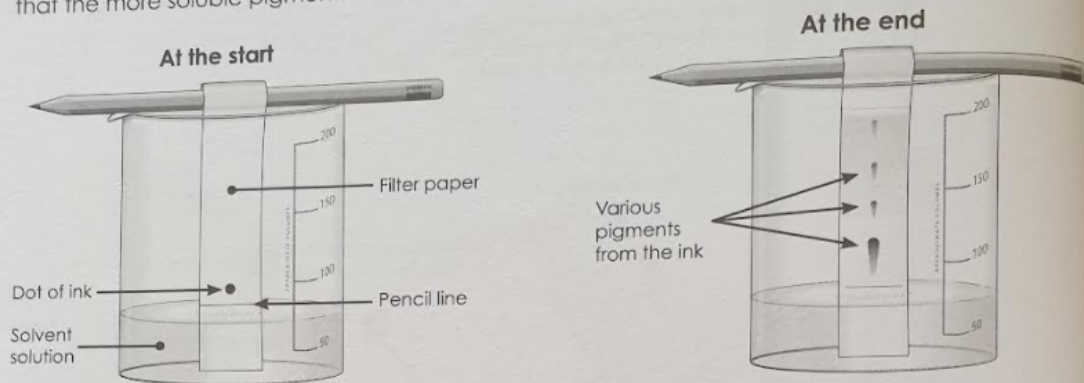


Chromatography - Separating a Mixture of Colours

Chromatography (*chroma* - Greek for 'colour' and *graphy* meaning 'words' or 'pictures') is a scientific technique used to separate a mixture of two or more coloured pigments, such as inks and dyes. The pigments separate because they have different solubilities in a solvent. This means that the more soluble pigments are carried faster, and therefore further, by the rising solvent.



Separating a Mixture using Chromatography

Aim: To separate the different pigments in inks or dyes using paper chromatography.

Equipment: Inks from ballpoint pens, marker pens or food colouring, 250 mL beaker, strip of filter paper, scissors, adhesive tape, pencil or ice-block stick, chromatography solution.

Method: 1. Cut a strip of filter paper that is long enough to reach the bottom of your beaker and able to wrap around your pencil or ice-block stick.



2. Rule a line in pencil approximately 2 cm from the bottom of your piece of paper.

3. Fill your beaker with enough chromatography solution to fill your beaker to a depth of 1 cm.



Chromatography solution

4. Place a dot of ink above the ruled line on your filter paper. You need to produce a concentrated dot of ink so repeated applications may be necessary.

5. Suspend the strip of paper from the pencil or stick. You may need to use adhesive tape to stop it from falling into the solution.

6. Wait to see what happens. It is important that you do not disturb the beaker. If the solution comes in contact with the ink dot, the ink will run down into the solution, rather than move up the filter paper.

Observations: _____

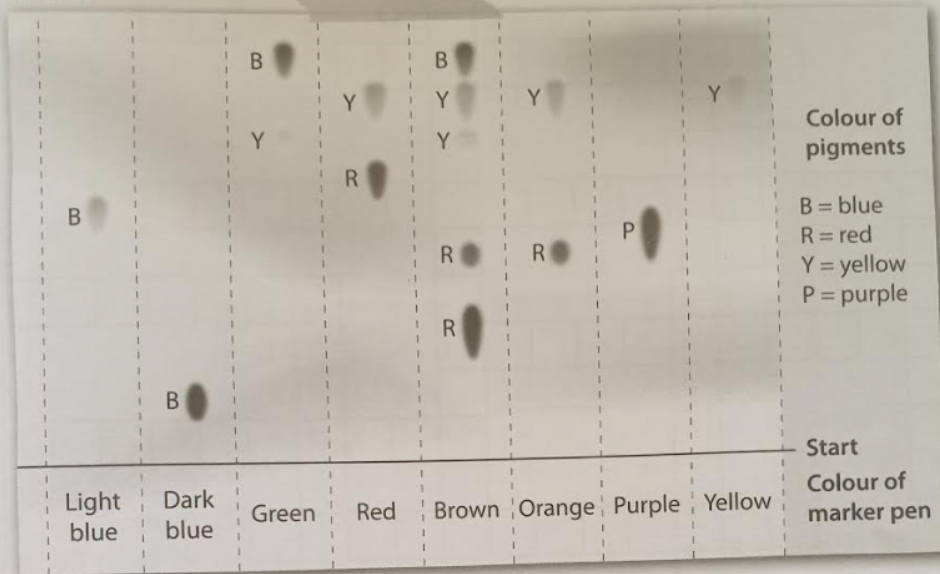
1. Outline the origin of the term *chromatography*. _____

2. Describe the type of mixtures that chromatography can separate. _____

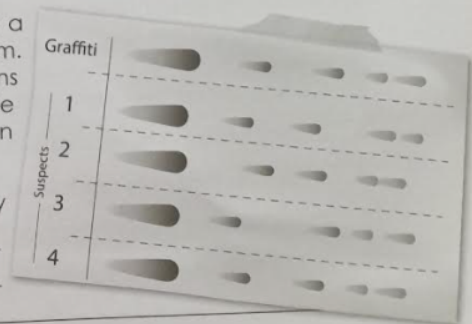
3. Explain why the pigments separate. _____

4. Which pigments are carried the furthest by the solvent? _____

5. Why should the 'start line' always be drawn in pencil? _____
6. Explain why the solvent level must be lower than the sample spots on the filter paper. _____
7. The chromatogram below was obtained using a set of felt-tip pens and water as the solvent. (Note: Spots of the same colour and same height can be assumed to be the same substance.

