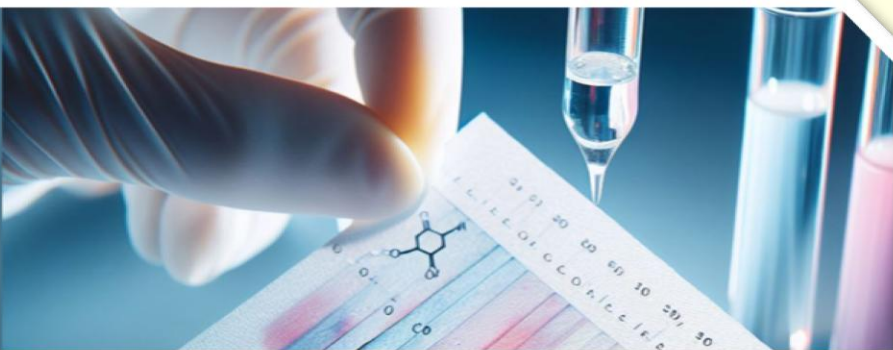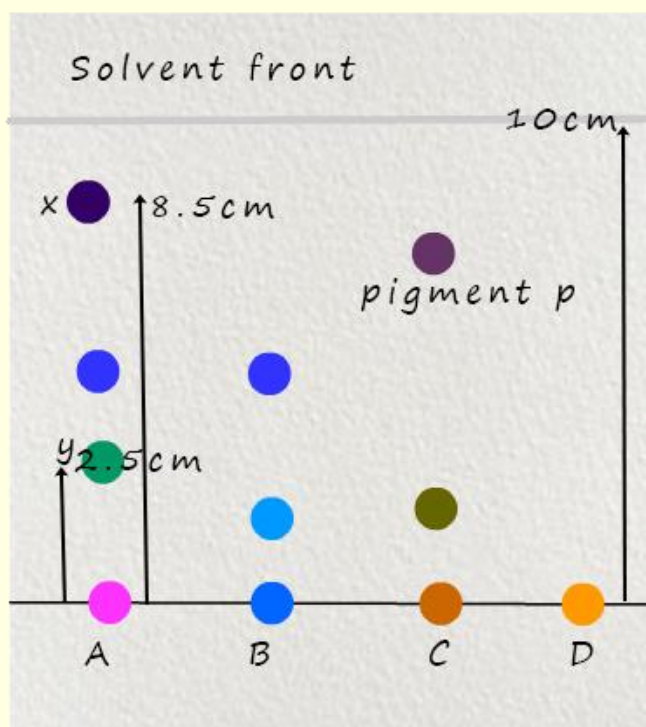Answer all the questions below then check your answers.

1. A student was investigating the colours in different paints, A, B, C and D. The student ran a chromatography experiment using ethanol as a solvent. The chromatogram below shows her results.

a.   Which paint contains only one pigment or colour?

b. Which paint contains 3 pigments or colours?

c. Which two paints contain the same pigment? Mark these pigments as Z on the chromatogram.

d. Complete the formula for calculating the R_f value for a pigment:

$$R_f = \rule{5cm}{0.4pt}$$

e. Calculate the R_f value for pigment y.

f. Calculate the R_f value for pigment x.

g. Pigment p has a R_f value of 0.8. Calculate how far it moved up the paper.

h. Explain why pigment D has not moved up the paper.

i. What is the mobile and stationary phase in this experiment?

2. A student set-up a chromatography experiment to analyze 3 different coloured dyes. He placed the three coloured dyes on a base line which he drew on the chromatography paper using a ruler and a pen. The image below shows the set-up he used.
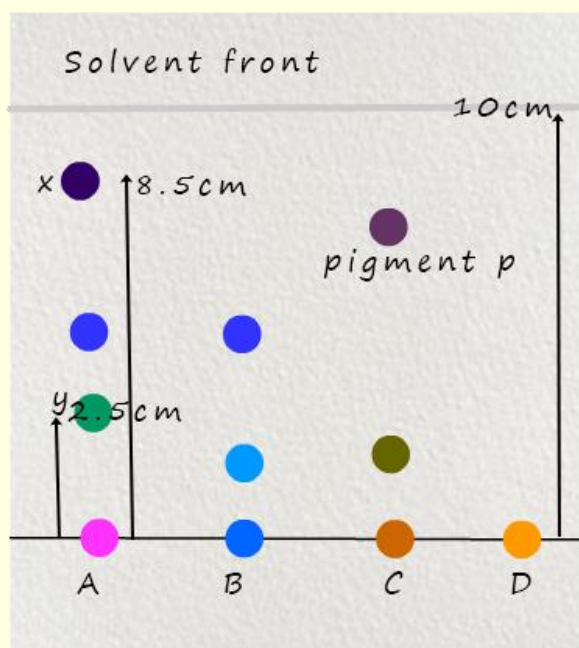

