

1. *A student carries out an experiment using paper chromatography to distinguish between three substances.

Here is his method.

1. Draw a pen line half way up the paper.
2. Put a large spot of the substance to be tested onto the line.
3. Stand the paper in the solvent. The solvent should be at the same level as the spot.
4. Leave the beaker uncovered.
5. Remove the paper from the beaker before the solvent reaches the top.

He calculates the R_f value for each substance.

Look at his results.

$$R_f = \frac{\text{distance the spot has travelled}}{\text{distance the solvent has travelled}}$$

Substance	Distance moved by solvent (mm)	Distance moved by spot (mm)	R_f value
X	95	78	1.22
Y	95	65	1.46
Z	95	51	1.86

His teacher noticed some mistakes with his method and his R_f values.

Describe and explain the mistakes the student has made and suggest corrections.

The pen line was drawn half way up the paper. This is a problem as there will not be enough space for separation. Therefore it should be drawn 1cm from the bottom.

A large spot of sample was used which may make the separation unclear.

A small spot should be used instead.

Standing the paper in the solvent means it can fall or bend so it should be hung from a splint using a paperclip.

The solvent should not be at the same level as the spot otherwise it will dissolve in the solvent and smudge. Instead it should be below the line.

The beaker was uncovered, which will allow the solvent to evaporate. A lid should be added.

[6]

The R_f values are greater than 1 which means the incorrect equation for R_f

has been used. Use the correct one: $R_f = \frac{\text{distance travelled by spot}}{\text{distance travelled by solvent}}$