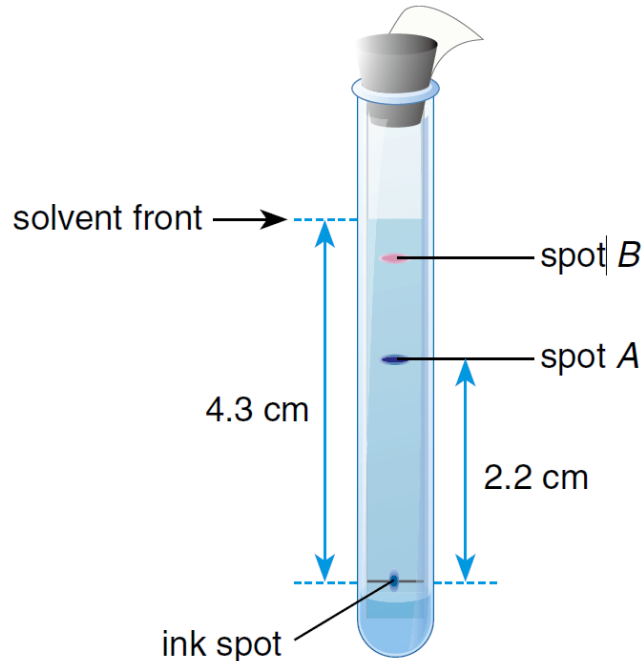
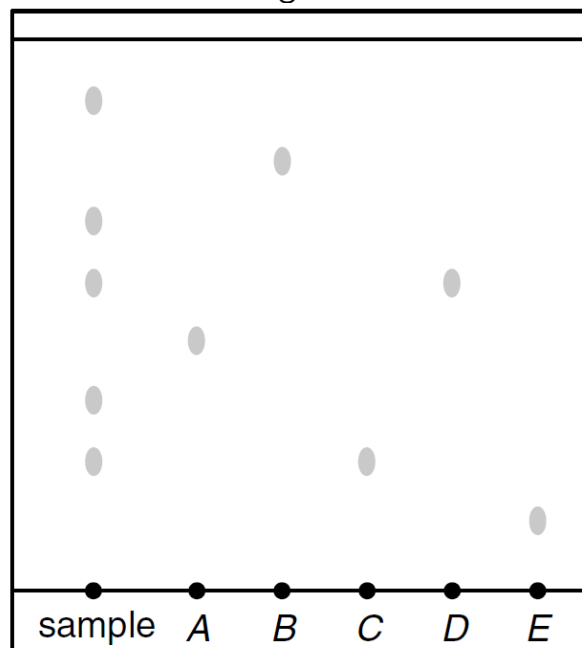


### Quiz (Separation Methods Part III)

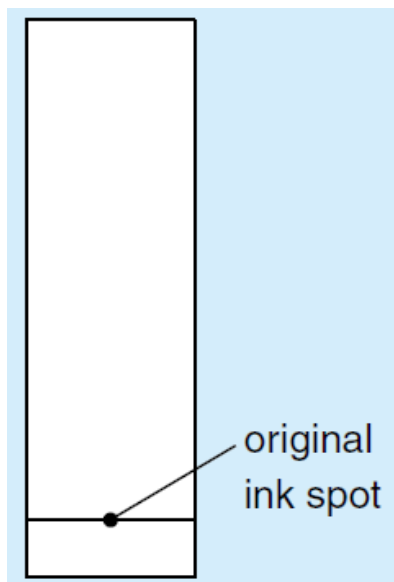
1. The dyes in an ink were separated by paper chromatography. A mixture of water and ethanol was used as the solvent. The resulting chromatogram is shown below:



- (a) The ink spot was spotted twice on the baseline of the filter paper. What is the purpose of spotting the filter paper twice?
- (b) Calculate the  $R_f$  value of spot A.
- (c) What is the distance travelled by dye B if it has a  $R_f$  value of 0.77?
2. A ketchup sample was analysed by thin-layer chromatography. The ketchup sample, together with spots of pure samples of five food dyes (A to E) were spotted on the plate. The chromatogram was obtained as follows:



- (a) How many components of the ketchup sample were separated by thin-layer chromatography? Explain briefly.
- (b) Which food dye(s) is/are likely to be used in the ketchup? Explain your answer.
3. Paper chromatography is carried out to separate different dyes in a certain brand of ink. Two spots (red and blue) can be seen in the chromatogram after the experiment.



The following data are obtained from the experiment.