chromatography paper

ethanol

base line drawn in pen
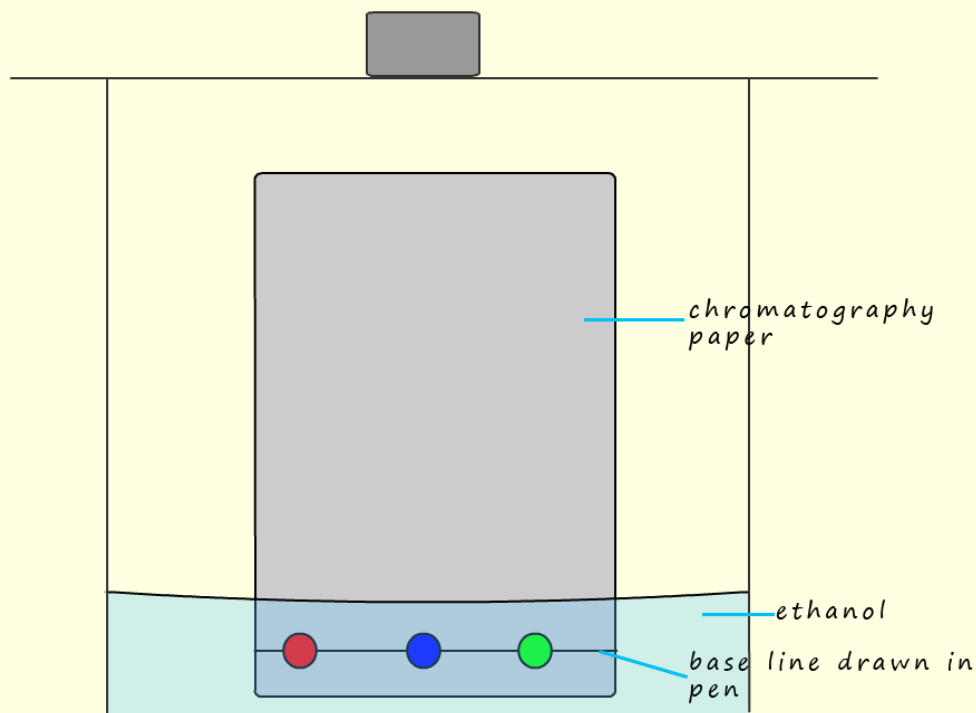
a. Identify 3 mistakes the student has made in setting up this chromatography experiment.

b. Name the solvent the student has used in his experiment.

i. How will the student know if the solvent he has decided to use is suitable for this particular experiment?

3. The police have taken samples of nail varnish from a suspect. Explain how they could find out if the sample they have matches one taken from a crime scene.

Chromatography questions

1. A student was investigating the colours in different paints, A, B, C and D. The student ran a chromatography experiment using ethanol as a solvent. The chromatogram below shows her results.

a. Which paint contains only one pigment or colour? None of the paints contain only one pigment.

b. Which paint contains 3 pigments or colours? A

c. Which two paints contain the same pigment? Mark these pigments as Z on the chromatogram. See diagram above

d. Complete the formula for calculating the R_f value for a pigment:

$$R_f = \frac{\text{distance moved by spot}}{\text{distance moved by solvent}}$$

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e. Calculate the R$_f$ value for pigment y. 2.5/10 = 0.25

f. Calculate the R$_f$ value for pigment x. 8.5/10=0.85

g. Pigment p has a R$_f$ value of 0.8. Calculate how far it moved up the paper.

