

7.12 The Common-Ion Effect

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS common ion 同离子 • le chatelier's principle 勒沙特列原理

Objective

Build the skills to answer exam questions on the **common-ion effect**.

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

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

■ 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.

■ 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.

■ 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.

■ The practical result

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

2 Practice

Now apply the methods above.

2.1 Does adding a common ion increase or decrease solubility? [1]

2.2 For $\text{AgCl} \rightleftharpoons \text{Ag}^+ + \text{Cl}^-$, name a salt that provides a common ion. [1]

2.3 Which way does the equilibrium shift when a common ion is added? [1]

3 Exam-style questions

3.1 Adding NaCl to a saturated AgCl solution makes AgCl [1]

- **A** more soluble
 - **B** less soluble
 - **C** unaffected
 - **D** a gas
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3.2 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 . [1]

(b) Explain using Le Chatelier's principle. [2]

3.3 Explain, in terms of Q and K_{sp} , why adding a common ion causes precipitation. [2]

Solutions

2.1 Decrease.

2.2 NaCl (or any soluble chloride).

2.3 Toward the solid (left, toward less dissolving).

3.1 B — less soluble.

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

3.3 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} .