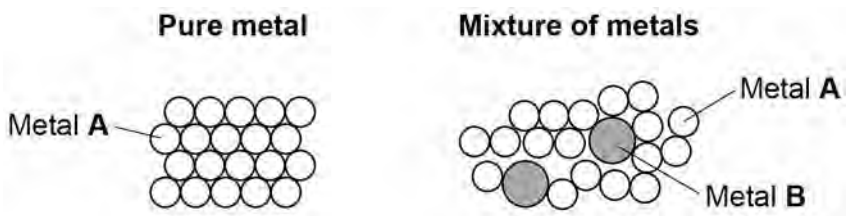
The vapour is then cooled to make it _____.

4.8.1.3 Chromatography

Question 20 · continued

Figure 2 shows the arrangement of atoms in a pure metal and in a mixture of metals.

Figure 2



0 1 . 4 Calculate the percentage of metal **B** atoms in the mixture of metals shown in **Figure 2**.

[2 marks]

Percentage of metal **B** atoms = _____ %

0 1 . 5 What is a mixture of metals called?

[1 mark]

Tick **one** box.

- An alloy ☐
- A compound ☐
- A molecule ☐
- A polymer ☐

4.8.1.3 Chromatography

Question 20 · continued

0 1 . 6 Why is the mixture of metals in **Figure 2** harder than the pure metal?

[1 mark]

Tick **one** box.

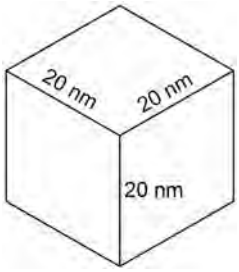
- The atoms in the mixture are different shapes. ☐
- The layers in the mixture are distorted. ☐
- The layers in the mixture slide more easily. ☐
- The mixture has a giant structure. ☐

0 1 . 7 A nanoparticle of pure metal **A** is a cube.

Each side of the cube has a length of 20 nm.

Figure 3 shows the cube.

Figure 3



What is the volume of the nanoparticle?

[1 mark]

Tick **one** box.

- $20\ nm^3$ ☐
- $60\ nm^3$ ☐
- $400\ nm^3$ ☐
- $8000\ nm^3$ ☐

11

4.8.1.3 Chromatography

Question 21

June 2018 | 8462/2F | Original Q5

0 5 A student investigated the colours in three different flowers, **A**, **B** and **C**, using paper chromatography.

The colours are soluble in ethanol but are insoluble in water.

This is the method used.

1. Place ethanol in a beaker.
2. Add the flower.
3. Stir until the colours dissolve in the ethanol.
4. Filter the mixture.
5. Put spots of the coloured filtrate on the chromatography paper.

0 5 . 1 The filtrate was a very pale coloured solution.

How could the student obtain a darker coloured solution?

[2 marks]

Tick **two** boxes.

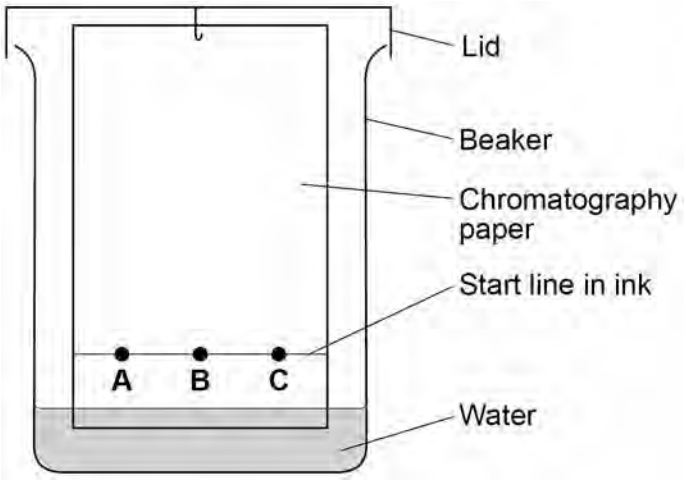
- Crush the flower ☐
- Filter the mixture three times ☐
- Use a larger beaker ☐
- Use more ethanol ☐
- Use more flowers ☐

4.8.1.3 Chromatography

Question 21 · continued

0 5 . 2 **Figure 2** shows the apparatus used.

