

Exercise walk-through

Common-Ion Effect ■ 7.12

eXercise

You must be able to

- predict that a **common ion** 同离子 lowers a salt's solubility
- explain it with Le Chatelier / Q vs K_{sp}
- reason qualitatively about the shift

Method — The common-ion effect

Adding an ion that is **already** part of a solubility equilibrium **decreases** the salt's solubility. The extra ion pushes the equilibrium back toward the solid.

Method — A worked case

$\text{AgCl}(s) \rightleftharpoons \text{Ag}^+ + \text{Cl}^-$. Add NaCl (a source of Cl^-): the extra Cl^- raises Q above K_{sp} , so the equilibrium shifts **left** — more AgCl precipitates, and less dissolves.

Method — Le Chatelier view

Adding a product (Cl^-) stresses the system; it shifts to consume the added ion, forming more solid. The salt is **less** soluble than in pure water.

Method — The practical result

You can reduce how much of a slightly soluble salt dissolves by adding a soluble salt sharing one of its ions.

Practice 2.1 ■ 1 mark

Does adding a common ion increase or decrease solubility?

Solution 2.1

Method: The common-ion effect

Worked steps

Decrease **B1**.

Practice 2.2 ■ 1 mark

For $\text{AgCl} \rightleftharpoons \text{Ag}^+ + \text{Cl}^-$, name a salt that provides a common ion.

Solution 2.2

Method: A worked case

Worked steps

NaCl (or any soluble chloride) **B1**.

Practice 2.3 ■ 1 mark

Which way does the equilibrium shift when a common ion is added?

Solution 2.3

Method: The common-ion effect

Worked steps

Toward the solid (left, toward less dissolving) **B1**.

Exam-style 3.1 ■ 1 mark

Adding NaCl to a saturated AgCl solution makes AgCl

A more soluble

B less soluble

C unaffected

D a gas

Solution 3.1

Method: A worked case

A more soluble

B less soluble



C unaffected

D a gas

Worked steps

B — less soluble.

Exam-style 3.2 ■ 1 mark

Consider $\text{CaF}_2(s) \rightleftharpoons \text{Ca}^{2+} + 2\text{F}^-$. Sodium fluoride (NaF) is added.

- (a) State the effect on the solubility of CaF_2 .
- (b) Explain using Le Chatelier's principle.

Solution 3.2

Method: Le Chatelier view

Worked steps

(a) It decreases **B1**. (b) Adding F^- (a product) stresses the equilibrium, which shifts left to consume it, forming more solid CaF_2 — so less dissolves **M1 A1**.

Exam-style 3.3 ■ 2 marks

Explain, in terms of Q and K_{sp} , why adding a common ion causes precipitation.

Solution 3.3

Method: The common-ion effect

Worked steps

The added common ion raises the ion product Q above K_{sp} ; the system responds by precipitating solid until Q falls back to K_{sp} **M1** **A1**.