**Chromatography: knowledge check**

1. Learners are completing an experiment to separate the coloured soluble substances in two different food dyes.

The diagram shows the apparatus used and the chromatogram produced.

Label the diagram using some of the words provided.

**chromatography paper origin line solvent solution**

**solvent front food colouring solute**

A diagram of a cylinder. Inside the cylinder is a rectangle suspended at the top by two wires. At the bottom of the cylinder is some liquid. Just above the bottom of the cylinder is a line with two black circles, labelled A and B. Above the circle A is a black oval labelled P. Above the circle B are three black ovals labelled Z, Y and X. Close to the top of the rectangle there is a line across it.
There are 5 arrows pointing to different parts of the diagram with label lines to be filled in.
The first label to fill in is on the left side of the diagram and points at the black oval above the circle A.
The next label line to complete points at the line at the top of the rectangle. Then there is a label line to complete pointing at the rectangle itself. The next label line down is pointing at the line at the bottom of the rectangle that circles A and B sit on. The final label line to complete is pointing to the liquid at the bottom of the cylinder.

**Questions 1.2 to 1.4 are about the experiment in question 1.1.**

1. The table shows the steps in the chromatography process used to separate the coloured substances, but they are given in the wrong order.

Add numbers to show the correct order for the steps. The first has been done for you.

|  |  |
| --- | --- |
| **1** | Draw an origin line in pencil about 1.5 cm from one end of the chromatography paper. |
|  | Place the paper inside the beaker. Make sure it just touches the water and it is vertical. |
|  | Check the paper is the right length by lining it up on the outside of the beaker so that the water is below the origin line. |
|  | Use a pipette to add small drops of food colourings **A** and **B** on the chromatography paper. |
|  | Allow the solvent to move through the paper, removing it before the solvent reaches the top. |

1. Use some of the words to complete the gaps in the following sentences.

**rates mobile phase stationary phase**

**chromatography paper solvent solute solution**

The chromatography paper is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ . The solvent is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ . The different dissolved substances in a mixture are attracted to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the chromatography paper in different proportions. This causes them to move at different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ up the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

1. Use some of the words to complete the gaps in the following sentences.

**pure impure compound one**

**two or more three**

A pure substance contains one type of element or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ only.

An impure substance contains \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ different elements or compounds. Food colouring A consists of one substance and is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ substance.

Food colouring B contains \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ different coloured substances. Food colouring B is an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ substance.

**Chromatography: test myself**

1. What type of mixtures can paper chromatography be used to separate?

[*Hint: Think about whether the substances would be soluble or insoluble.*]

1. This is a chromatogram of four different inks.

A chromatogram of four coloured inks. 
A line across the bottom of the chromatogram is labelled pencil line.
On the far left is the word yellow under the pencil line. About half way up the chromatogram is a single spot of yellow.
Next is the word red under the pencil line and a short way above that is a single spot of red.
Next is the word blue under the pencil line and a single spot of blue almost at the top of the chromatogram.
Finally is the word brown under the pencil line and three spots above it. The first spot is red and a short way above the line, then a spot of yellow about half way up the chromatogram and almost at the top is a blue spot.

Circle the inks on the chromatogram that are pure substances.

1. How is chromatography used to identify unknown substances?

[*Hint: Think about what can be measured and compared on a chromatogram.*]

1. Thin layer chromatography uses a glass plate coated with alumina or silica gel.

What does this glass plate replace in the experiment in **question 1.1**?

1. This is a chromatogram of dark blue ink.

A paper chromatography diagram.
The image is a rectangle. Almost at the bottom of the rectangle is a dotted line labelled origin. 2 cm above that is a red spot. 6 cm from the origin is a purple spot. 8 cm from the origin is a blue spot. 10 cm from the origin is the solvent front.

The equation used to calculate the *Rf* value is:

*Rf* **=**

Use the data shown in the chromatogram, along with the equation, to calculate the correct *Rf* values for the red, purple and blue substances.

|  |  |
| --- | --- |
| **Substance** | ***Rf* values** |
| Red |  |
| Purple |  |
| Blue |  |

1. A compound has a *Rf* value of 0.6. If the solvent travels 16.0 cm up the chromatography paper, what is the distance travelled by the compound?

