

(Chromatography (Rf values, separation techniques))

Q1. a). (2018)

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

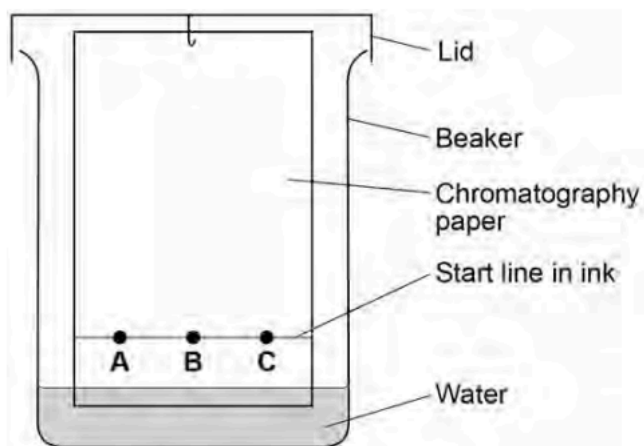
The colours are soluble in ethanol but are insoluble in water.

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



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 _____

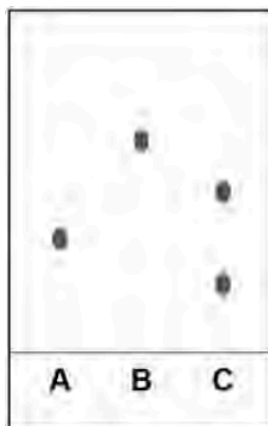
Problem caused _____

Q1. b). (2018)

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 _____

Q1. c). (2018)

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

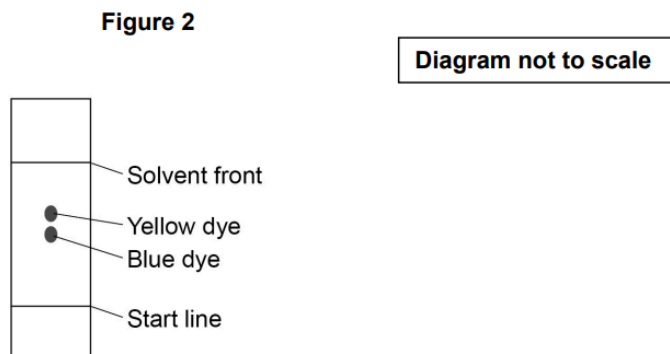
Q2. a). (2020)

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.



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

The green ink contains more than two compounds.

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

[1 mark]

Q2. c). (2020)

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.

☐

Q2. d). (2020)

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

Suggest **one** reason why.

[1 mark]

Q3. (2020)

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.

☐

Q4. (2021)

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]

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

☐

Q6. (2021)

Paper chromatography involves a stationary phase.

What is the stationary phase in paper chromatography?

[1 mark]

Tick (✓) **one** box.

Beaker

☐

Dye

☐

Paper

☐

Solvent

☐

Q7. a). (2023)

This question is about chromatography.

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

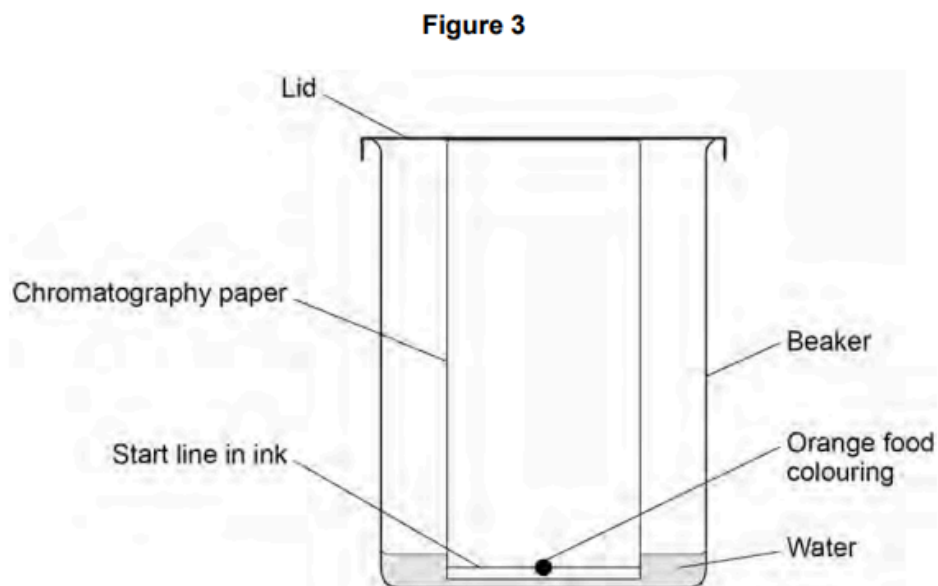
The food colouring:

- 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.

Figure 3 shows how the student set up the apparatus.



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

Give **two** mistakes the student made.

[2 marks]

1 _____

2 _____

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

Determine value **X** in **Table 3**.

[3 marks]

X = _____ cm

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

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

Use **Table 3**.