Figure 2



What **two** mistakes did the student make in setting up the apparatus?

[2 marks]

Tick **two** boxes.

- The paper does not touch the beaker ☐
- The start line is drawn in ink ☐
- The water level is below the start line ☐
- Uses a lid on the beaker ☐
- Uses water as the solvent ☐

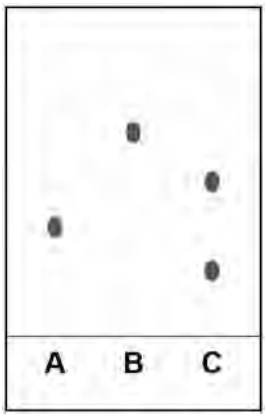
Question 5 continues on the next page

Question 21 · continued

0 5 . 3 Another student sets up the apparatus correctly.

Figure 3 represents the student's results.

Figure 3



What **two** conclusions can be made from **Figure 3**?

[2 marks]

Tick **two** boxes.

- Flower **A** contains a single pure colour ☐
- Flowers **A** and **B** contain the same colours ☐
- The colour in flower **C** is a mixture ☐
- The colour in flower **B** was the least soluble ☐
- Two of the colours have the same R_f value ☐

4.8.1.3 Chromatography

Question 21 · continued

0 5 . 4 The student records some measurements.

The measurements are:

- the colour from flower **B** moves 7.2 cm
- the solvent moves 9.0 cm

Calculate the R_f value for the colour from flower **B**.

Use the equation:

$$R_f = \frac{\text{distance moved by colour}}{\text{distance moved by solvent}}$$

[2 marks]

R_f value = _____

Turn over for the next question

4.8.1.3 Chromatography

Question 22

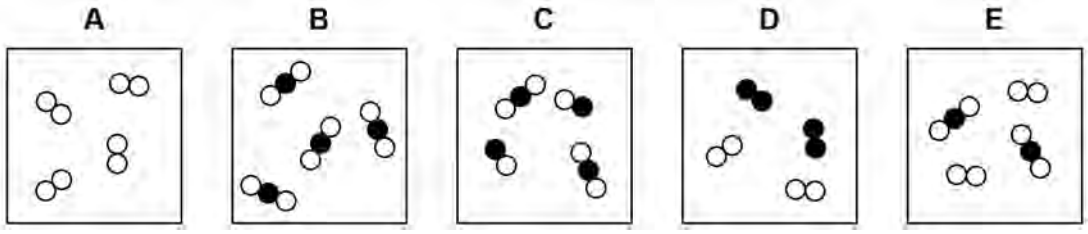
June 2019 | 8462/1F | Original Q3

0 3 This question is about elements, compounds and mixtures.

Figure 5 shows five different substances, **A**, **B**, **C**, **D** and **E**.

○ and ● represent atoms of different elements.

Figure 5



Use **Figure 5** to answer Questions **03.1** to **03.3**

0 3 . 1 Which substance is only one compound?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

0 3 . 2 Which substance is a mixture of elements?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

0 3 . 3 Which substance is a mixture of an element and a compound?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

4.8.1.3 Chromatography

Question 22 · continued

Substances are separated from a mixture using different methods.

0 3 . 4 Draw **one** line from each method of separation to the substance and mixture it would separate.

[2 marks]

Method of separation	Substance and mixture
chromatography	blue food colour from a mixture of food colours
	copper from an alloy of copper and zinc
crystallisation	copper sulfate from copper sulfate solution
	ethanol from a mixture of ethanol and water

4.8.1.3 Chromatography

Question 22 · continued

0 3 . 5 Sand does not dissolve in water. A student separates a mixture of sand and water by filtration.

