Chromatography

AQA 7405 · A level

Answer on your own paper. Show your working where needed.

1. Calculate a retention factor

From the pencil baseline, a spot moves 3.2 cm and the solvent front moves 8.0 cm. Calculate the Rf value and state whether it has units.

2. Check a TLC setup

A student draws the starting line on a TLC plate with a pen, adds the samples and stands the plate in solvent. The solvent initially covers the spots. Explain two changes to the setup that would improve the chromatogram.

3. Explain different retention factors

Substances A and B have Rf values 0.33 and 0.75 on the same TLC plate. A student claims B interacts more strongly with the stationary phase relative to the solvent. Use the results to assess the claim.

4. Compare with a standard

An unknown mixture gives spots at Rf 0.28 and 0.59. A pure standard run on the same plate under the same conditions gives Rf 0.59. State the strongest conclusion supported by this evidence.

5. Read a gas chromatogram

An unknown gives peaks at 2.3, 4.7 and 6.2 min. In the same conditions standards X and Y give retention times of 2.3 and 6.2 min respectively. Identify any possible matches and explain why the two matching peaks have different retention times.

6. Compare two fractions from a column

A mixture of X and Y runs through a column with a solid stationary phase and a liquid solvent. X appears in a fraction collected before Y. Use the relative attractions to the two phases to explain the order.

7. Identify components with GC-MS

A gas chromatogram has peaks P and Q, with molecular ions at m/z 46 and 60 respectively. The candidates are ethanol (M_r 46) and two isomeric alcohols A and B (both M_r 60).

Under the same conditions, standard A elutes at 3.9 min and standard B at 5.1 min. Q elutes at 5.1 min. Suggest the best match for P and Q and explain why both techniques are useful.

8. Choose a technique for each stage

A chemist wants to compare an ink with four available standards, and to separate a mixture of two volatile liquids before measuring the masses of their molecular ions. Choose a technique for each task and explain your choices.

9. Extra challenge · Use two separations and mass evidence

A sample and a pure reference are run in separate lanes on one TLC plate. Each lane shows one spot 1.8 cm from the baseline. The solvent front has moved 6.0 cm.

The volatile sample gives GC peaks at 3.1 and 5.7 min. The reference elutes at 5.7 min. Both sample peaks have molecular-ion m/z 88. Calculate the matching Rf, explain how the two GC observations help, and state the limit of the identification.

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