

GUINNESS WORLD

RECORD ATTEMPT

Largest Practical Science Lesson

Separations



Police rely on science to help them catch criminals. You will use a separating method called chromatography to help solve a crime.

Chromatography is used by scientists working with foods or dyes if they need to find out what is in the colour.



We are learning about mixtures and how they can be separated. Some substances dissolve in water and others don't. This allows us to separate them.

Stage 1: Dissolving

Make a mixture of salt and pepper. Add some water. What happens?

Stage 2: Filtration

How can we separate the pepper from the salty water?

Stage 3: Chromatography:

The ink in the markers contains different colours. You can find out what colours they are.

The colour of my pen was _____.

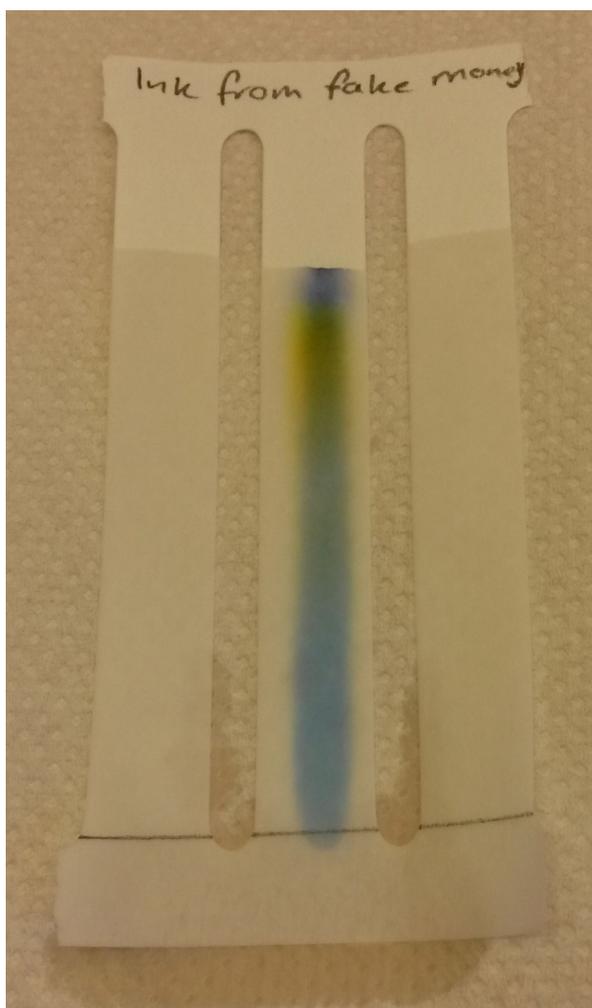
When I put a dot of it onto the paper and dipped it in water, the colours I could see were:

Crime Investigation:

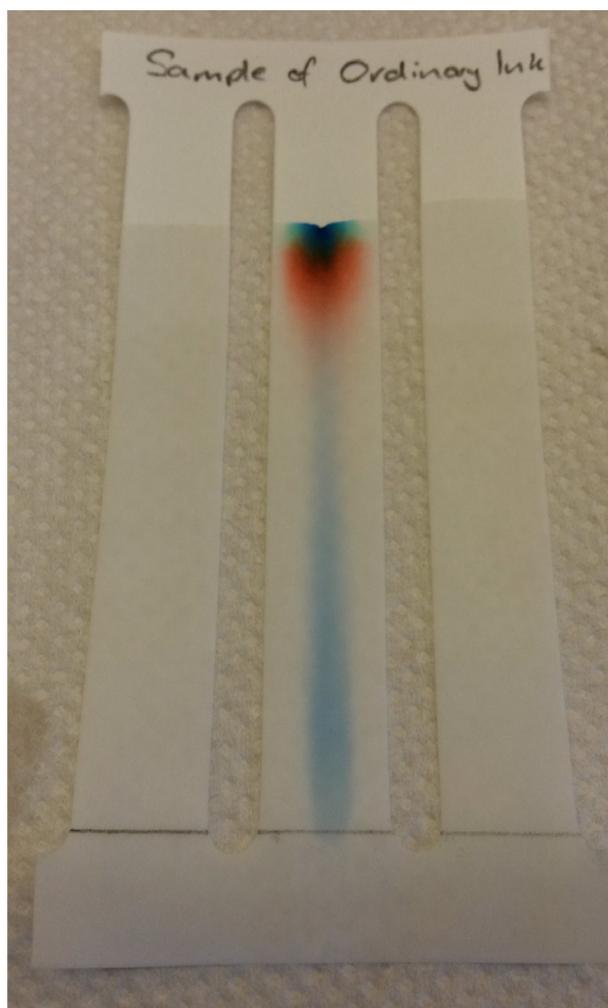
Lots of fake banknotes have been spent in Belfast recently. The police are now investigating. The only difference between these notes and real money is one of the inks that has been used for the signature.