Draw a diagram of the apparatus the student could use.

You should label:

- where the sand is collected
- where the water is collected.

[3 marks]

Diagram

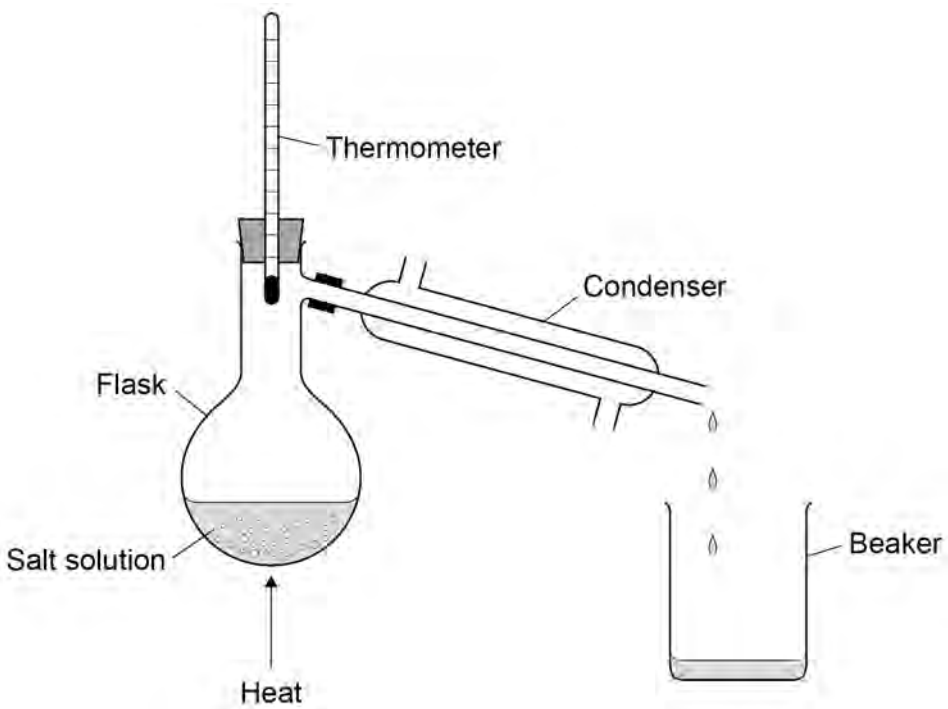
Question 3 continues on the next page

Question 22 · continued

0 3 . 6 A student distils a sample of salt solution to produce pure water.

Figure 6 shows the apparatus.

Figure 6



What temperature would you expect the thermometer to show?

[1 mark]

Tick (✓) **one** box.

0 °C ☐

10 °C ☐

50 °C ☐

100 °C ☐

4.8.1.3 Chromatography

Question 22 · continued

0 3 . 7 Describe how the process of distillation shown in **Figure 6** produces pure water from salt solution.

[4 marks]

13

Turn over for the next question

4.8.1.3 Chromatography

Question 23

November 2020 | 8462/2F | Original Q4

0 4 This question is about ink.

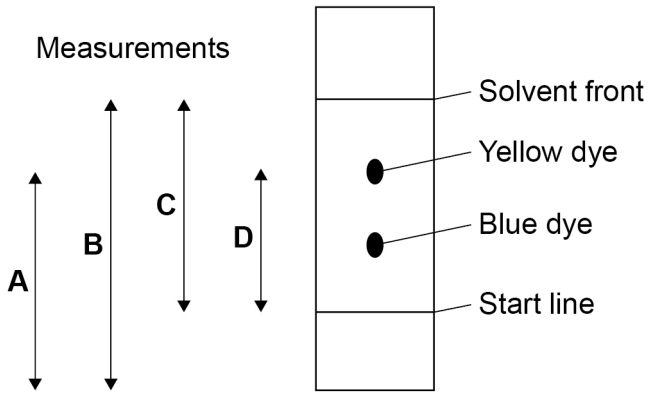
A student investigated green ink using paper chromatography in a beaker.

