i. **Tall Beaker:** Containing a small amount of water at the bottom.
ii. **Filter Paper Strip:** Dipped vertically into the water.
iii. **Pencil Baseline:** Drawn horizontally near the bottom of the filter paper, above the water level.
iv. **Ink Spot:** A small, dark dot on the pencil baseline.
v. **Arrows:** Showing water (solvent) moving up the filter paper.

b) **Explain what you would expect to observe on the filter paper if the black ink is indeed a mixture of different colours.** (2 marks)

i. You would expect to see the black ink separating into different colored bands or spots moving up the filter paper at varying heights from the original ink spot.

ii. Each distinct band would represent a different dye component present in the black ink, as they travel at different rates with the solvent.

2. You perform the investigation and observe that the black ink separates into distinct bands of blue, red, and yellow colours on the filter paper.

a) **Name the scientific technique you have used to separate the colours.** (1 mark) **Paper Chromatography**

b) **Explain why the different colours separate and travel to different heights on the filter paper.** (2 marks)

i. The different colors separate because the dyes have different solubilities in the solvent (water) and different affinities for the stationary phase (filter paper).

ii. Dyes that are more soluble in water and have weaker attraction to the filter paper will travel further up the paper, while those that are less soluble or have stronger attraction to the paper will travel shorter distances, resulting in the separation into distinct bands.

c) **How is this technique applicable in real-world scenarios, for instance, in forensic science?** (2 marks)

i. In forensic science, chromatography (including paper or more advanced forms like gas chromatography or HPLC) is used to analyze and identify unknown substances found at crime scenes. For example, it can be used to compare ink samples from a ransom note to a suspect's pen.

ii. It can also be used to separate and identify components in complex mixtures such as drugs, poisons, or accelerants in arson investigations, helping to link suspects to crimes or establish facts about a case.

### Sub-strand 2.2: Acids, Bases and Indicators

**Strands And Sub Strands Revision Questions And Answers**