AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.8.1.3

Chromatography

Past-paper questions

Tier	**Higher**
Question groups	**18**
Available paper years	**2007–2024**

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 Q3 | Legacy

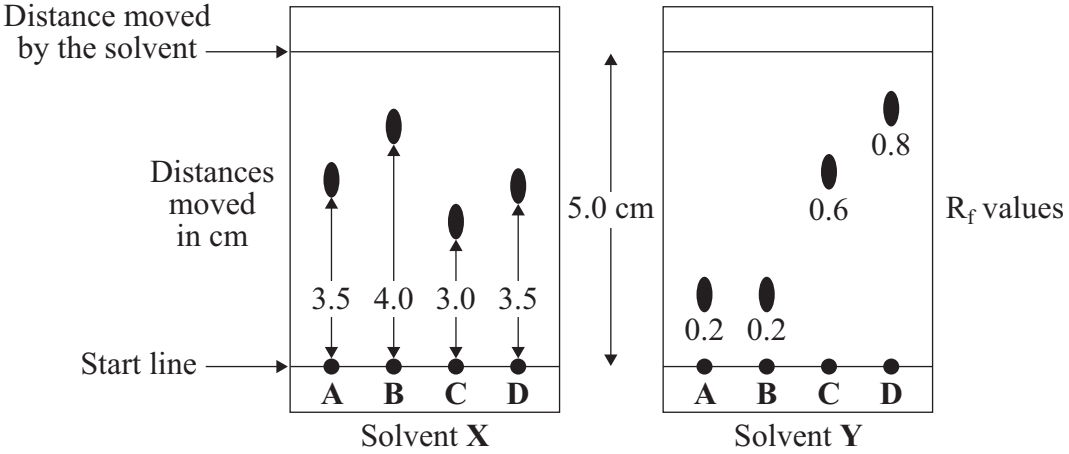
QUESTION THREE

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.

3A What is the R_f value of substance **B** in solvent **X**?

1 0.6

2 0.7

3 0.8

Question 01 · continued

3B 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.

3C Which statement about chromotography is true?

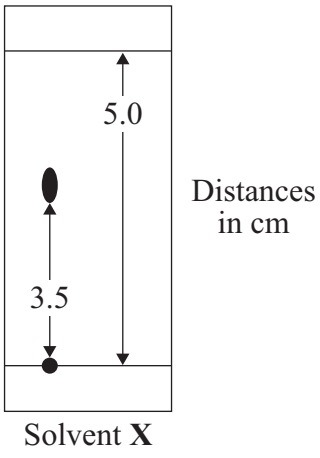
1 Chromatography works only on added artificial colouring.

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.

3D 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

January 2008 | CHY1H | Original Q3 | Legacy

3 The nutrition label is from a pack of smoked salmon.

Typical values	Per 100 g	Per 50 g portion
Energy kJ kcal	695 165	350 85
Protein g Carbohydrate g of which sugars g	22.3 3.2 0.1	11.2 1.6 0.05
Fat g of which saturates g monounsaturates g polyunsaturates g	7.1 1.7 2.5 2.4	3.6 0.9 1.3 1.2
Fibre g Sodium g	0.5 1.30	0.3 0.70
Equivalent as salt g	3.2	1.6

Guideline Daily Amounts Recommended by nutrition professionals for average adults			
	Per 50 g portion	Woman	Man
Calories	85	2000	2500
Fat g	3.6	70	95
Salt g	1.6	6	6

(a) Smoked salmon is said to be a healthy food because it contains Omega 3 and other *unsaturated* fats.

(i) What does *unsaturated* mean?

.....

(1 mark)

(ii) To detect unsaturated fats, a small amount of bromine or iodine solution can be added.

What happens to show that an unsaturated fat is present?

.....

(1 mark)

(b) The amount of salt in this smoked salmon may be considered unhealthy.

Explain why it is advisable to consume only one portion of the smoked salmon per day.

.....

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(2 marks)

4.8.1.3 Chromatography

Question 02 · continued

BLANK

(c) 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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(3 marks)

7

4.8.1.3 Chromatography

Question 03

June 2008 | CHY1BP | Original Q8 | Legacy

QUESTION EIGHT

Green plant cells contain many different coloured pigments.

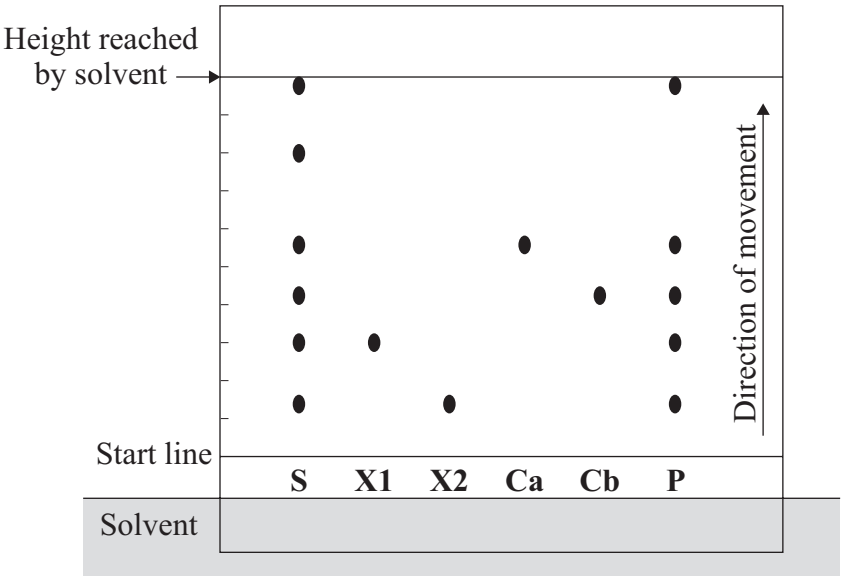
Examples are:

- two types of chlorophyll, **Ca** and **Cb**
- two types of xanthophyll, **X1** and **X2**.