Figure 6 shows:

- the results the student obtained
- measurements **A**, **B**, **C** and **D** the student could make.

Figure 6

Diagram not to scale



0 4 . 1 The student calculated the R_f value of the blue dye.

The student measured:

- the distance moved by the blue dye = 2.7 cm
- the distance moved by the solvent = 9.0 cm

Calculate the R_f value of the blue dye.

Use the equation:

$$R_f = \frac{\text{distance moved by dye}}{\text{distance moved by solvent}}$$

[2 marks]

R_f = _____

4.8.1.3 Chromatography

Question 23 · continued

0 4 . 2 Which measurements on **Figure 6** are needed to calculate the R_f value of the yellow dye?

[1 mark]

Tick (✓) **one** box.

A and **B** ☐

A and **C** ☐

B and **D** ☐

C and **D** ☐

0 4 . 3 Paper chromatography has a stationary phase and a mobile phase.

Draw **one** line from each phase to the identity of that phase in the student's investigation.

[2 marks]

Phase	Identity
	Beaker
Mobile phase	Ink
	Paper
Stationary phase	Solvent
	Start line

4.8.1.3 Chromatography

Question 23 · continued

The green ink contains 85% yellow dye and 15% blue dye.

0 4 . 4 Determine the simplest whole number ratio of yellow dye : blue dye in the green ink.

[1 mark]

Yellow dye : Blue dye = _____ : _____

0 4 . 5 Which word correctly describes the green ink?

[1 mark]

Tick (✓) **one** box.

- Compound ☐
- Element ☐
- Formulation ☐
- Solvent ☐

0 4 . 6 The student repeated the investigation using green ink containing 75% yellow dye and 25% blue dye.

What would happen to the R_f value of the yellow dye?

[1 mark]

Tick (✓) **one** box.

- The R_f value would decrease. ☐
- The R_f value would increase. ☐
- The R_f value would stay the same. ☐

8

4.8.1.3 Chromatography

Question 24

November 2021 | 8462/2F | Original Q10

1 0 This question is about paper chromatography.

A food colouring contains a dye.

1 0 . 1 Plan an investigation to determine the R_f value for the dye in this food colouring.

$$R_f = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$$

Your plan should include the use of:

- a beaker
- a solvent
- chromatography paper.

[6 marks]

4.8.1.3 Chromatography

Question 24 · continued

1 0 . 2 Two students investigated a dye in a food colouring using paper chromatography.

Each student did the investigation differently.

The R_f values they determined for the **same** dye were different.

How did the students' investigations differ?

[1 mark]

Tick (✓) **one** box.

- Different length of paper used ☐
- Different period of time used ☐
- Different size of beaker used ☐
- Different solvent used ☐

1 0 . 3 Paper chromatography involves a stationary phase.

What is the stationary phase in paper chromatography?

[1 mark]

Tick (✓) **one** box.

- Beaker ☐
- Dye ☐
- Paper ☐
- Solvent ☐

8

4.8.1.3 Chromatography

Question 25

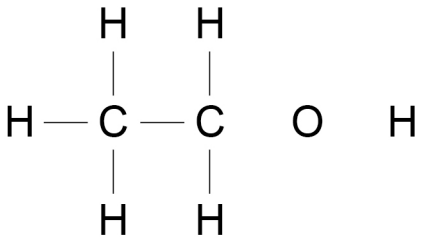
June 2022 | 8462/2F | Original Q4

0 4 This question is about ethanol.

0 4 . 1 The formula of ethanol is C_2H_5OH

Complete the displayed structural formula of ethanol.

[1 mark]



0 4 . 2 Which is **one** use of ethanol?

[1 mark]

Tick (✓) **one** box.