[3 marks]

Q7. d). (2023)

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

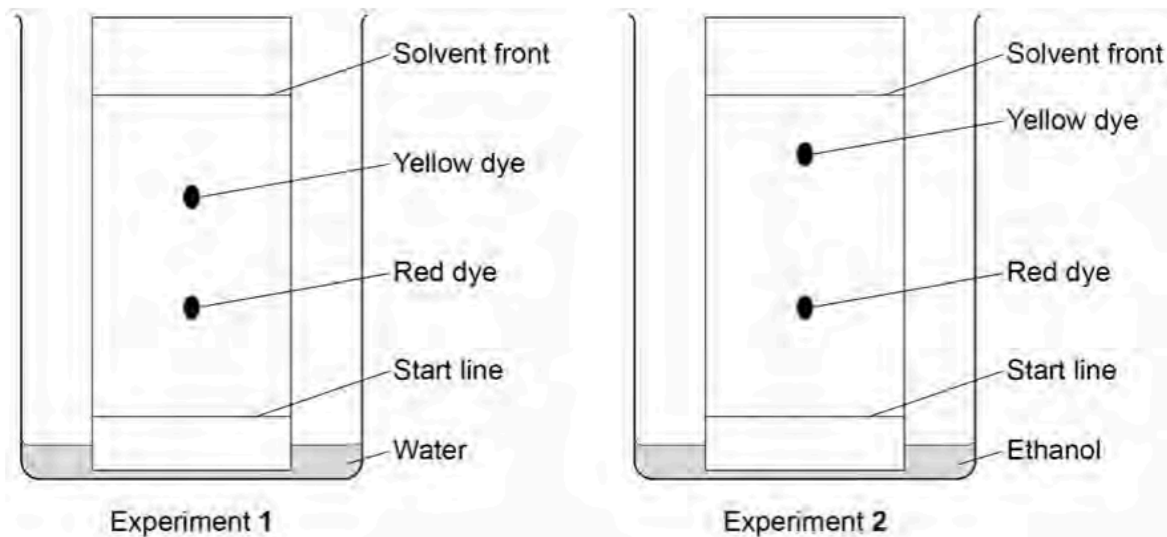
[1 mark]

Q8. a). (2024)

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



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]

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**.

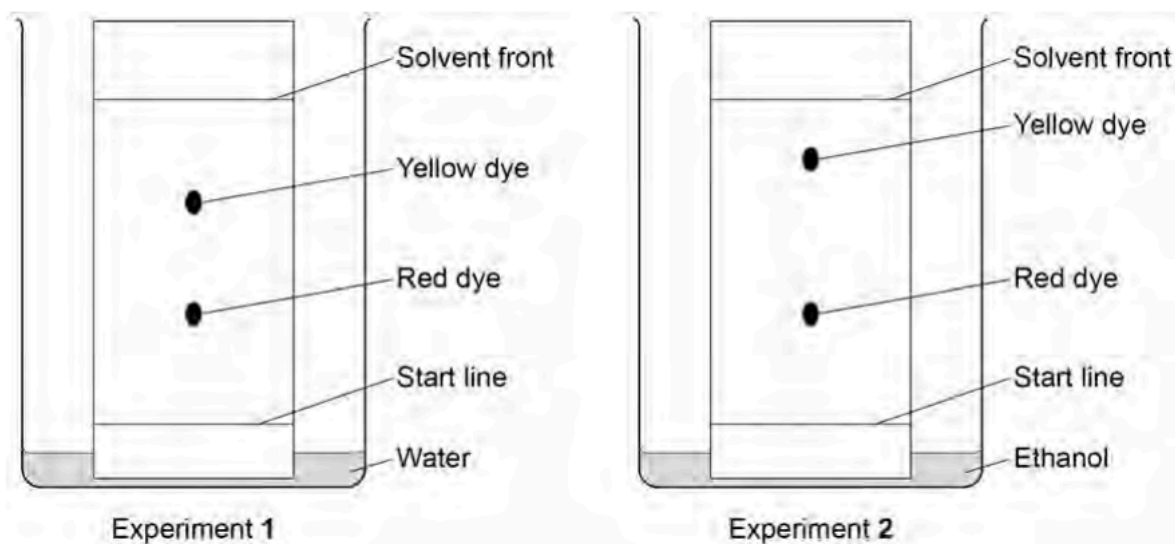
[3 marks]

Q8. c). (2024)

Figure 4 is repeated below.

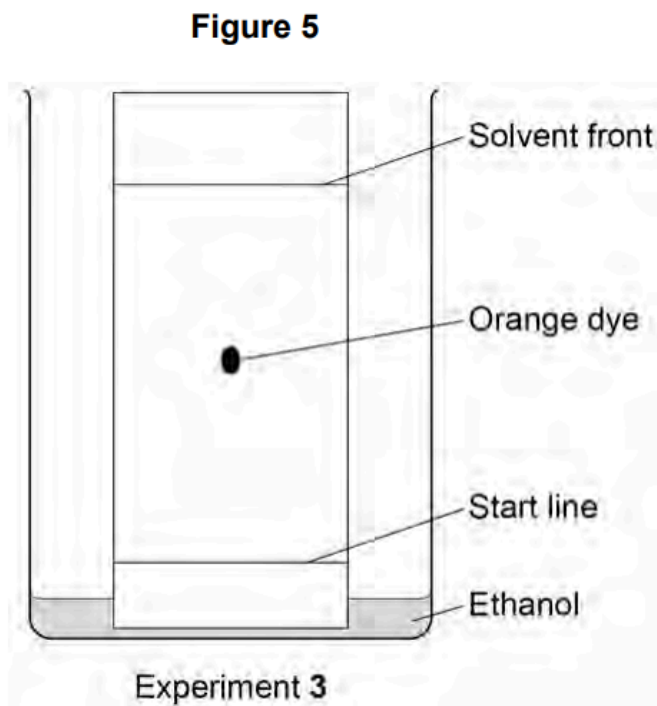
Figure 4 shows the results of Experiment 1 and Experiment 2 using orange dye **A**.

Figure 4



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

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



Compare the purity of the orange dyes **A** and **B**.

Give reasons for your answer.

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

[2 marks]

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

Q9. (2024)

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

[1 mark]