The pigments can be separated by chromatography.

In an experiment, extracts from two plants, **P** and **S**, were compared with pure **Ca**, **Cb**, **X1** and **X2** using chromatography.

The diagram shows the results of the experiment.



Key	
X1 and **X2**	Pure xanthophyll
Ca and **Cb**	Pure chlorophyll
S	Extract from plant **S**
P	Extract from plant **P**

8A From this experiment it is possible to deduce that plant **S** contains . . .

1 coloured substances **not** identified by this experiment.

2 four coloured substances.

3 seven coloured substances.

4 the same mixture of coloured substances as plant **P**.

4.8.1.3 Chromatography

8B From this experiment it is possible to deduce that plant **P** . . .

1 contains coloured substances that are soluble in the solvent.

2 contains substances that could be safely used for colouring food.

3 is unhealthy.

4 would look identical to plant **S**.

In chromatography, the R_f value = $\frac{\text{distance moved by the substance}}{\text{distance moved by the solvent}}$

8C What is the R_f value for **X1**?

1 0.03

2 0.16

3 0.30

4 3.33

8D Two other coloured substances found in plants are:

- carotene R_f value 0.98
- phaeophytin R_f value 0.80

From this information we can deduce that the leaves on plant **S** contain . . .

1 both carotene and phaeophytin.

2 carotene but **not** phaeophytin.

3 phaeophytin but **not** carotene.

4 neither carotene nor phaeophytin.

4.8.1.3 Chromatography

Question 04

June 2008 | CHY1H | Original Q3 | Legacy

3

Why blue sweets are turning white

A recent study identified a possible harmful effect on children'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.

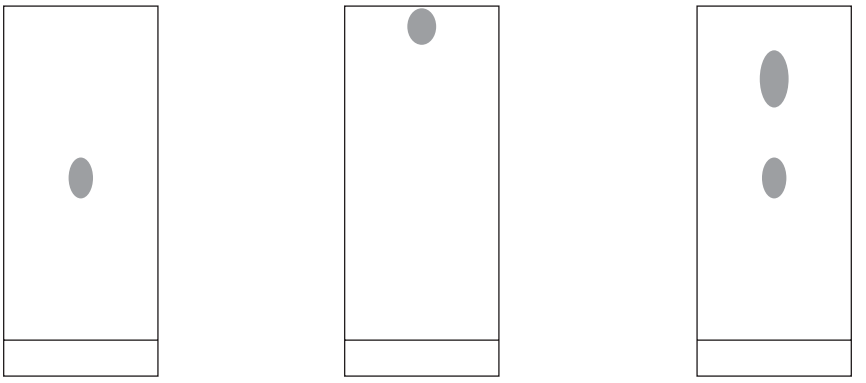
3 (a) Suggest why it is important to be able to identify the colour additives in food.

.....

.....

(1 mark)

3 (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 marks)

4.8.1.3 Chromatography

Question 04 · continued

for mark

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 marks)

6

Turn over for the next question

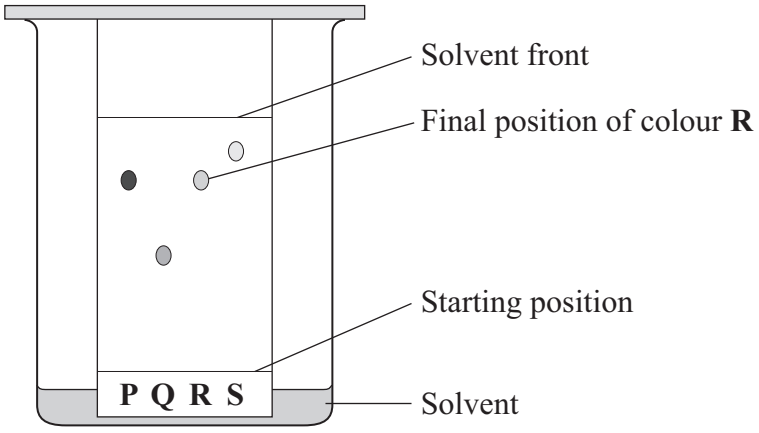
4.8.1.3 Chromatography

Question 05

June 2009 | CHY1BP | Original Q9 | Legacy

QUESTION NINE

The diagram shows an investigation of four colours, **P**, **Q**, **R** and **S**, using paper chromatography.



As the solvent rises up the paper it moves the colours depending on their attraction for the solvent and the paper.
The greater the attraction of a colour for the solvent and the less the attraction for the paper, the further the colour moves.

The R_f value is defined as:

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

9A In the investigation shown in the diagram, what was the R_f value of colour **Q**?

