

25.2 Partition coefficients

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS partition coefficient 分配系数 • solute 溶质 • solvent 溶剂 • polarity 极性

Objective

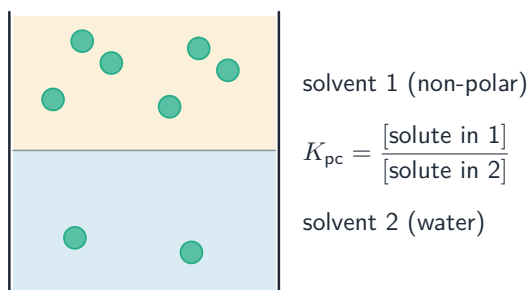
Build the skills to answer exam questions on **partition coefficients** 分配系数 — what K_{pc} is, calculating it, and the factors that affect it.

You must be able to:

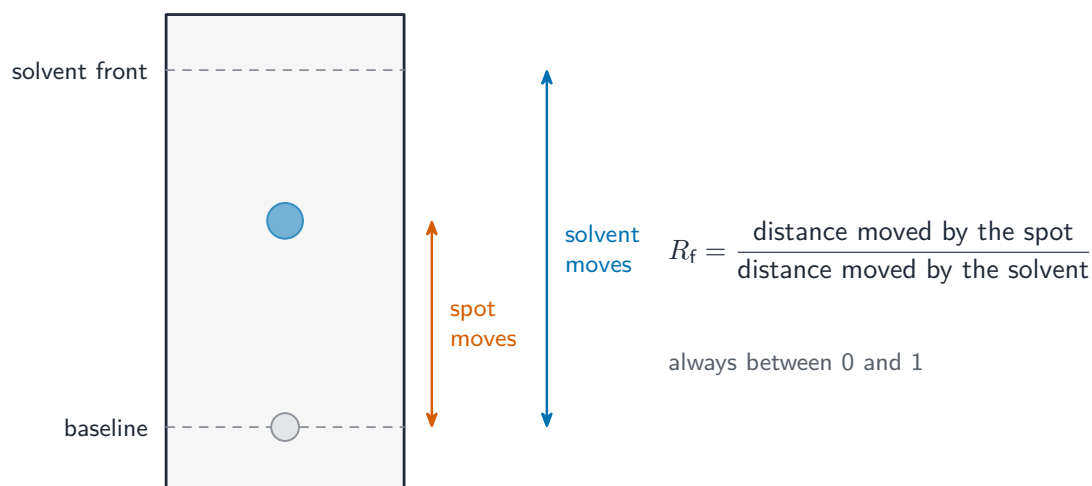
- state what a partition coefficient is
- calculate and use a partition coefficient
- explain how solute and solvent polarity affect its value

1 Worked examples

■ Partition coefficient



A solute shaken with two immiscible solvents distributes between them in a fixed ratio



Chromatography separates by partition

The **partition coefficient** K_{pc} is the ratio of the concentrations of a solute in two immiscible solvents at equilibrium (the solute in the same physical state in both):

$$K_{pc} = \frac{[\text{solute in solvent 1}]}{[\text{solute in solvent 2}]}$$

A solute dissolves better in the solvent of **similar polarity** (“like dissolves like”), so the value depends on the polarities of the solute and the two solvents.

2 Practice

2.1 State what a partition coefficient measures. [1]

2.2 State the rule that decides which solvent a solute prefers. [1]

3 Exam-style questions

3.1 A non-polar solute is shaken with water and hexane (a non-polar solvent). It will mostly be found in: [1]

- **A** the water
- **B** the hexane
- **C** equally in both
- **D** neither

3.2 The partition coefficient depends on: [1]

- **A** the temperature only
 - **B** the polarities of the solute and the two solvents
 - **C** the volume of the container
 - **D** the colour of the solute
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3.3 A solute is shaken with equal volumes of two immiscible solvents. At equilibrium its concentration is 0.80 mol dm^{-3} in solvent A and 0.20 mol dm^{-3} in solvent B.

(a) Calculate the partition coefficient $K_{\text{pc}} = \frac{[\text{A}]}{[\text{B}]}$. [1]

(b) State, with a reason, which solvent the solute dissolves in better. [2]

3.4 Explain why a polar solute has a higher concentration in water than in hexane. [2]

Solutions

2.1 the ratio of the concentrations of a solute distributed between two immiscible solvents at equilibrium.

2.2 “like dissolves like” — a solute prefers the solvent of similar polarity.

3.1 B. A non-polar solute dissolves better in the non-polar hexane.

3.2 B. It depends on the polarities of the solute and the solvents.

3.3 (a) $K_{pc} = 0.80/0.20 = 4.0$.

(b) solvent A; the higher concentration shows the solute is more soluble in A (it is of more similar polarity).

3.4 a polar solute and water can form strong interactions (e.g. hydrogen bonds / dipole–dipole); hexane is non-polar and cannot, so the solute prefers the water.