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.

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.

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[6]

2. One method of checking the purity of a substance is paper chromatography.

*This is the method the students follow for the paper chromatography experiment.

1. Draw a pen line near the bottom of the paper.
2. Put a 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. Cover the beaker.
5. Remove the paper from the beaker before the solvent reaches the top.
6. Calculate the R_f value of the substance by using this equation:

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

Their teacher notices some mistakes with this method.

Describe and explain the **mistakes** in the method and suggest improvements that could be made.

[6]

END OF QUESTION paper