As a protective coating on aluminium ☐

In hand gel to kill microbes ☐

To test for the presence of hydrogen gas ☐

4.8.1.3 Chromatography

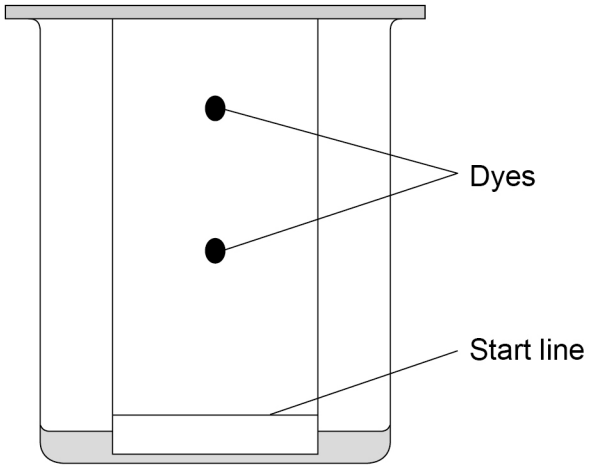
Question 25 · continued

0 4 . 3 Ethanol is used as a solvent in some inks.

A student used paper chromatography to show that an ink contained two different dyes.

Figure 4 shows the apparatus at the end of the investigation.

Figure 4



Describe a method the student could have used for the investigation.

[4 marks]

Question 25 · continued

0 4 . 4 Ethanol can be produced from sugar solution by fermentation.

What must be added to sugar solution to produce ethanol?

[1 mark]

E5 and E10 are types of fuel used in cars.

These fuels contain ethanol and petrol.

Table 6 shows information about E5 and E10.

Table 6

Fuel	Percentage (%) by mass of ethanol	Percentage (%) by mass of petrol
E5	5	95
E10	10	90

0 4 . 5 Calculate the mass of ethanol in 4.4 kg of E5.

Give your answer in grams.

Use **Table 6**.

[3 marks]

Mass = _____ g

4.8.1.3 Chromatography

Question 25 · continued

0 4 . 6 The ethanol in E5 and E10 is produced from sugar.

Sugar is produced from plants.

Explain why the production of E10 removes more carbon dioxide from the atmosphere than the production of E5.

Use **Table 6**.

[3 marks]

0 4 . 7 **Table 7** shows the energy content of ethanol and petrol.

Table 7

	Energy content in MJ (megajoules) per kg
Ethanol	30.0
Petrol	46.4

Suggest **one** disadvantage of using E10 instead of E5.

Complete the sentence.

[1 mark]

