

CAIE IGCSE Chemistry

12.3 Chromatography

Notes

This work by [PMT Education](https://www.pmt.education) is licensed under [CC BY-NC-ND 4.0](https://creativecommons.org/licenses/by-nc-nd/4.0/)



Describe how paper chromatography is used to separate mixtures of soluble coloured substances, using a suitable solvent

- Paper chromatography is a separation technique used to separate mixtures of soluble substances depending on their different solubilities
- Chromatography involves 2 different phases: the stationary phase and the mobile phase
- The stationary phase is usually the chromatography paper
- The mobile phase is the solvent that carries the different substances with it, e.g. ethanol
- A more soluble substance will be more attracted to the mobile phase so will travel further than a less soluble substance

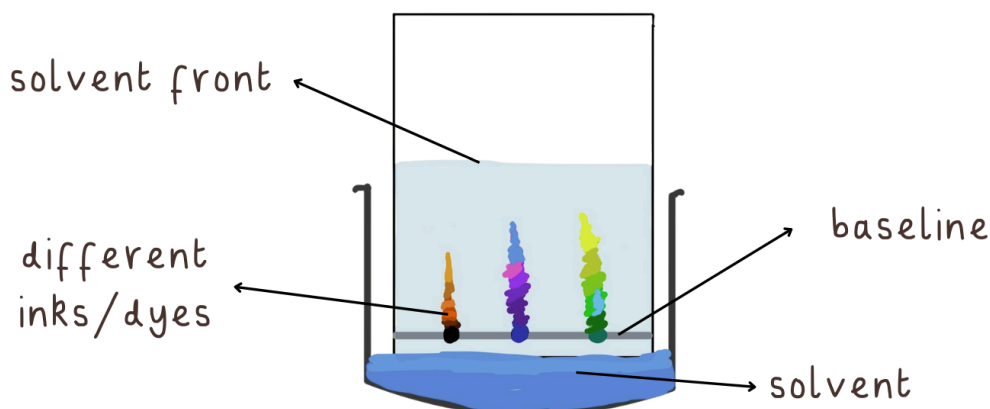
Apparatus needed

- Chromatography paper
- Pencil
- Ruler
- Suitable solvent e.g. ethanol
- Suitable sized beaker
- Soluble coloured substance e.g. 2 coloured pens

Method

1. Draw a straight pencil line across, 1 cm from the base of the chromatography paper
Pencil is used since pen ink would dissolve along with the substance being tested and disrupt the chromatogram.
2. Mark evenly spaced spots of the coloured pens along the line
3. Add a small volume of solvent into the beaker, roughly less than 1 cm.
4. Place the chromatography paper into a beaker so it is stood upright, ensuring the pencil line sits above the solvent.
5. Wait for the solvent to travel up the paper, carrying the different substances in the pigments with it
6. Remove the paper and mark a line where the solvent went up to, this is known as the solvent front and allow the chromatogram to dry





Interpret simple chromatograms to identify:

Unknown substances by comparison with known substances

- When setting up the chromatography paper, place a spot of the unknown substance alongside spots of known substances, evenly spacing them.
- Once the chromatogram has dried, the unknown substance will have separated into its separate components if it is a mixture
- Identify the unknown substance by comparing its separate components with the reference substances, as the spots that have the same solubility will be in line with each other

Pure and impure substances

- An impure substance will show up with more than one spot on the chromatogram
- A pure substance will show up with only one spot on the chromatogram

(Extended only) Describe how paper chromatography is used to separate mixtures of soluble colourless substances, using a suitable solvent and a locating agent

- Colourless mixtures of chemicals can be analysed if the 'spots' can be coloured by a chemical or light treatment
- Examples include:
 - Ninhydrin used with proteins – breaks them down into amino acids and colours them purple
 - UV light – fluoresce many colourless organic molecules



NB: The knowledge names of specific locating agents is not required

- These are all known as locating agents, allowing R_f values to be taken and (previously colourless) molecules to be identified

(Extended only) State and use the equation for R_f :

- To find the R_f value of a substance, use the following equation:

$$R_f = \frac{\text{distance travelled by substance}}{\text{distance travelled by solvent}}$$

- The distance travelled by the solute should be measured to the centre of the solute spot
- Different compounds have different R_f values in different solvents, which can be used to help identify the compounds
- Compounds in a mixture may separate into different spots depending on the solvent but a pure compound will produce only one spot in all solvents