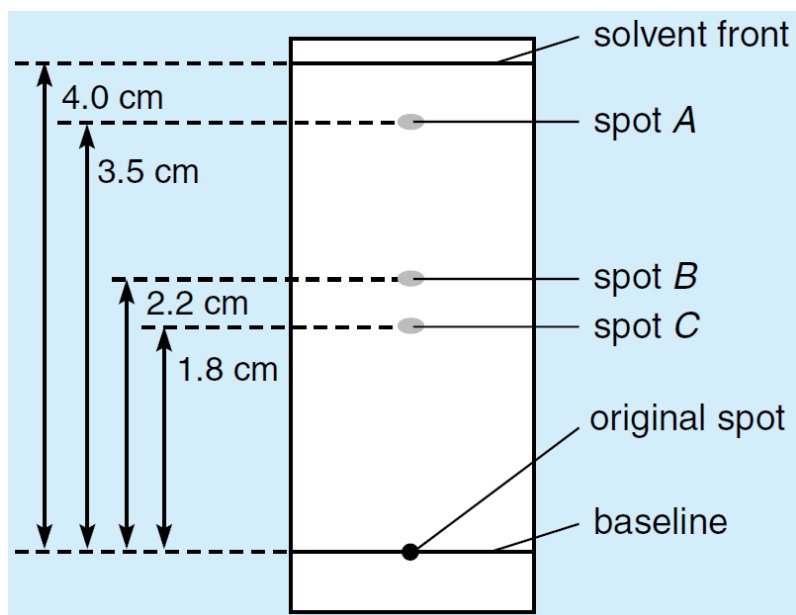
Distance travelled by the solvent from the baseline = 3.0 cm

$R_f$  value for the red spot = 0.7

$R_f$  value for the blue spot = 0.5

- (a) By using the data given, draw the positions of the red spot, the blue spot and the solvent front on the chromatogram.
- (b) Is the ink a pure substance or a mixture? Explain your answer.
- (c) What is the underlying principle for the separation of the dyes?

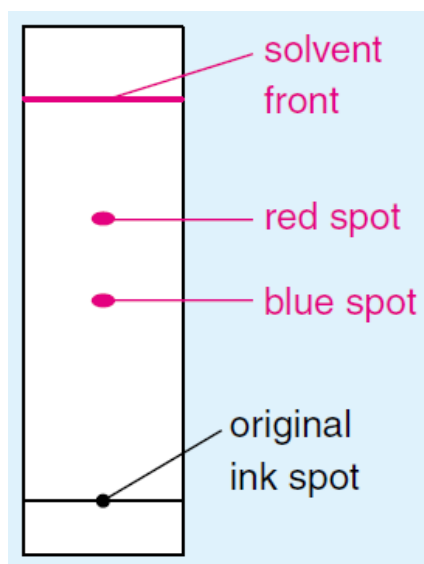
4. A student carries out thin-layer chromatography to study the components in a mixture of colourless organic compounds. After treatment, the colourless components become visible. The following diagram shows the chromatogram.



- (a) Suggest how to make the colourless spots visible.
- (b) Which spot is the most soluble in the developing solvent? Explain your answer.
- (c) Calculate the  $R_f$  value of spot B.
- (d) If the mixture is separated by column chromatography (with the same mobile phase and stationary phase), which component will run out first?

### Suggested Answer

1. (a) To increase the amount of the ink in order to increase the intensity of the spots in the chromatogram.
- (b)  $R_f = 2.2 \text{ cm} / 4.3 \text{ cm} = 0.51$
- (c) Distance travelled by dye B =  $0.77 \times 4.3 \text{ cm} = 3.3 \text{ cm}$
2. (a) In the chromatogram, there are five spots coming from the spot of the ketchup sample. Therefore, five components of the ketchup sample were separated.
- (b) Food dyes C and D are likely to be used in the ketchup. This is because two of the components of the ketchup sample have the same  $R_f$  values as those of C and D.
3. (a)



- (b) The ink is a mixture because there are more than one spot in the chromatogram.
- (c) Different dyes have different solubilities in water on paper fibres (stationary phase) and in the developing solvent (mobile phase). The dye that is more soluble in the developing solvent moves up the paper more quickly. As a result, different dyes in the ink are separated.
4. (a) Put the chromatographic plate into a jar saturated with iodine vapour.  
OR Shine ultraviolet light on the plate that contains a fluorescent material.
- (b) Spot A, because it moves up the plate fastest.
- (c)  $R_f$  value of spot B =  $2.2 \text{ cm} / 4.0 \text{ cm} = 0.55$
- (d) Component A