1. 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.

(a) The filtrate was a very pale coloured solution.

How could the student obtain a darker coloured solution?

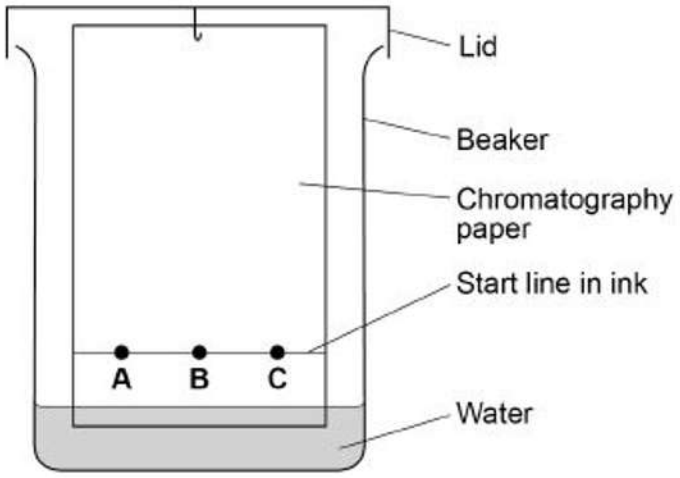
Tick **two** boxes.

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

(2)

(b) **Figure 1** shows the apparatus used.

Figure 1



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

Tick **two** boxes.

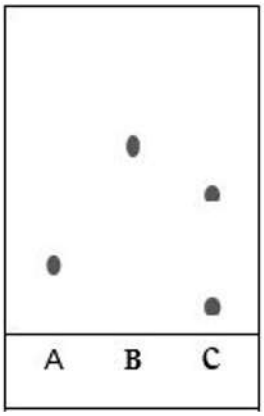
- The paper does not touch the beaker ☐
- The start line is drawn in ink ☐
- The water level is below the start line ☐
- Uses a lid on the beaker ☐
- Uses water as the solvent ☐

(2)

(c) Another student sets up the apparatus correctly.

Figure 2 represents the student's results.

Figure 2



What **two** conclusions can be made from **Figure 2**?

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 ☐

(2)

(d) 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)

(Total 8 marks)

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

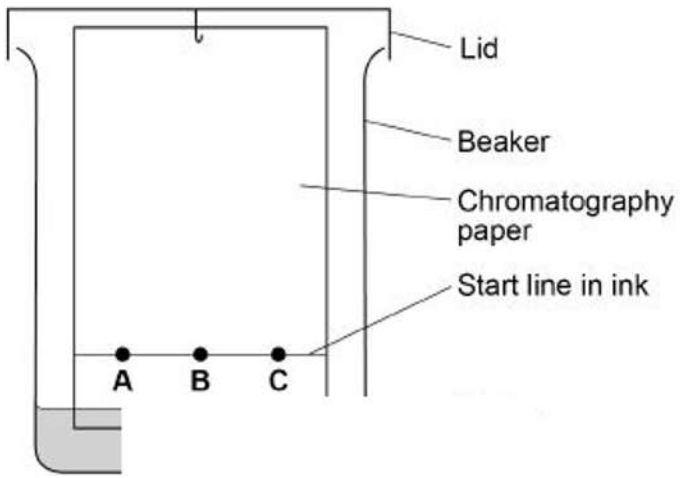
The colours are soluble in ethanol but are insoluble in water.

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 1 shows the apparatus used.

Figure 1



(a) The student made **two** mistakes in setting up the apparatus.

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

Mistake 1 _____

Problem caused _____

_____

Mistake 2 _____

Problem caused _____

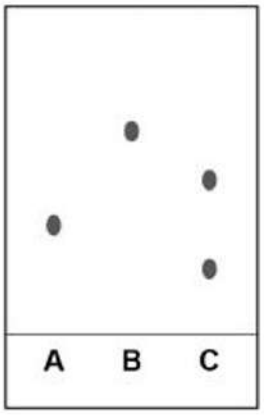
_____

(4)

(b) Another student set up the apparatus correctly.

Figure 2 represents the student's results.

Figure 2



Give **two** conclusions you can make from **Figure 2**.