A disadvantage of using E10 is that _____

14

4.8.1.3 Chromatography

Question 26

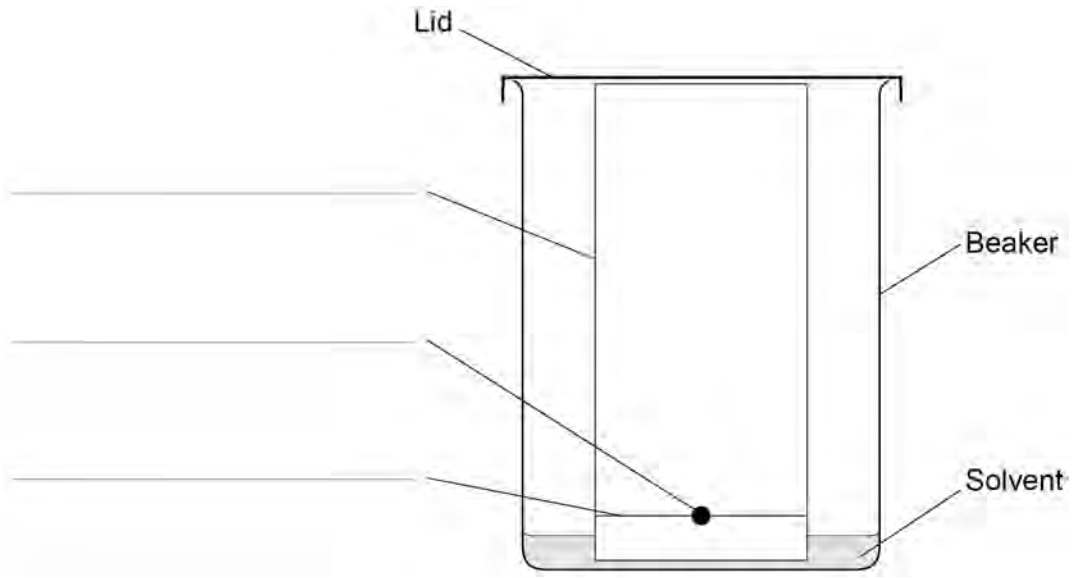
June 2023 | 8462/2F | Original Q3

0 3 This question is about chromatography.

A student investigated an orange dye using paper chromatography.

0 3 . 1 **Figure 3** shows the apparatus at the start of the investigation.

Figure 3



Complete the labels on **Figure 3**.

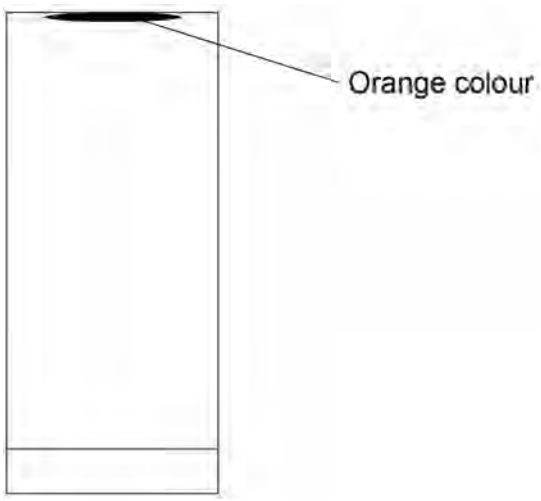
[3 marks]

4.8.1.3 Chromatography

Question 26 · continued

0 3 . 2 **Figure 4** shows the results at the end of the investigation.

Figure 4



The student made a mistake in the investigation.

What mistake did the student make to produce the results shown in **Figure 4**?

[1 mark]

Tick (✓) **one** box.

Left the investigation for too long ☐

Used a lid on the beaker ☐

Used a solvent which did not dissolve the dye ☐

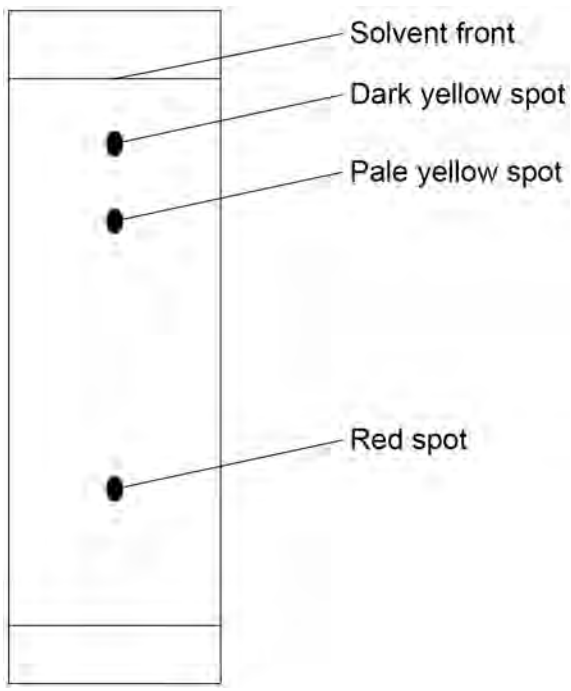
Question 3 continues on the next page

Question 26 · continued

A different student did the investigation correctly.

