

(Chromatography (R_f values, separation techniques))

Q1.a)(2018)

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.

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

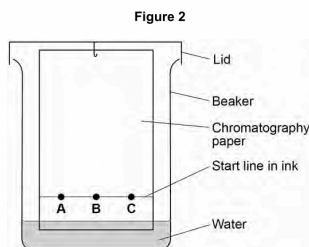
☐

Use more flowers

☐

Q1.b)(2018)

Figure 2 shows the apparatus used.



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

☐

Q1c).(2018)

Another student sets up the apparatus correctly.

Figure 3 represents the student's results.



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

☐

Q1.d).(2018)

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 = _____

Q2.a).(2020)

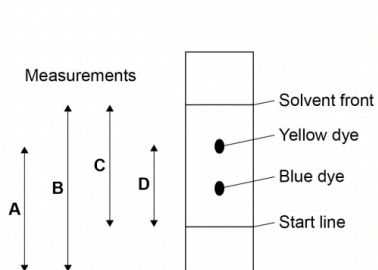
This question is about ink.

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



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]

$R_f =$ _____

Q2.b)(2020)

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

☐

Q2.c)(2020)

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

Q2.d)(2020)

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

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

[1 mark]

Yellow dye : Blue dye = _____ : _____

Q2.e)(2020)

Which word correctly describes the green ink?

[1 mark]

Tick (✓) **one** box.

Compound

☐

Element

☐

Formulation

☐

Solvent

☐

Q2.f)(2020)

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.

☐

Q3.a)(2021)

Chemical Analysis

<http://www.pcfgstudy.com>

This question is about paper chromatography.

A food colouring contains a dye.

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]

Q3.b)(2021)

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

☐

Q3.c)(2021)

Paper chromatography involves a stationary phase.

What is the stationary phase in paper chromatography?

[1 mark]

Tick (✓) **one** box.

Beaker

☐

Dye

☐

Paper

☐

Solvent

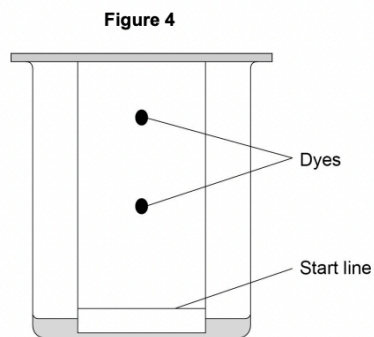
☐

Q4.(2022)

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.



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

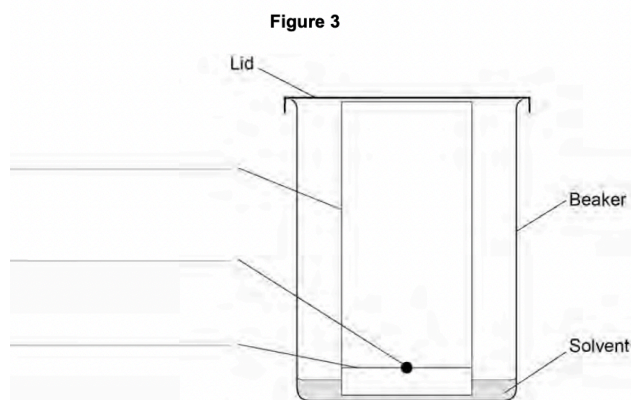
[4 marks]

Q5.a)(2023)

This question is about chromatography.

A student investigated an orange dye using paper chromatography.

Figure 3 shows the apparatus at the start of the investigation.

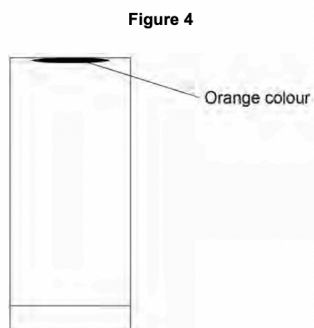


Complete the labels on **Figure 3**.

[3 marks]

Q5.b)(2023)

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



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

☐

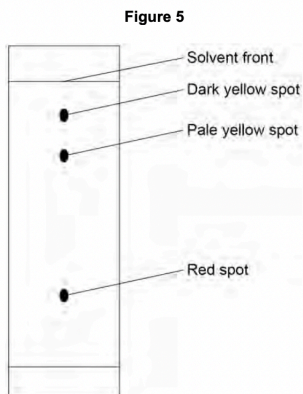
Used a solvent which did not dissolve the dye

☐

Q5.c)(2023)

A different student did the investigation correctly.

Figure 5 shows the results.



How do the results in **Figure 5** show that the orange dye is **not** a pure substance?
[1 mark]

Q5.d)(2023)

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 = _____

Q5.e)(2023)

Which spot had the greatest R_f value?

Use **Figure 5**.

[1 mark]

Tick (✓) **one** box.

Dark yellow spot

☐

Pale yellow spot

☐

Red spot

☐

Q6.a)(2024)

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.

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]

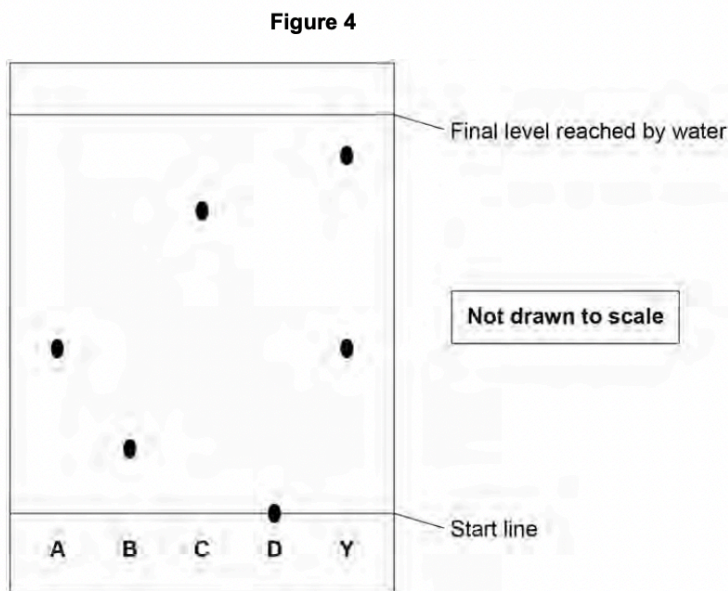
Mistake _____

Reason _____

Q6.b)(2024)

A different student used a method which gave valid results.

Figure 4 shows the results.



How many different dyes are in substance Y?

Use **Figure 4**.

[1 mark]

Q6.c)(2024)

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 _____

Q6.d)(2024)

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

Use **Figure 4**.

[1 mark]

Q6.e)(2024)

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:

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

[2 marks]

$R_f =$ _____

Q6.f)(2024)

Complete the sentence.

Choose the answer from the box.

[1 mark]

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