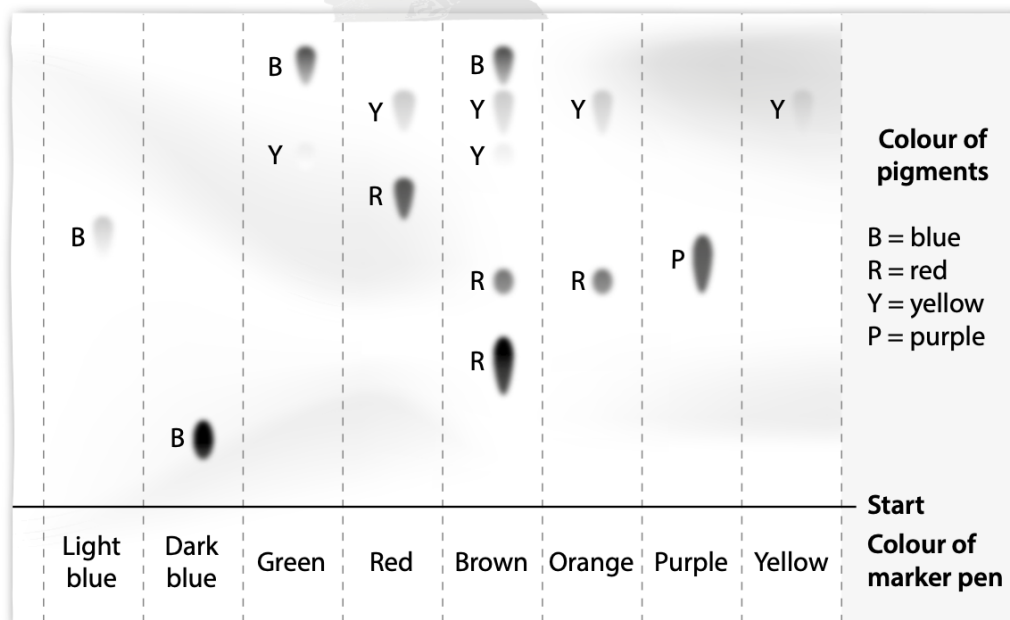


- (a) Name the pens that contain only one pigment. _____
- (b) Green is made by mixing blue and yellow. Did the manufacturer use the pigment from the light blue marker, the dark blue marker or a different blue pigment? Justify your answer. _____
- (c) How many red pigments were used in the 8 marker pens? _____
- (d) Did the manufacturer use the same yellow in the orange and green marker pens? Justify your answer. _____
- (e) Which of the pigments used in making the pens is the least soluble in water? _____
8. Someone has drawn graffiti on your sciPAD! You share a bench with four others and suspect it must be one of them. You take an ink sample from the graffiti and from the pens of the four suspects. Using chromatography, you separate the pigments in the ink samples. The chromatogram on the right shows the results of your investigation.
- Which suspect could have drawn the graffiti? Justify your answer. _____



Answers

- Outline the origin of the term *chromatography*. Colour from 'chroma' and image from 'graphy'.
- Describe the type of mixtures that chromatography can separate. Chromatography can separate mixtures of two or more coloured pigments, such as inks, dyes, and paints.
- Explain why the pigments separate. The pigments separate because they have different solubilities in a solvent. This means that the more soluble pigments are carried faster, and therefore further by the rising solvent.
- Which pigments are carried the furthest by the solvent? The more soluble pigments travel the greater distance.
- Why should the 'start line' always be drawn in pencil? Pencil 'lead' is insoluble and will not 'run' with the solvent.
- Explain why the solvent level must be lower than the sample spots on the filter paper. So that the sample does not run down into the solvent.
- The chromatogram below was obtained using a set of felt-tip pens and water as the solvent. (Note: Spots of the same colour and same height can be assumed to be the same substance.



- Name the pens that contain only one pigment. Light blue, dark blue, purple, and yellow.
- Green is made by mixing blue and yellow. Did the manufacturer use the pigment from the light blue marker, the dark blue marker or a different blue pigment? Justify your answer. They used a different blue as the blue pigment in the green pen ran to a higher level than either of the blue pigments.

- (c) How many red pigments were used in the 8 marker pens? Three.
- (d) Did the manufacturer use the same yellow in the orange and green marker pens? Justify your answer. No. Two different yellow pigments were used as they ran to different levels on the chromatogram.
- (e) Which of the pigments used in making the pens is the least soluble in water? The blue pigment in the dark blue pen. It ran the shortest distance.

Someone has drawn graffiti on your sciPAD! You share a bench with four others and suspect it must be one of them. You take an ink sample from the graffiti and from the pens of the four suspects. Using chromatography, you separate the pigments in the ink samples. The chromatogram on the right shows the results of your investigation.

Which suspect could have drawn the graffiti? Justify your answer. Suspect 4 owns the pen used to write the graffiti as the chromatogram is exactly the same as the one from the graffiti sample.