Figure 5 shows the results.

Figure 5



0 3 . 3 How do the results in **Figure 5** show that the orange dye is **not** a pure substance?

[1 mark]

Question 26 · continued

0 3 . 4 Determine the R_f value for the red spot.

You should measure:

- the distance moved by the red spot
- the distance moved by the solvent.

Use **Figure 5** and the equation:

$$R_f = \frac{\text{distance moved by red spot}}{\text{distance moved by solvent}}$$

[4 marks]

Distance moved by red spot _____ cm

Distance moved by solvent _____ cm

_____

_____

R_f = _____

0 3 . 5 Which spot had the greatest R_f value?

Use **Figure 5**.

[1 mark]

Tick (✓) **one** box.

Dark yellow spot ☐

Pale yellow spot ☐

Red spot ☐

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4.8.1.3 Chromatography

Question 27

0 3 This question is about paper chromatography.

A student investigated substance **Y** using paper chromatography.

This is the method used.

1. Draw a start line in ink on a piece of chromatography paper.
2. Put spots of four different dyes, **A**, **B**, **C** and **D**, and a spot of substance **Y** on the start line.
3. Dip the paper into water so that the water level is below the start line.
4. Wait until the water has risen to near the top of the paper.

0 3 . 1 The student's method contains a mistake in **Step 1**.

What is the mistake in **Step 1**?

Give **one** reason for your answer.

[2 marks]

Mistake _____

_____

Reason _____

_____

Question 3 continues on the next page

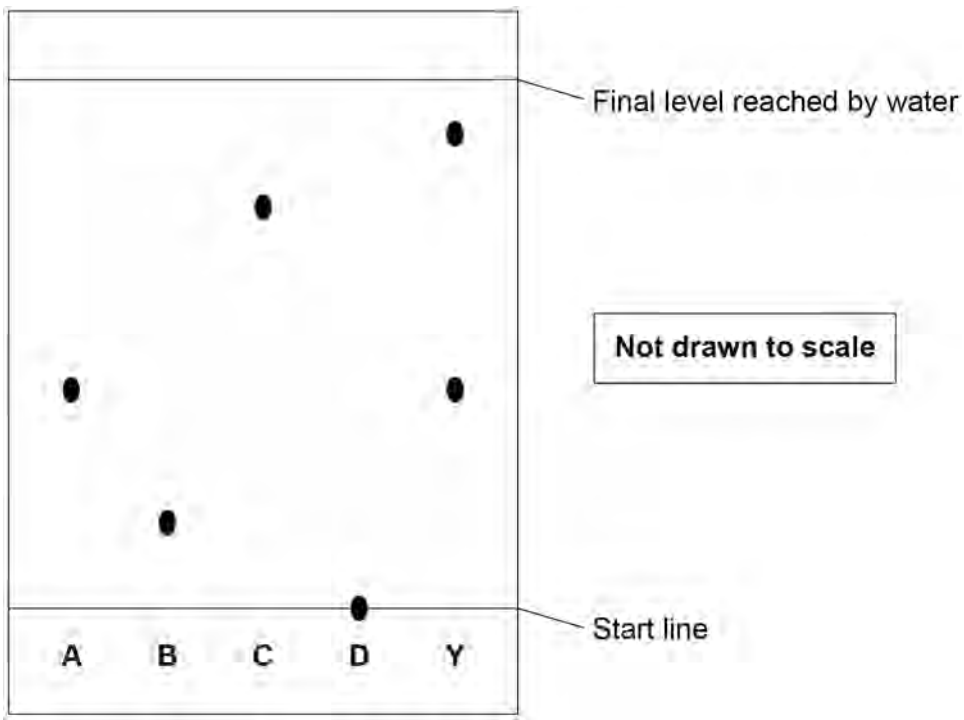
4.8.1.3 Chromatography

Question 27 · continued

A different student used a method which gave valid results.

Figure 4 shows the results.