1 0.0

2 0.5

3 0.7

4 0.9

4.8.1.3 Chromatography

Question 05 · continued

The R_f values for the colours, **P**, **Q**, **R** and **S**, in four different solvents are shown in the table.

	Solvent			
	Water	**Ethanol**	**Propanone**	**Tetrachloromethane**
Colour P	0.5	0.9	0.7	0.5
Colour Q	0.0	0.8	0.6	0.2
Colour R	0.5	0.7	0.6	0.1
Colour S	0.2	0.6	0.4	0.2

9B Which colour is **not** soluble in water?

1 **P**

2 **Q**

3 **R**

4 **S**

9C Using the data in the table above, which solvent could be used to separate a mixture of all four colours, **P**, **Q**, **R** and **S**?

1 water

2 ethanol

3 propanone

4 tetrachloromethane

Question 9 continues on the next page

4.8.1.3 Chromatography

Question 05 · continued

9D R_f values are not very reliable because other factors can affect how the colours move. These factors include the temperature and the amount of solvent vapour in the atmosphere around the chromatography paper. For this reason, R_f values are not normally quoted in textbooks.

Which of the following statements is true?

1 Chromatography is useless for identifying unknown substances.

2 Chromatography can only be used if the temperature is carefully controlled to a constant value.

3 Chromatography can only be used if there is always the same amount of solvent in the beaker.

4 Chromatography can be used if known colours are used, with the unknown colour as a comparison.

END OF TEST

4.8.1.3 Chromatography

Question 06

November 2010 | CHY1BP | Original Q1 | Legacy

QUESTION ONE

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 energy by the process of . . . **4** . . . .

4.8.1.3 Chromatography

Question 07

4 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.

4 (a) State **two** reasons why a manufacturer could justify the use of these additives.

1 .....

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2 .....

.....

(2 marks)

4 (b) Some scientists asked 4000 twelve year-old children to help them to investigate if there is a link between these three additives and hyperactivity.
How would the scientists use these 4000 children to investigate if there is a link between these three additives and hyperactivity in children?

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(4 marks)

4.8.1.3 Chromatography

Question 07 · continued

4 (c) A manufacturer used an independent scientist to show that their orange drink did not contain these three additives.

4 (c) (i) Suggest why the manufacturer would use a scientist who was independent instead of using their own scientist.

.....

.....

(1 mark)

4 (c) (ii) The scientist had samples of E102, E104 and E110 and the orange drink. The scientist used paper chromatography for the test.

Describe how the scientist could use the results to show that the orange drink did not contain any of these three additives. (You may include a diagram of the paper chromatography results.)

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(2 marks)

9

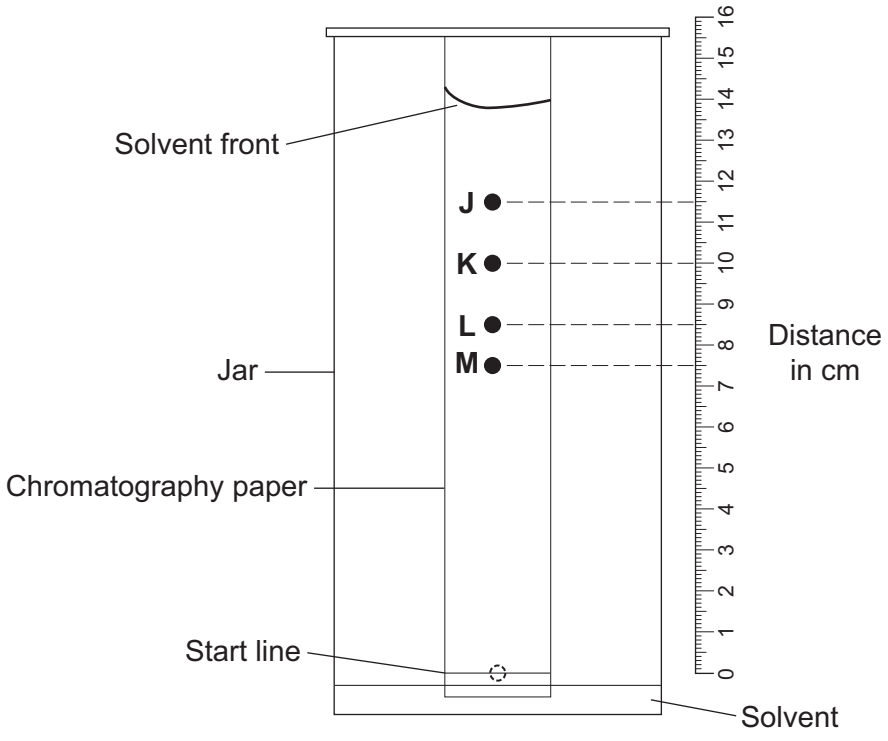
4.8.1.3 Chromatography

Question 08

November 2011 | CHY1BP | Original Q9 | Legacy

QUESTION NINE

The colours from a sweet were dissolved in a solvent. A spot of the solution was put onto some chromatography paper. The paper was then placed in a jar. After a period of time, the colours were separated as shown in the diagram.



$$\text{the } R_f \text{ value for a colour} = \frac{\text{distance moved by the colour}}{\text{distance moved by the solvent}}$$

The substance responsible for a colour can be identified by using its R_f value. This tells you where to look on the chromatogram for this colour.

