

GCSE Chemistry

Worksheet: Chromatography

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
-----------------------	--------------------------	------------------------------	-----------------------------------

Topics: Chromatography

NAME _____ **CLASS** _____ **DATE** _____

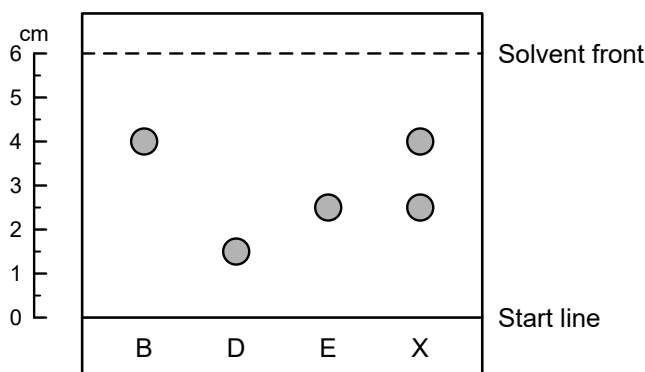
- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

A student used paper chromatography to compare an unknown mixture, X, with three reference dyes, B, D and E.

Figure 1 shows the chromatogram, drawn to scale.

Figure 1



0 1 . 1

How many different substances does mixture X contain?

.....

.....

.....

[1 mark]

0 1 . 2

The solvent front moved 6.0 cm from the start line.

Use Figure 1 to calculate the R_f value of dye B.

Use the equation:

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

.....

.....

.....

.....

R_f value =

[2 marks]

0 2

0 2 . 1

Complete the sentences about paper chromatography using words from the list.

insoluble mobile soluble stationary

The paper is the phase.

The solvent is the phase.

A dye that is completely in the solvent will stay on the start line.

.....

.....

.....

.....

.....

.....

[3 marks]

0 2 . 2

A pencil line is used to mark the start line, rather than a pen.

Give the reason why.

.....

.....

[1 mark]

0 3

A student uses paper chromatography to compare two solvents, water and a mixture of water and ethanol, for separating three food dyes, X, Y and Z.

0 3 . 1

Why should the start line be drawn in pencil and not in ink?

.....

.....

[1 mark]

0 3 . 2

Why must the start line be above the level of the solvent in the beaker?

.....

.....

[1 mark]

0 3 . 3

What is the independent variable in this investigation?

Tick (✓) **one** box.

The distance moved by each dye

☐

The solvent used

☐

The type of paper

☐

The R_f value of each dye

☐

[1 mark]

0 3 . 4

Give **one** variable the student should keep the same.

.....

.....

[1 mark]

0 3 . 5

The water-ethanol mixture is flammable.

Give **one** safety precaution the student should take.

.....

.....

[1 mark]

0 4

0 4 . 1

In paper chromatography, what is the mobile phase?

Tick (✓) **one** box.

The paper

☐

The solvent

☐

The start line

☐

The spots of dye

☐

[1 mark]

0 4 . 2

Why is the start line on a chromatogram drawn in pencil and not in ink?

.....

.....

[1 mark]

0 4 . 3

A pure substance is tested using three different solvents.

How many spots would you expect on each chromatogram?

.....

.....

.....

.....

[1 mark]

0 4 . 4

Complete the equation for the R_f value of a substance.

$R_f = \dots\dots\dots$

.....

.....

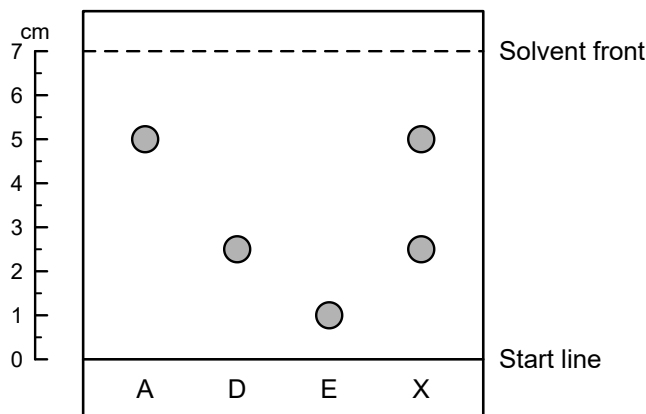
[1 mark]

0 5

A student used paper chromatography to compare an unknown mixture, X, with three reference dyes, A, D and E.

Figure 2 shows the chromatogram, drawn to scale.

Figure 2



0 5 . 1

Use Figure 2 to calculate the R_f value of dye A.

.....

.....

.....

.....

R_f value =

[2 marks]

0 5 . 2

Which of the reference dyes A, D and E are in mixture X?
Give a reason for your answer.

.....

.....

.....

.....

[2 marks]

0 6

Using the water-ethanol solvent, dye X moved 6.9 cm from the start line and the solvent front moved 9.2 cm from the start line. The student measured to the centre of the spot, using a ruler marked in millimetres.

0 6 . 1

Calculate the R_f value of dye X.

.....

.....

.....

.....