Figure 4



0 3 . 2 How many different dyes are in substance **Y**?

Use **Figure 4**.

[1 mark]

0 3 . 3 Which of the four dyes, **A**, **B**, **C** and **D**, could be in substance **Y**?

Give **one** reason for your answer.

Use **Figure 4**.

[2 marks]

Dye _____

Reason _____

Question 27 · continued

0 3 . 4 Suggest why dye **D** remained on the start line at the end of the investigation.

Use **Figure 4**.

[1 mark]

0 3 . 5 The student determined that:

- the distance moved by the water was 6.0 cm
- the distance moved by dye **A** was 2.4 cm.

Calculate the R_f value of dye **A**.

Use the equation:

$$R_f = \frac{\text{distance moved by dye } \mathbf{A}}{\text{distance moved by water}}$$

[2 marks]

R_f = _____

0 3 . 6 Complete the sentence.

Choose the answer from the box.

[1 mark]

solute	**solution**	**solvent**

The water in **step 3** is used as a _____ .

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4.8.1.3 Chromatography

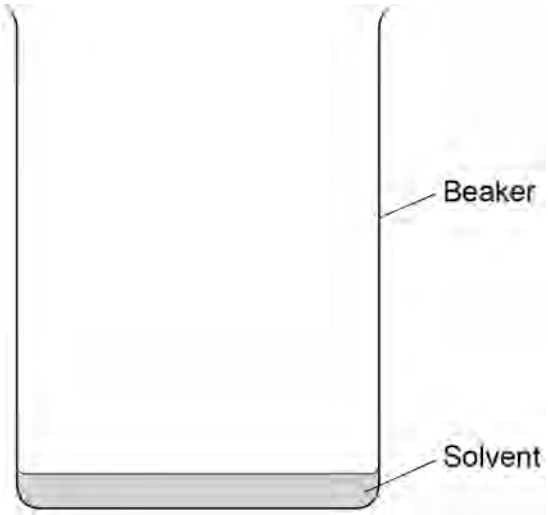
Question 28

June 2025 | 8462/2F | Original Q5

0 5 This question is about chromatography.

Figure 4 shows some equipment used for paper chromatography.

Figure 4



0 5 . 1 Complete **Figure 4** to show how the equipment can be used to separate the dyes in an ink.

You should draw and **label**:

- a piece of chromatography paper **in the beaker**
- a start line on the chromatography paper
- a spot of the ink on the chromatography paper at the **start** of the experiment.

[3 marks]

0 5 . 2 Why should a pencil be used to draw the start line on the chromatography paper?

[1 mark]

Question 28 · continued

The R_f value of a dye was 0.80

A spot of the dye moved a distance of 5.2 cm.

0 5 . 3 Calculate the distance moved by the solvent.

Use the equation:

$$R_f = \frac{\text{distance moved by spot}}{\text{distance moved by solvent}}$$

[3 marks]

Distance moved by solvent = _____ cm

0 5 . 4 How is the distance moved by the spot of the dye measured?

[1 mark]

Tick (✓) **one** box.

From the start line to the bottom of the spot ☐

From the start line to the centre of the spot ☐

From the start line to the top of the spot ☐

Question 5 continues on the next page

4.8.1.3 Chromatography

Question 28 · continued

0 5 . 5 Which **two** changes could produce a different R_f value for this dye?

[2 marks]

Tick (✓) **two** boxes.

- Use a different beaker. ☐
- Use a different length of time. ☐
- Use a different sized spot of dye. ☐
- Use a different solvent. ☐
- Use a different type of chromatography paper. ☐

0 5 . 6 A different dye is a pure substance.

How many spots will this dye produce during chromatography?

[1 mark]

_____

0 5 . 7 Which is an advantage of using gas chromatography instead of paper chromatography?

Choose the answer from the box.

[1 mark]

less sensitive	**more accurate**	**slower**

Gas chromatography is _____.

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