Paper Chromatography

Chromatography

- **Chromatography** is a method used to separate and identify the components of a mixture of soluble substances.

- We can also use it to carry out purity tests. One of the most well-known uses of chromatography is in the separation of different pigments in ink, such as colorings or plant pigments like chlorophyll.

- The process of chromatography involves two phases

1. the mobile phase

2. the stationary phase.

Paper Chromatography

- A specific type of chromatography is paper chromatography. There are two phases include in paper chromatography:

1. The **stationary phase** is the non-moving phase, which doesn't move through the chromatography paper when the solvent carries the sample.
2. The **mobile phase** is the solvent in which the sample can move. Solvent (which is usually a liquid) moves along the chromatography paper, and the size of the molecules determines the rate at which they move.

- The mobile phase moves through the stationary phase, picking up compounds. Meanwhile, the stationary phase remains fixed in place.

Procedure of Paper Chromatography:

To perform paper chromatography, follow these steps:

1. Start by drawing a baseline on the chromatography paper using a pencil. The baseline is insoluble, so it won't move with the solvent.

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2. Place a small spot of the sample mixture on the baseline.

3. Pour the solvent into a beaker. Place a glass rod over the beaker, and tape or clip the paper to it, ensuring that the paper's base just touches the solvent without being submerged.

Note: **Solvent** does not have to be water. For example, it could be **ethanol.**

4. Allow the solvent to slowly travel upwards through the paper, taking with it a few soluble pigments from the sample mixture. This will create different spots along the paper.

5. Remove the paper from the beaker before the solvent reaches the top. You now have a chromatogram.

6. Analyse the chromatogram to identify the different components of the sample mixture. Each spot on the chromatogram represents a different component of the mixture.

8. Finally, mark the distance travelled by the solvent for calculating the Rf value

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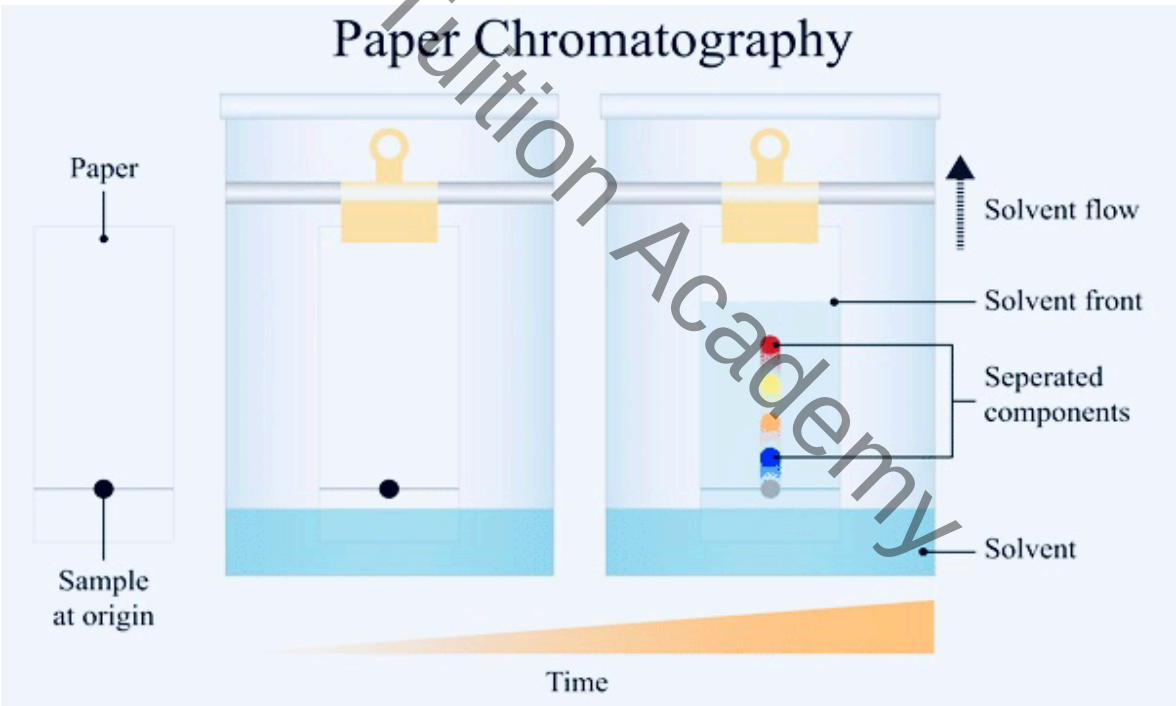

Interpreting a Chromatogram Results

- A **chromatogram** is a visual representation, essentially a graph, that shows the results of a chromatography experiment.

- After carrying out paper chromatography, we can interpret the results to distinguish between pure and impure substances.

  I. A **pure substance** will only produce one spot on the chromatogram
  II. An **impure substance** will separate into two or more spots

- **Identical Chromatogram:** Substances that are identical will produce identical chromatograms. This means that they will produce the same number of spots, and those spots will travel the same distances up the paper, with matching colours. **For example,** when analysing brown ink using chromatography, we can see that it is a mixture of red, blue, and yellow inks.