$R_f =$

[2 marks]

0 6 . 2

Explain why the R_f value is more uncertain than the resolution of the ruler (1 mm) suggests.

.....

.....

.....

.....

[2 marks]

0 6 . 3

A different student, using a new piece of chromatography paper with the same dye and solvent, obtained an R_f value of 0.74 for dye X.

What does this show about the first student's result? Give a reason for your answer.

.....

.....

.....

.....

[2 marks]

0 7

A student used paper chromatography to find out how many dyes are in a food colouring. The student put a spot of the food colouring on a pencil line 2 cm from the bottom of the paper. The student placed the paper in a beaker containing water to a depth of 1 cm and put a lid on the beaker.

0 7 . 1

Give **one** reason why the water must be below the pencil line.

.....

.....

[1 mark]

0 7 . 2

Give **one** reason why the student put a lid on the beaker.

.....

.....

[1 mark]

0 7 . 3

The water moved 7.5 cm from the pencil line. One dye moved 5.4 cm. Calculate the R_f value of this dye. Give your answer to 2 significant figures.

.....

.....

.....

.....

R_f value =

[2 marks]

0 7 . 4

One dye did not move from the pencil line. Suggest why.

.....

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Chemistry · Worksheet: Chromatography · 31 marks

Question 1 (3 marks)

01.1 [1 mark]

Answer: 2

- 2 / two (1)
-

01.2 [2 marks]

Answer: 0.67

- distance moved by B = 4.0 cm (1)
- (R_f =) $4.0 \div 6.0 = 0.67$ (1)

Notes: Allow 0.65–0.68.

Question 2 (4 marks)

02.1 [3 marks]

Answer: stationary; mobile; insoluble

- stationary (1)
 - mobile (1)
 - insoluble (1)
-

02.2 [1 mark]

- pencil (marks / graphite) does not dissolve in the solvent, so the start line does not move and interfere with the results (1)
-

Question 3 (5 marks)

03.1 [1 mark]

Answer: Pencil does not dissolve in the solvent, but ink would dissolve and move up the paper.

- pencil (graphite) does not dissolve in the solvent / does not move up the paper, but ink would dissolve and separate (1)

03.2 [1 mark]

Answer: So that the dyes do not dissolve into the solvent in the beaker.

- so the dyes do not dissolve / wash into the solvent in the beaker (1)

03.3 [1 mark]

Correct: The solvent used

03.4 [1 mark]

Answer: The type of chromatography paper.

- type of paper / size of the dye spots / distance the solvent is allowed to travel / temperature / volume of solvent in the beaker (1)

03.5 [1 mark]

Answer: Keep the solvent away from naked flames.

- keep it away from naked flames / make sure no Bunsen burners are lit nearby (1)

Question 4 (4 marks)

04.1 [1 mark]

Correct: The solvent

04.2 [1 mark]

- pencil does not dissolve in the solvent / pencil will not move up the paper (1)

Notes: Allow 'ink would dissolve / separate and move up the paper'.

04.3 [1 mark]

Answer: 1

- 1 / one (in each solvent) (1)

04.4 [1 mark]

Answer: distance moved by substance ÷ distance moved by solvent

- (R_f =) distance moved by substance ÷ distance moved by solvent (1)
-

Question 5 (4 marks)

05.1 [2 marks]

Answer: 0.71

- distance moved by A = 5.0 cm and distance moved by the solvent = 7.0 cm (1)
- ($R_f =$) $5.0 \div 7.0 = 0.71$ (1)

Notes: Allow 0.70–0.73.

05.2 [2 marks]

Answer: A and D

- A and D (1)
- the spots in X are at the same heights as (have the same R_f values as) the spots of A and D (1)

Notes: Both letters are needed for the first mark. Max 1 mark if an extra letter is given.

Question 6 (6 marks)

06.1 [2 marks]

Answer: 0.75

- $R_f = 6.9 \div 9.2$ (1)
- = 0.75 (1)

Notes: A correct answer with no working scores 2 marks.

06.2 [2 marks]

Answer: The spot is spread out with fuzzy edges, so it is hard to judge exactly where its centre is; this is a bigger uncertainty than 1 mm.

- the spot is spread out / has fuzzy edges, so it is difficult to judge exactly where its centre is (or exactly where the solvent front is) (1)
- this uncertainty is larger than the resolution of the ruler (1 mm) (1)

06.3 [2 marks]

Answer: It is reproducible: a different person obtained a very similar value.

- the result is reproducible (1)
- a different person (with different paper) obtained a very similar value (0.74 compared with 0.75) (1)

Notes: Do not accept 'repeatable' for the first mark.

Question 7 (5 marks)

07.1 [1 mark]

- so that the dyes do not dissolve into the water in the beaker (1)

Notes: Allow 'so the spot is not washed off the paper'.

07.2 [1 mark]

- to stop the water / solvent evaporating (1)
-

07.3 [2 marks]

Answer: 0.72

- $5.4 \div 7.5$ (1)
- 0.72 (1)

Notes: An answer of 0.72 scores 2 marks.

07.4 [1 mark]

- the dye is insoluble in water / in the solvent (1)
-