1. _____

_____

2. _____

_____

(2)

(c) Colour **A** has an R_f value of 0.65

Colour **A** moves 3.2 cm

Calculate the distance moved by the solvent.

_____

_____

Distance moved by the solvent = _____ cm

(2)

(Total 8 marks)

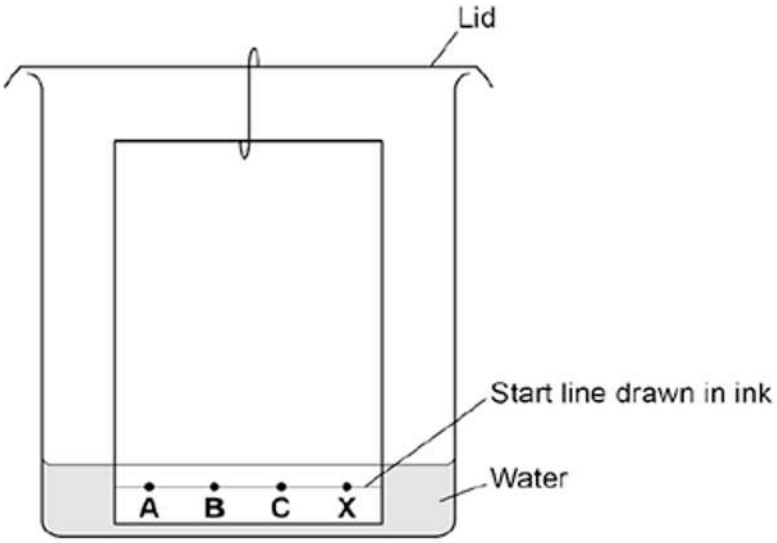
3. A student investigated a food colouring using paper chromatography.

This is the method used.

1. Put a spot of food colouring **X** on the start line.
2. Put spots of three separate dyes, **A**, **B** and **C**, on the start line.
3. Place the bottom of the paper in water and leave it for several minutes.

(a) **Figure 1** shows the apparatus the student used.

Figure 1



Give **two** mistakes the student made in setting up the experiment.

Tick **two** boxes.

The lid was on the beaker. ☐

The paper did not touch the bottom of the beaker. ☐

The spots were too small. ☐

The start line was drawn in ink. ☐

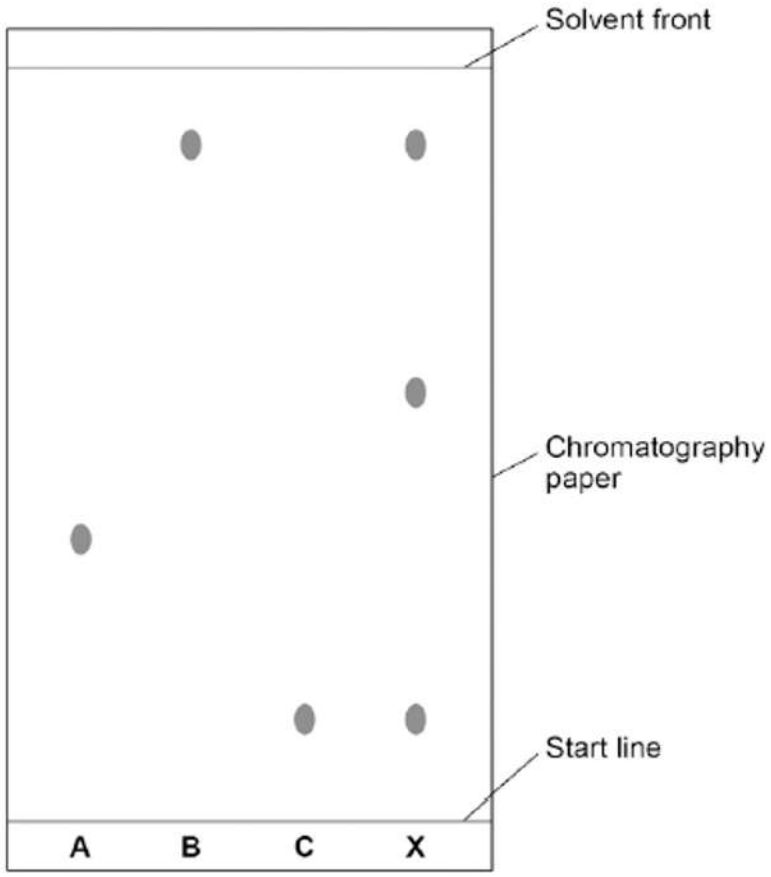
The water level was above the spots. ☐

(2)

(b) Another student set the experiment up correctly.