9A Amaranth has an R_f value of 0.54.

Which of the colours is possibly amaranth?

1 **J**

2 **K**

3 **L**

4 **M**

4.8.1.3 Chromatography

Indigo carmine has an R_f value of 0.58 and amaranth has an R_f value of 0.54.

9B There must be some doubt about whether a particular spot is indigo carmine or amaranth because . . .

1 the solvent front is not straight.

2 the length of time the chromatography paper was in the solvent is not known.

3 the scale is marked in 10 mm divisions.

4 only colours from one sweet were used.

9C The test was done four times for one particular colour.
R_f values of 0.51, 0.53, 0.58 and 0.61 were obtained.

This data tells us that . . .

1 the colour is amaranth.

2 the colour is indigo carmine.

3 the colour could be indigo carmine or amaranth.

4 the method cannot detect different colours.

9D It is recommended that indigo carmine should not be eaten by children.

The evidence from this investigation should lead to . . .

1 these sweets being banned.

2 further investigation with additional chemical tests.

3 these sweets being banned for children only.

4 this test being repeated more times.

END OF TEST

4.8.1.3 Chromatography

Question 09

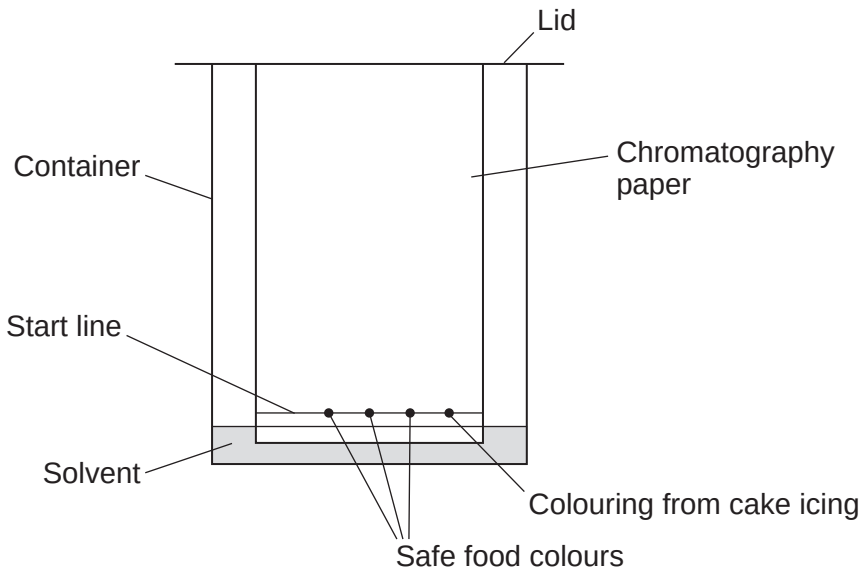
June 2012 | CH2HP | Original Q1 | Legacy

1 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.

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



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

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(1 mark)

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

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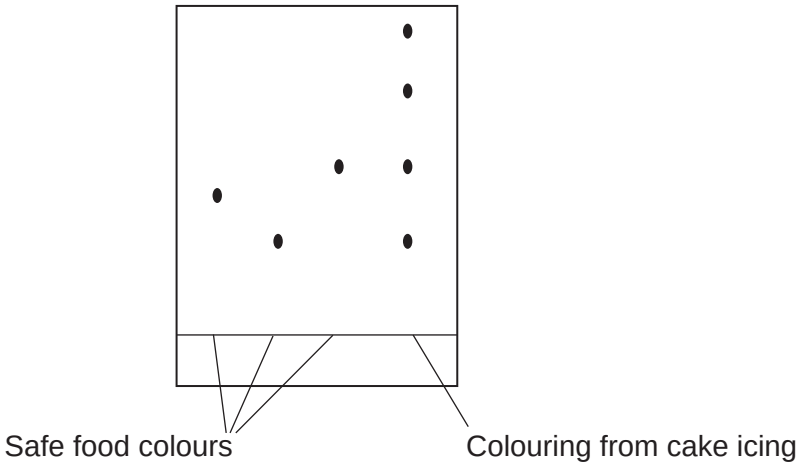
(1 mark)

4.8.1.3 Chromatography

Question 09 · continued

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



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

.....

(1 mark)

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

Give a reason for your answer.

.....

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(1 mark)

Question 1 continues on the next page

4.8.1.3 Chromatography

Question 09 · continued

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

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

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(2 marks)

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

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.....

(1 mark)

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

.....

.....

(1 mark)

8

4.8.1.3 Chromatography

Question 10

January 2013 | CH2HP | Original Q4 | Legacy

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

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

Why does the catalyst work for a long time before it needs replacing?

.....

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(1 mark)

4 (b) Thermosoftening polymers would **not** be suitable for packaging very hot food.

Explain why in terms of their properties and structure.

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(2 marks)

4.8.1.3 Chromatography

Question 10 · continued

4 (c) Compounds from food packaging must not contaminate the food.

Food can be tested for contamination using gas chromatography linked to mass spectroscopy (GC-MS).

4 (c) (i) Gas chromatography can separate substances in a mixture of compounds.

Describe how, as fully as you can.

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(3 marks)

4 (c) (ii) What information does the molecular ion peak give about the molecule?