Chromatography can be used to separate the different coloured dyes used to make an ink. When the ink from the banknotes is investigated, the following chromatograms (chromatography patterns) are produced.

Ink from fake banknotes:



Ordinary ink:



Today, police raided a number of printing companies. They have taken a huge number of ink samples. To cut down on the work for their scientists, they have asked for your help.

Can you analyse the samples provided and let us know if any of them match the ink used by the criminals when making their banknotes.

Case Number: _____

Sample Number: _____

Record your results in the table below:

Result	✓ or X	Action
Ink similar to ink in forged money		Further police action required
Ink similar to ordinary ink		No further police action required
Another different ink		No further action required

Key Words:

Separate

Dye

Chromatography

Chromatogram

Mixture

Dissolve

Filter

Questions:

1. Many sweets contain artificial dyes.



image © iStock/Thinkstock.com

Mary is given a packet of sweets. The label states that the red sweets in the packet contain dyes 'Red 40' and 'Red 3'.

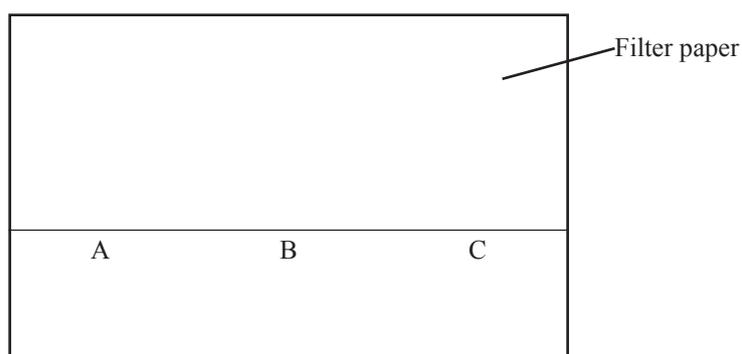
- (a) Complete the following sentence:

Different coloured dyes may be separated by a technique called

_____ [1]

- (b) Mary uses this technique to test for 'Red 40' and 'Red 3' in the sweets. She is provided with:

- sample of 'Red 40',
- sample of 'Red 3'
- a liquid made of crushed sweets
- a piece of filter paper marked as shown in the diagram
- a large plastic cup
- water



- (i) What will she put on the filter paper at the positions A, B, C?

_____ [1]

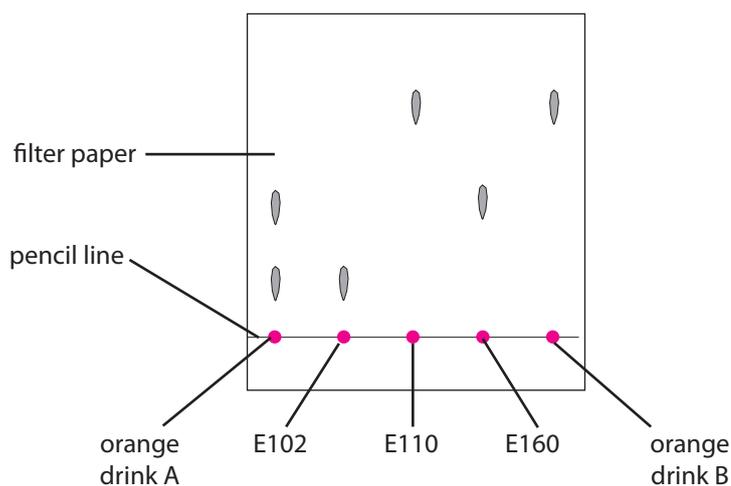
- (ii) The sweets contain both 'Red 40' and 'Red 3'. On the diagram of the filter paper above, draw what Mary should expect to see after her experiment. [3]

2. Create a poster which explains what you have learnt today to show your teacher.

A large, empty rectangular box with a thin black border, intended for a student to create a poster. The box occupies most of the page below the instruction.

3. Mary investigated the food colourings in two types of orange drink A and B. She wanted to see if the Orange drinks contained food colourings E102, E110 or E160.