- These colours separate out, with each ink travelling the same distance up the paper as its respective reference ink. **For example,** the yellow spot from the brown ink travelled the same distance up the paper as the yellow ink, which we used as a reference. This allows us to identify the different components of the mixture. Same for other colours

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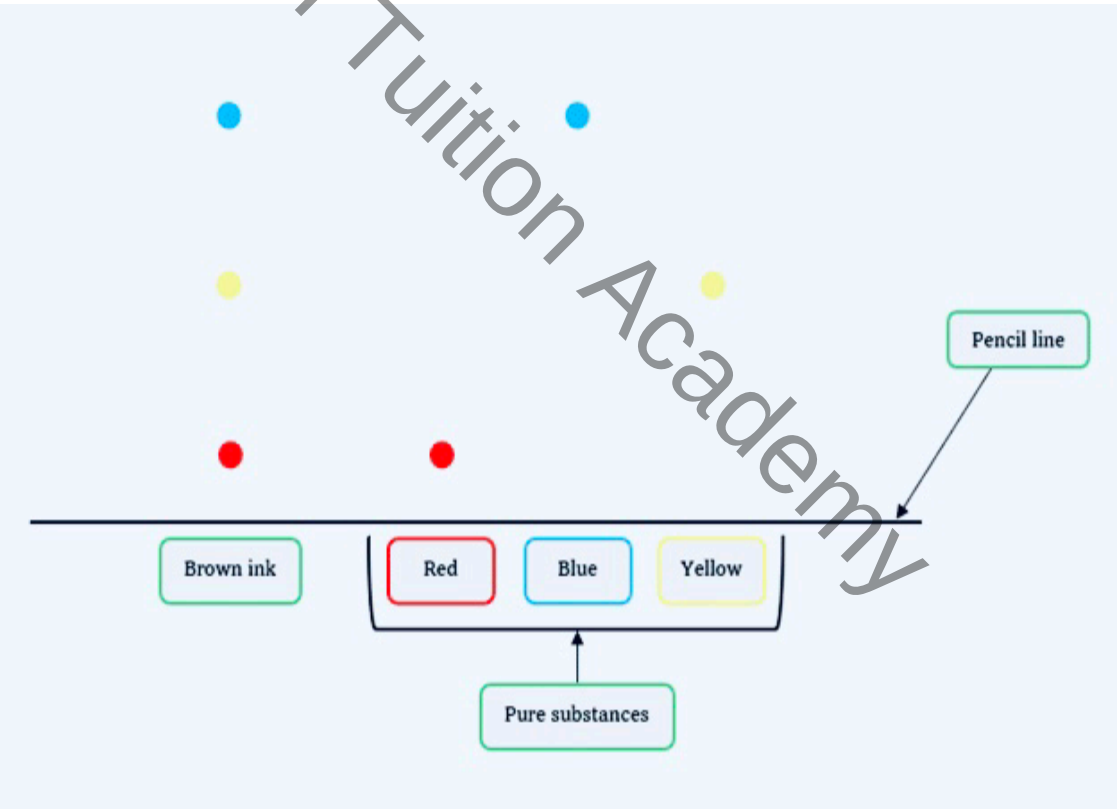

Rf Value

- The **Rf value** is the ratio between the distance travelled by the dissolved substance (solute) and the distance travelled by the solvent. It is used to identify the components of a mixture. To calculate the Rf value, we use this equation:

$$R_f = \frac{Distance\ travelled\ by\ substance}{Distance\ travelled\ by\ solvent}$$

- Therefore, it is a number between 0 and 1. A particular substance will always give you the same Rfvalue, as long as the solvent is the same. However, changing the solvent will change the Rf value.

- **Reference Value** We can compare the Rf value of unknown substances with the Rf values of known substances under the same conditions. These are called reference values.

- To find the distance travelled by substance, measure from the baseline to the centre of the spot.

- The Rf value is determined by the solubility of the sample in the chosen solvent. In other words, the efficiency with which the sample dissolves in the solvent will influence the Rf value.

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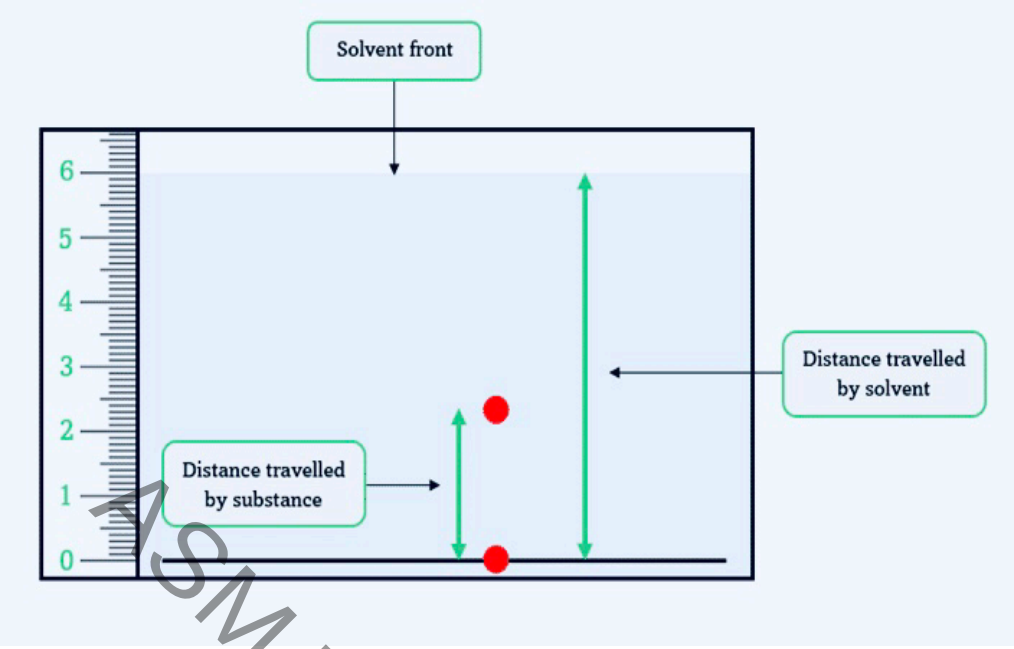

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