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(1 mark)

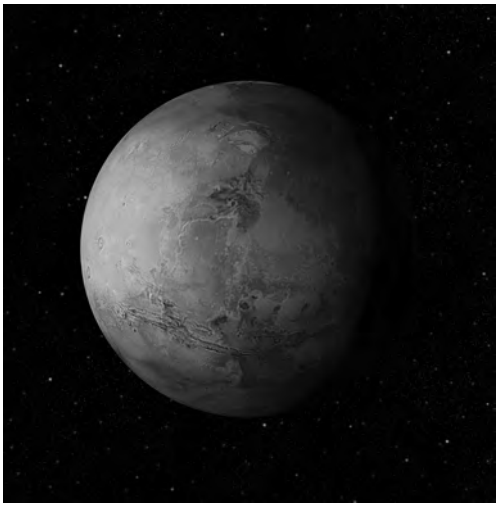
7

4.8.1.3 Chromatography

Question 11

June 2013 | CH2HP | Original Q6 | Legacy

6 Spacecraft have been to the planets Venus and Mars. The spacecraft have sent back information about the atmosphere of each planet.



6 (a) The main gas in the atmosphere of Mars is carbon dioxide.

Explain why, in terms of structure, carbon dioxide is a gas, even at low temperatures.

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(3 marks)

4.8.1.3 Chromatography

Question 11 · continued

6 (b) Gas chromatography linked to a mass spectrometer (GC-MS) is used to identify substances found on Mars.

6 (b) (i) What is the purpose of gas chromatography?

.....

.....

(1 mark)

6 (b) (ii) What information do the molecular ion peaks from the mass spectrometer give about the substances?

.....

(1 mark)

6 (c) The atmosphere on Venus contains droplets of sulfuric acid solution.

6 (c) (i) Suggest a pH value for sulfuric acid solution.

pH = ...

(1 mark)

6 (c) (ii) Name the ion which makes sulfuric acid solution acidic.

.....

(1 mark)

6 (d) The atmosphere of Venus contains the isotopes $^{2}_{1}H$ and $^{1}_{1}H$

Describe the similarities and the differences in the isotopes $^{2}_{1}H$ and $^{1}_{1}H$

You should refer to the sub-atomic particles in each isotope.

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(3 marks)

10

4.8.1.3 Chromatography

Question 12

June 2014 | CH2HP | Original Q1 | Legacy

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

Cola

Ingredients:

Carbonated water
Sugar
Colouring
Phosphoric acid
Flavouring
Caffeine

1 (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]

.....

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

[1 mark]

.....

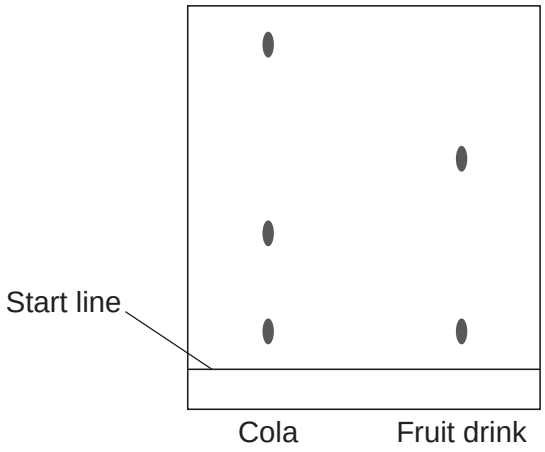
4.8.1.3 Chromatography

Question 12 · continued

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

The chromatogram in **Figure 1** shows the student's results.

Figure 1



1 (b) (i) Complete the sentence.

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

Give a reason for your answer.

[2 marks]

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.....

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

[3 marks]

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4.8.1.3 Chromatography

Question 12 · continued

1 (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]

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.....

1 (d) Caffeine is a stimulant.

Large amounts of caffeine can be harmful.

1 (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?	

1 (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 13

June 2017 | CH2HP | Original Q5 | Legacy

5 This question is about methods of analysis.

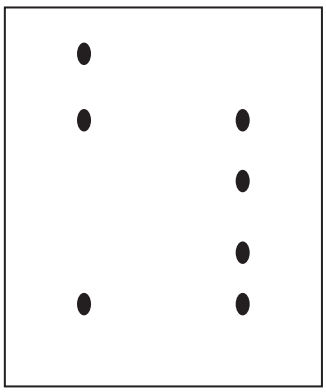
5 (a) A student wanted to compare the colours in two inks, **A** and **B**, using paper chromatography.

5 (a) (i) Describe a method the student could use.

[4 marks]

5 (a) (ii) **Figure 6** shows the student's results.

Figure 6



Compare the colours in the inks **A** and **B**.

[2 marks]

4.8.1.3 Chromatography

Question 13 · continued

5 (b) A method of instrumental analysis is gas chromatography linked to mass spectrometry (GC-MS).

5 (b) (i) Describe how gas chromatography separates substances in a mixture of compounds.

[3 marks]

5 (b) (ii) A mass spectrometer is used to identify the substances.

What information about each substance is given by the mass spectrometer?

[1 mark]

10

4.8.1.3 Chromatography

Question 14

0 4 A student investigated the colours in three different flowers, **A**, **B** and **C**.