Mary took a piece of filter paper and drew a pencil line across it. She put a drop of each orange drink and a drop of each food colouring on the pencil line. Mary then stood the filter paper in a clear cup of water and left it until the water reached the top of the filter paper. Her results are shown below:



- (a) What is the name of the process Mary used to investigate the presence of food colourings in the two orange drinks?

_____ [1]

- (b) (i) Orange drink A contains the food colouring E102. How do Mary's results show this?

_____ [1]

- (ii) What other food colouring does orange drink A contain?

_____ [1]

- (iii) Draw a spot on the diagram of Mary's results to show what it would look like if orange drink B contained food colouring E160.

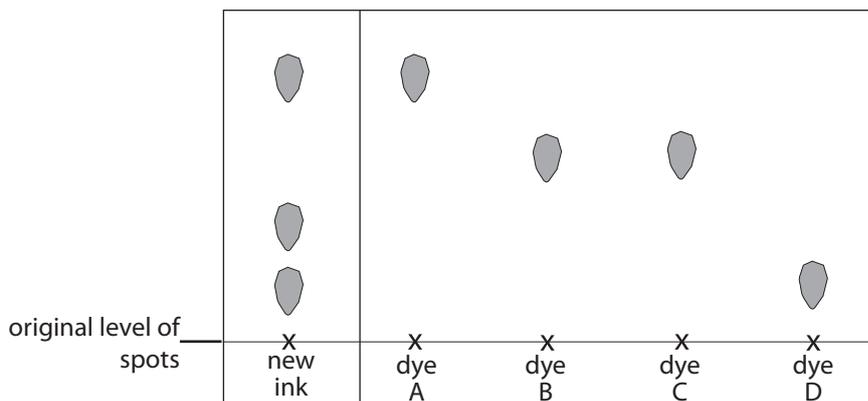
[1]

- (c) The line across the bottom of the filter paper was drawn with a pencil not with ink. Why should the line not be drawn with ink?

_____ [1]

4. A new ink contains a mixture of dyes and a scientist is required to find out if it is safe for general use.

Chromatography is used to see which dyes are in the ink. The dyes in the new ink are compared to dyes A, B, C and D. The dye D is harmful. The results of the chromatography are shown below:



- (a) Which two dyes are identical?

_____ [1]

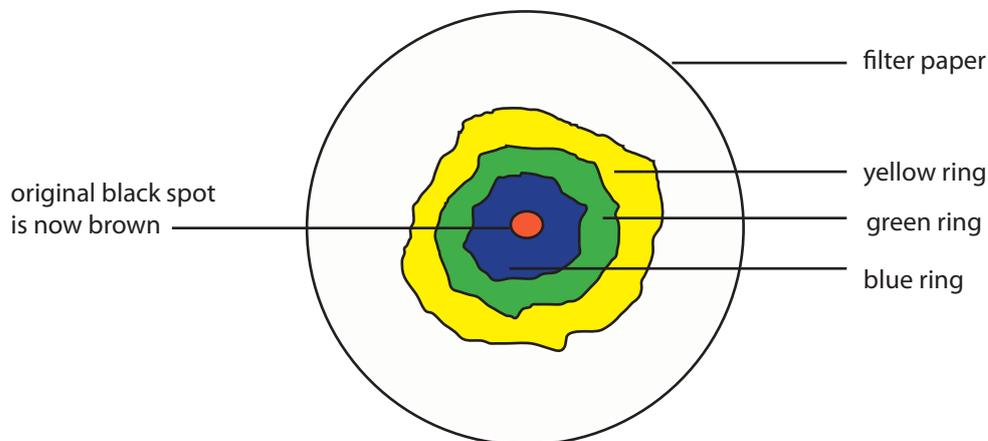
- (b) Which dyes can be identified in the new ink?

_____ [1]

- (c) Explain why, as a scientist, you would not pass the new ink for general use.

_____ [1]

5. Peter wanted to find out if there are different dyes in black ink. He put some black ink in the middle of a piece of filter paper. Next he added drops of water on to the black ink. Coloured rings formed as the water spread over the filter paper. A brown spot remained in the middle.



- (a) (i) From the diagram, how can you tell that not all the substances in black ink were dissolved in the water?

_____ [1]

- (ii) Which coloured dye dissolved best in the water?

_____ [1]

- (b) Peter got some of the black ink on his shirt. The shirt was washed but a stain remained. What colour was the stain?

_____ [1]

