

Exercise walk-through

37.1

Thin-layer chromatography

A-Level Chemistry

Thin-layer chromatography

The **baseline** is the starting line where the spots are placed; the **solvent front** is the highest level the solvent reaches. The **mobile phase** is the solvent that travels up the plate, the **stationary phase** the coating it travels through. A spot of mixture travels up a plate. Components that adsorb more strongly to the stationary phase move less.

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

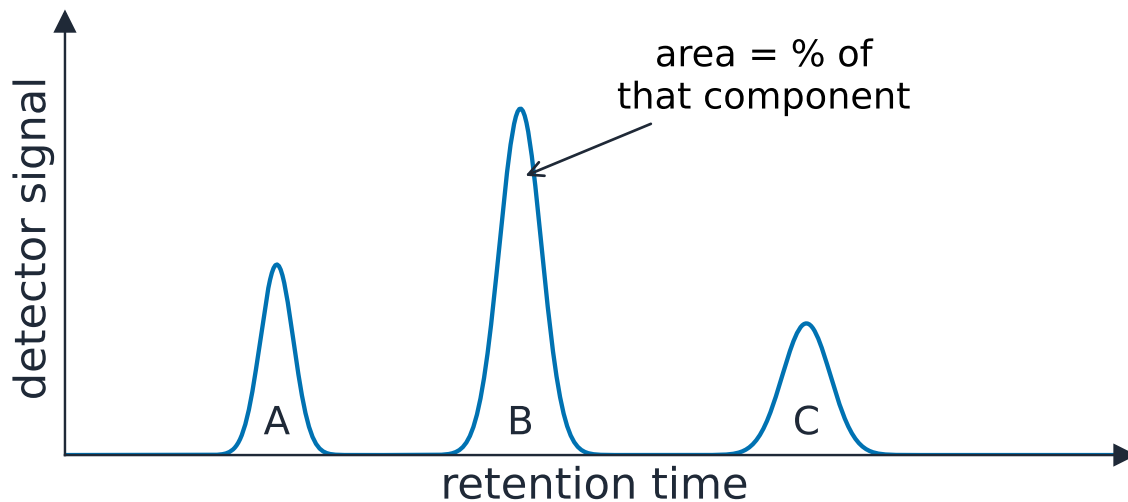
R_f is always between 0 and 1. Identify a component by matching R_f with a known standard on the same plate.

Gas/liquid chromatography

In **GLC** a carrier gas sweeps the mixture over a liquid stationary phase.

Each component peaks at its own **retention time** ; the peak **area** gives its percentage in the mixture.

Gas/liquid chromatography, in detail



t_R identifies · peak area $\approx$ amount

In **GLC**

a carrier gas sweeps the mixture over a liquid stationary phase.

Exercises 2.1·2.2

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]

Exercises 2.1·2.2

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

2.1

- aluminium oxide (alumina) / silica on a plate
-

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

2.2

- $R_f = 3.6/4.8 = 0.75$

Exercises 3.1-3.2

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

Exercises 3.1-3.2

3.1 An R_f value can never be:

[1]

- ☐ A 0.2
☐ B 0.85
☐ C 1.4
☐ D 0.5

3.1 C

- R_f is always between 0 and 1, so 1.4 is impossible

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

3.2 B

- A smaller R_f means it sticks more strongly to the stationary phase and moves less

Exercise 3.3 (a)

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]

Exercise 3.3 (a)

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]

(a)

- $R_f = \frac{2.1}{6.0} = 0.35$

Exercise 3.3 (b)

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

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

Exercise 3.3 (b)

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

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

(b)

- it binds (adsorbs) strongly to the stationary phase

Exercise 3.4

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

[2]

Exercise 3.4

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

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