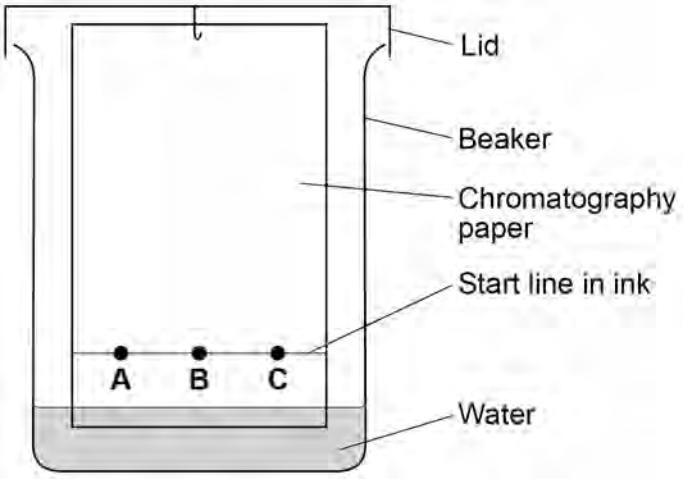
The colours are soluble in ethanol but are insoluble in water.

This is the method used.

1. Crush flower **A**.
2. Add ethanol to flower **A**.
3. Filter the mixture.
4. Put spots of the coloured filtrate on to the chromatography paper.
5. Repeat steps 1-4 with flowers **B** and **C**.

Figure 4 shows the apparatus used.

Figure 4



0 4 . 1 The student made **two** mistakes in setting up the apparatus.

Give **one** problem caused by each mistake.

[4 marks]

Mistake 1 _____

Problem caused _____

_____

Mistake 2 _____

Problem caused _____

_____

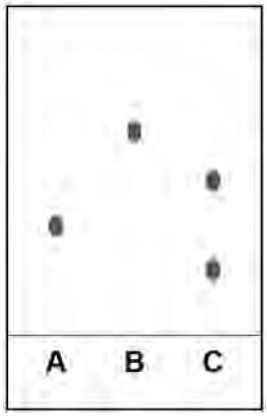
4.8.1.3 Chromatography

Question 14 · continued

0 4 . 2 Another student set up the apparatus correctly.

Figure 5 represents the student's results.

Figure 5



Give **two** conclusions you can make from **Figure 5**.

[2 marks]

1 _____

_____

2 _____

_____

0 4 . 3 Colour **A** has an R_f value of 0.65

Colour **A** moves 3.2 cm

Calculate the distance moved by the solvent.

[2 marks]

_____

_____

Distance moved by solvent = _____ cm

8

4.8.1.3 Chromatography

Question 15

November 2020 | 8462/2H | Original Q4

0 4 This question is about ink.

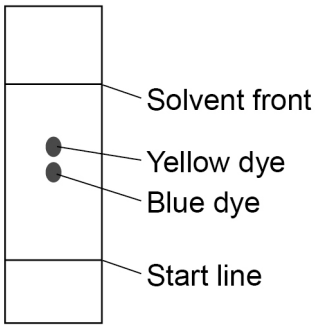
A student investigated green ink using paper chromatography in a beaker.

The student used water as the solvent.

Figure 2 shows the chromatogram obtained.

Figure 2

Diagram not to scale



0 4 . 1 The R_f value of the yellow dye = 0.60

The distance moved by the yellow dye = 5.7 cm

Calculate the distance moved by the solvent.

[3 marks]

Distance moved by the solvent = _____ cm

4.8.1.3 Chromatography

Question 15 · continued

0 4 . 2 The green ink contains more than two compounds.

Suggest **one** reason why only two spots are seen on **Figure 2**.

[1 mark]

0 4 . 3 On the student's chromatogram, the yellow and blue spots are very close together.

Which **two** ways could increase the distance between the spots?

[2 marks]

Tick (✓) **two** boxes.

- Allow the solvent front to travel further. ☐
- Dry the chromatogram more slowly. ☐
- Use a different solvent. ☐
- Use a larger beaker. ☐
- Use a larger spot of green ink. ☐

0 4 . 4 The manufacturers of the green ink always use the same proportions of yellow dye and blue dye.

Suggest **one** reason why.

[1 mark]

4.8.1.3 Chromatography

Question 15 · continued

0 4 . 5 The R_f value of a dye depends on:

- the solubility of the dye in the solvent
- the attraction of the dye to the paper.

Which will **definitely** produce a smaller R_f value if the solvent and paper are both changed?

[1 mark]

Tick (✓) **one** box.

The dye is less soluble in the new solvent and less attracted to the new paper. ☐

The dye is less soluble in the new solvent and more attracted to the new paper. ☐

The dye is more soluble in the new solvent and less attracted to the new paper. ☐

The dye is more soluble in the new solvent and more attracted to the new paper. ☐

8

4.8.1.3 Chromatography

Question 16

November 2021 | 8462/2H | Original Q3

0 3 This question is about paper chromatography.

A food colouring contains a dye.

0 3 . 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 16 · continued

0 3 . 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 ☐

0 3 . 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 17

June 2023 | 8462/2H | Original Q6

0 6 This question is about chromatography.

A student investigated an orange food colouring using two different types of chromatography paper.

The food colouring:

- contained a mixture of red and yellow dyes
- was soluble in water.

