

Exercise walk-through

25.2

Partition coefficients

A-Level Chemistry

What we will cover

- 1 Conjugate acids & bases
- 2 pH & the constants
- 3 Calculating pH
- 4 Buffer solutions
- 5 Solubility & partition



pH paper estimates acidity

Conjugate acids and bases

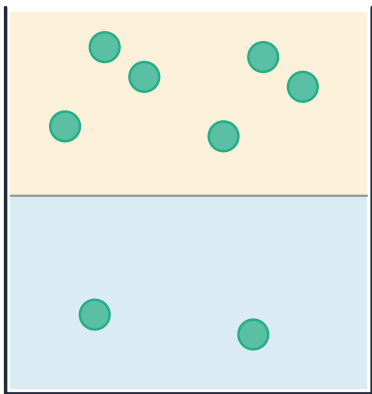
An acid loses H^+ to give its **conjugate base** ; a base gains H^+ to give its **conjugate acid** .

A **conjugate pair** differs by just one H^+ – e.g. CH_3COOH and CH_3COO^- .

conjugate pair: differ by one H^+



Partition coefficients



solvent 1 (non-polar)

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

solvent 2 (water)

The **partition coefficient** is the ratio of a solute's concentrations in two immiscible solvents.

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

It depends on the **polarity** of the solute & solvents.

Exercises 2.1·2.2

2.1 State what a partition coefficient measures.

[1]

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

[1]

Exercises 2.1·2.2

2.1 State what a partition coefficient measures. [1]

2.1

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

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

2.2

- “like dissolves like” – a solute prefers the solvent of similar polarity

Exercises 3.1·3.2

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

Exercises 3.1·3.2

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

3.1 B

- A non-polar solute dissolves better in the non-polar hexane

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

3.2 B

- It depends on the polarities of the solute and the solvents

Exercise 3.3 (a)

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]

Exercise 3.3 (a)

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]

(a)

- $K_{\text{pc}} = 0.80/0.20 = 4.0$

Exercise 3.3 (b)

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.

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

Exercise 3.3 (b)

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.

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

(b)

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

Exercise 3.4

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

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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