   0.8 x 10 = 8cm

h. Explain why pigment D has not moved up the paper.

   It is insoluble in the ethanol, a different solvent is needed.

i. What is the mobile and stationary phase in this experiment?

   Mobile= ethanol stationary= paper

2. A student set-up a chromatography experiment to analyze 3 different coloured dyes. He placed the three coloured dyes on a base line which he drew on the chromatography paper using a ruler and a pen. The image below shows the set-up he used.

chromatography paper

ethanol

base line drawn in pen
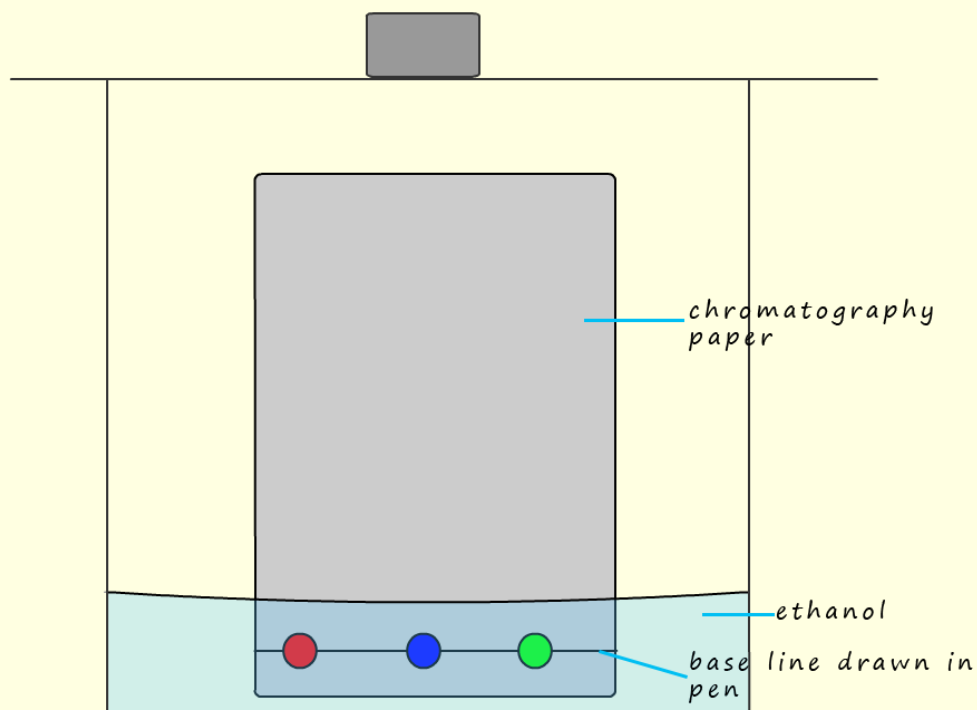
a. Identify 3 mistakes the student has made in setting up this chromatography experiment.

- He drew the base line in pen. Should have used a pencil.
- The base line should be above the height of the solvent layer.
- The dots of coloured dyes are too large.

b. Name the solvent the student has used in his experiment.

ethanol

i. How will the student know if the solvent he has decided to use is suitable for this particular experiment?

If the coloured dots all rise up the paper then all the dyes are soluble in the ethanol. If one or more of the dots stay on the base line then one or more of the dyes is insoluble in ethanol and another solvent should be used. The solvent should also carry the dyes or at least some of them most of the way up the chromatography paper.

2. The police have taken samples of nail varnish from a suspect. Explain how they could find out if the sample they have matches one taken from a crime scene.

- Find a suitable solvent for the nail varnish.
- Draw a pencil line approx 2cm from the bottom of a strip of chromatography paper.
- Spot the nail varnish onto the paper using a fine capillary tube.
- Place the spotted paper in a chromatography cell ensuring the paper dips into the solvent but that the pencil line is above the solvent.
- Put the lid on the chromatography cell/tank.
- Allow the solvent to rise 3/4 way up the paper.

- Allow the paper to dry.

- Calculate the R_f for any spots which match. Spots with the same R_f values are likely to be identical substances.