This is the method used.

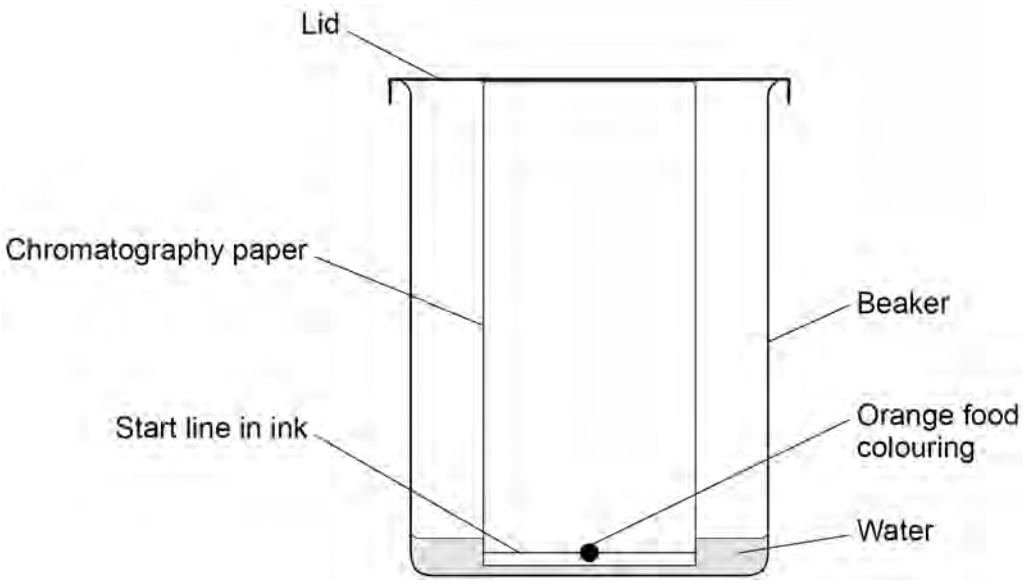
1. Draw a start line on a piece of type **A** chromatography paper.
2. Put a spot of orange food colouring on the line.
3. Put the paper into a beaker containing water as a solvent.
4. Wait for the water to travel up the paper.
5. Measure the distance above the start line moved by the red and yellow dyes and the water.
6. Repeat steps 1 to 5 using type **B** chromatography paper.

4.8.1.3 Chromatography

Question 17 · continued

Figure 3 shows how the student set up the apparatus.

Figure 3



0 6 . 1 The student made **two** mistakes when setting up the apparatus.

Give **two** mistakes the student made.

[2 marks]

1 _____

_____

2 _____

_____

Question 6 continues on the next page

4.8.1.3 Chromatography

Another student set up the apparatus correctly.

Table 3 shows the results.

Table 3

	Type A chromatography paper		Type B chromatography paper	
	Red dye	**Yellow dye**	**Red dye**	**Yellow dye**
Distance moved by dye in cm	4.8	6.6	5.4	**X**
Distance moved by water in cm	12.0	12.0	12.0	12.0
R_f value	0.40	0.55	0.45	0.60

0 6 . 2 Determine value **X** in **Table 3**.

[3 marks]

X = _____ cm

4.8.1.3 Chromatography

Question 17 · continued

Changing the type of chromatography paper resulted in different R_f values for the red dye.

0 6 . 3 Explain why the R_f values for the red dye are different using the two types of chromatography paper.

Use **Table 3**.

[3 marks]

0 6 . 4 What other change to the investigation could result in a different R_f value for the red dye?

[1 mark]

9

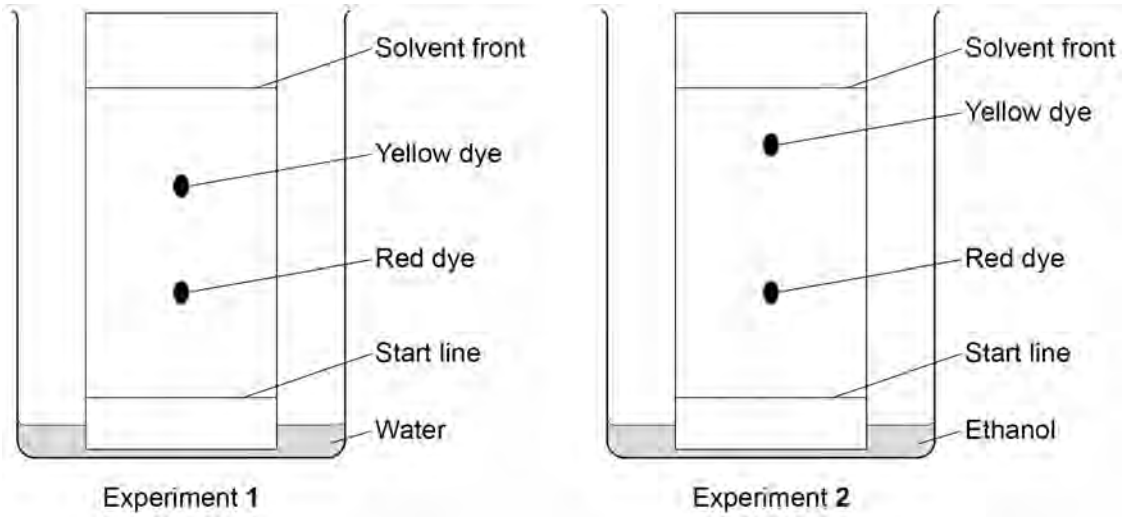
4.8.1.3 Chromatography

Question 18

0 4 A student investigated an orange dye (**A**) using paper chromatography.