Figure 2 shows the student's results.

Figure 2



How many dyes were in **X**?

Tick **one** box.

1		**3**		**4**		**6**	

(1)

(c) Which dye, **A**, **B** or **C**, is **not** in **X**?

Write your answer in the box. ☐

(1)

(d) Use **Figure 2** to complete the table below.

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

	Distance in mm
Distance moved by dye **A**	_____
Distance from start line to solvent front	_____

Use the equation:

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

Give your answer to two significant figures.

_____

_____

_____

R_f value = _____

(5)

(Total 9 marks)

4. Read the article.

Problem food colourings

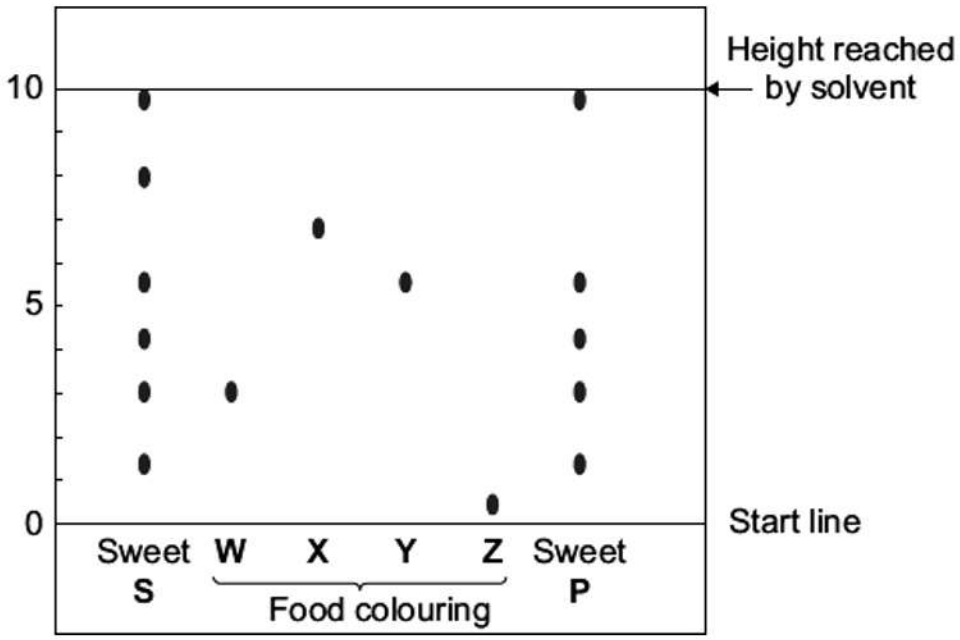
Scientists say they have evidence that some food colourings cause hyperactive behaviour in young children.

These food colourings are added to some sweets.

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

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

The results are shown on the chromatogram.



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

Suggest **one** reason why.

_____

_____

(1)

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

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

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

(1)

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 5 marks)

5. This question is about mixtures and analysis.

(a) Which **two** substances are mixtures?

Tick **two** boxes.

Air	☐
Carbon dioxide	☐
Graphite	☐
Sodium Chloride	☐
Steel	☐

(2)

(b) Draw **one** line from each context to the correct meaning.

Context	Meaning
	A substance that has had nothing added to it
Pure substance in chemistry	A single element or a single compound
	A substance containing only atoms which have different numbers of protons
Pure substance in everyday life	A substance that can be separated by filtration
	A useful product made by mixing substances

(2)

(c) What is the test for chlorine gas?

Tick **one** box.

A glowing splint relights ☐

A lighted splint gives a pop ☐

Damp litmus paper turns white ☐

Limewater turns milky ☐

(1)

(d) A student tested a metal chloride solution with sodium hydroxide solution.

A brown precipitate formed.

What was the metal ion in the metal chloride solution?

Tick **one** box.

Calcium ☐

Copper(II) ☐

Iron(II) ☐

Iron(III) ☐

(1)

(Total 6 marks)