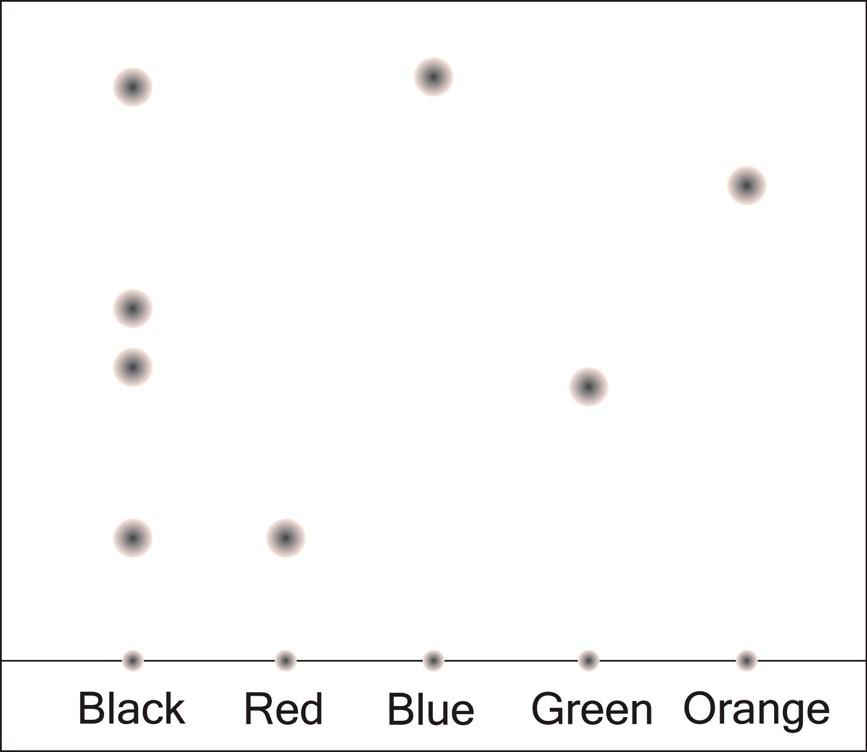
Use the equation to calculate the answer in cm.

**=** *Rf*

**Chromatography: feeling confident?**

1. This is a chromatogram of different coloured inks.

What can you conclude about the black ink from the chromatogram shown?



Use the words in your answer. The first sentence has been started to help you.

**black ink red blue green orange**

My conclusion is that the **black ink** contains

1. Substances **A**, **B** and **C** are found in chlorophyll. The *Rf* values of these three substances can be determined using thin layer chromatography and an organic solvent.

The equation used to calculate the *Rf* value is:

*Rf* **=**

Use the equation to calculate the missing values in the table.

|  |  |  |
| --- | --- | --- |
| **Substance** | **Distance travelled by the substance when the solvent travels 10 cm (cm)** | ***Rf* value** |
| A |  |  |
| B |  |  |
| C |  |  |

**Chromatography: what do I understand?**

Think about your answers and confidence level for each mini-topic. Decide whether you understand it well, are unsure or need more help. Tick the appropriate column.

|  |  |  |  |
| --- | --- | --- | --- |
| **Mini-topic** | **I understand  this well** | **I think I understand this** | **I need more  help** |
| I can describe the process of paper chromatography. |  |  |  |
| I can describe how to prepare a chromatogram. |  |  |  |
| I can define a pure substance and an impure substance |  |  |  |
| I can interpret a chromatogram. |  |  |  |
| I can calculate *Rf* values. |  |  |  |
| I can use *Rf* values. |  |  |  |
| **Feeling confident? topics** | **I understand  this well** | **I think I understand this** | **I need more  help** |
| I can interpret chromatograms of coloured inks. |  |  |  |
| I can interpret and use information from chromatograms of chlorophyll. |  |  |  |