Figure 4 shows the results of Experiment **1** and Experiment **2** using orange dye **A**.

Figure 4



0 4 . 1 Explain why the yellow dye and red dye travel different distances in Experiment **1**.

Refer to forces of attraction between the dyes and the chromatography paper in your answer.

[2 marks]

4.8.1.3 Chromatography

Question 18 · continued

0 4 . 2 The student used the same type of chromatography paper in Experiment **1** and in Experiment **2**.

Explain why the yellow dye is in different positions in Experiment **1** and in Experiment **2**.

Use **Figure 4**.

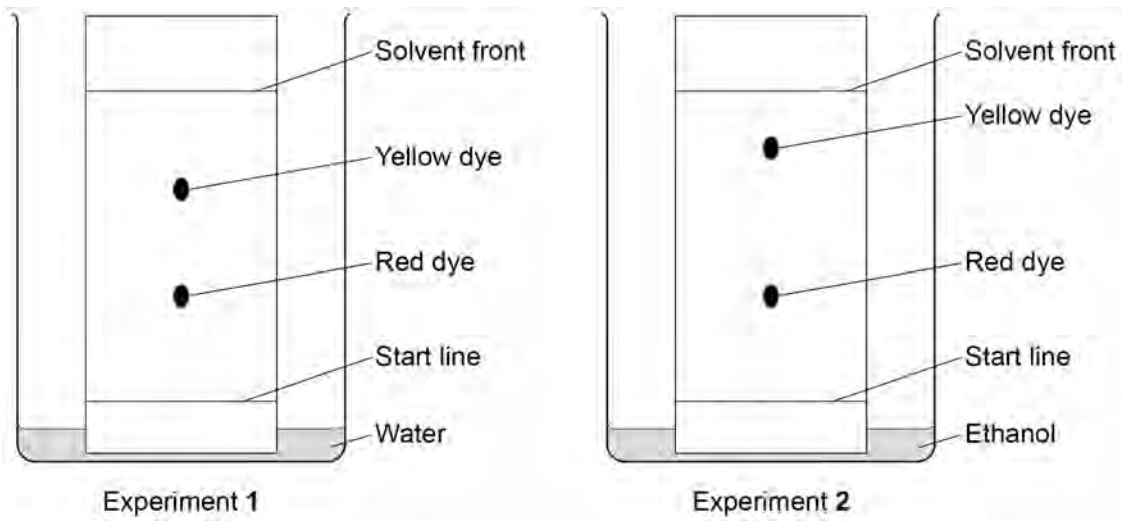
[3 marks]

Question 4 continues on the next page

Figure 4 is repeated below.

Figure 4 shows the results of Experiment **1** and Experiment **2** using orange dye **A**.

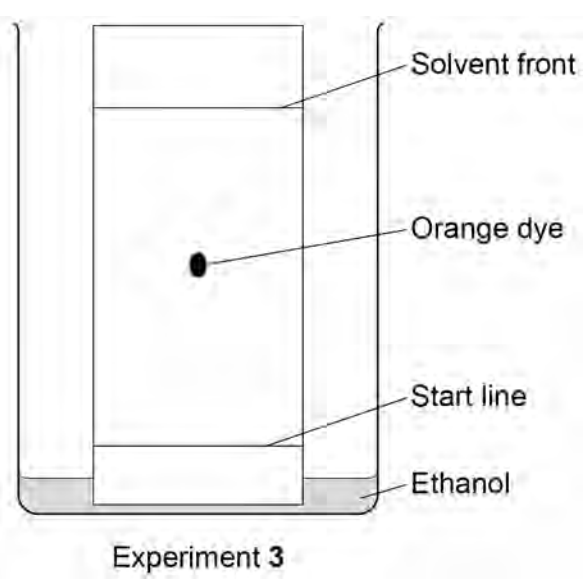
Figure 4



The student investigated a different orange dye (**B**).

Figure 5 shows the results of Experiment **3** using orange dye **B**.

Figure 5



4.8.1.3 Chromatography

Question 18 · continued

0 4 . 3 Compare the purity of the orange dyes **A** and **B**.

Give reasons for your answer.

Use **Figure 4** and **Figure 5**.

[2 marks]

0 4 . 4 The student calculated that the R_f value of the orange dye in the experiment shown in **Figure 5** was 0.48

Calculate the distance moved by the solvent front when the orange dye had moved 5.4 cm.

[3 marks]

Distance moved by solvent front = _____ cm

0 4 . 5 Why is the R_f value of a dye **not** affected by how far the solvent front is allowed to travel?

[1 mark]

4.8.1.3 Chromatography

Question 18 · continued

0 4 . 6 Another type of chromatography is called gas chromatography.

Gas chromatography is an instrumental method of chemical analysis.

Scientists tested the orange dyes using gas chromatography.

Suggest **two** advantages of using the instrumental method of gas chromatography rather than paper chromatography.

[2 marks]

1 _____

_____

2 _____

_____

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