A-LEVEL CHEMISTRY • EXERCISE SHEET

37.1 Thin-layer chromatography

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

Objective

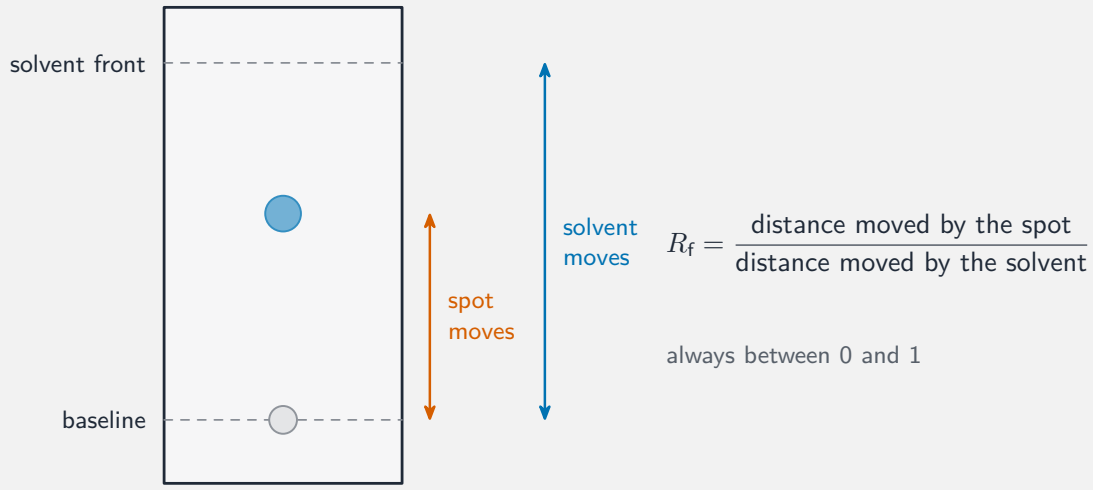
Build the skills to answer exam questions on **thin-layer chromatography** 薄层色谱 (TLC) —the two phases, the R_f **value**, and what it tells you.

You must be able to:

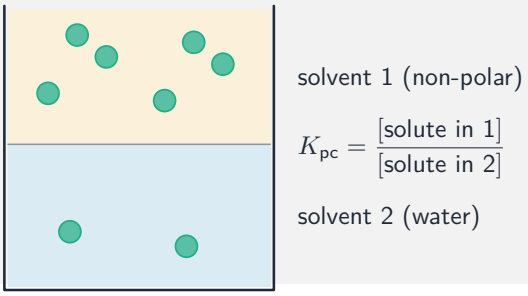
- identify the stationary and mobile phases in TLC
- calculate an R_f value
- explain why one component has a smaller R_f than another

1 Worked examples

The R_f value



The R_f value is how far the spot moved divided by how far the solvent front moved



TLC separates by partition between phases

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

- **stationary phase** stays still (e.g. aluminium oxide on a plate); **mobile phase** is the solvent that moves up.
- R_f is always between 0 and 1.
- a substance that sticks more strongly to the stationary phase (or is less soluble in the mobile phase) moves **less** → **smaller** R_f.

2 Practice

2.1 Name the stationary phase commonly used in TLC. [1]

2.2 A spot moves 3.6 cm; the solvent front moves 4.8 cm. Calculate its R_f. [1]

3 Exam-style questions

3.1 An R_f value can never be: [1]

- **A** 0.2
- **B** 0.85
- **C** 1.4
- **D** 0.5

3.2 A component with a **smaller** R_f value: [1]

- **A** is more soluble in the mobile phase
- **B** sticks more strongly to the stationary phase
- **C** moves further up the plate
- **D** has no interaction with the plate

3.3 On a TLC plate, a spot travels 2.1 cm while the solvent front travels 6.0 cm.

(a) Calculate the R_f value. [2]

(b) State what a low R_f suggests about how strongly the component binds to the stationary phase. [1]

3.4 Explain why two components of a mixture separate on a TLC plate. [2]

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **37.1 Thin-layer chromatography** material in the Library, or try this in **Practice mode**:

- 9701/41 N25 —Q6 (chromatography / analysis)

Solutions

2.1 aluminium oxide (alumina) / silica on a plate.

2.2 $R_f = 3.6/4.8 = 0.75$.

3.1 C. R_f is always between 0 and 1, so 1.4 is impossible.

3.2 B. A smaller R_f means it sticks more strongly to the stationary phase and moves less.

3.3 (a) $R_f = \dfrac{2.1}{6.0} = 0.35$.
(b) it binds (adsorbs) strongly to the stationary phase.

3.4 the components have different affinities for the stationary and mobile phases; so they travel up the plate at different rates and end at different heights, giving different R_f values.