

Exercise walk-through

7.12

Common-Ion Effect

AP Chemistry

Solubility equilibria

A sparingly soluble salt has a **solubility product** K_{sp} (solid left out):



$$K_{sp} = [\text{Ag}^+][\text{Cl}^-] = s^2$$

$$s = \sqrt{1.8 \times 10^{-10}} = 1.3 \times 10^{-5} \text{ M.}$$

Common-ion effect :
adding a shared ion shifts dissolving **backward** – less dissolves (K_{sp} unchanged).

In 0.10 M NaCl, AgCl solubility drops to $1.8 \times 10^{-9} \text{ M}$.

Unit 7 – key takeaways

1

Equilibrium

dynamic; equal forward and reverse rates

2

Q vs K

$Q < K$ forward, $Q > K$ reverse;
ICE table for K

3

Le Chatelier

shift to undo a stress; only T
changes K

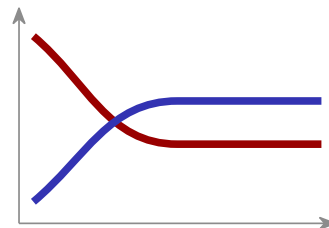
4

Solubility

K_{sp} ; common ion suppresses dissolving

Check yourself

- 1 At equilibrium, how do the forward and reverse rates compare?
- 2 If $Q < K$, which way does the reaction run?
- 3 Which stress actually changes the value of K ?
- 4 Does adding a common ion raise or lower solubility?



Answers 1. they are equal 2. forward 3. temperature 4. lower

Exercises 2.1-2.3

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]

Exercises 2.1-2.3

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

2.1

- Decrease
-

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

2.2

- NaCl (or any soluble chloride)
-

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

2.3

- Toward the solid (left, toward less dissolving)

Exercise 3.1

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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3.1 B

- less soluble

Exercise 3.2 (a)

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]

Exercise 3.2 (a)

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]

(a)

- It decreases

Exercise 3.2 (b)

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

(b) Explain using Le Chatelier's principle.

[2]

Exercise 3.2 (b)

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

(b) Explain using Le Chatelier's principle.

[2]

(b)

- Adding F^- (a product) stresses the equilibrium, which shifts left to consume it, forming more solid CaF_2 – so less dissolves

Exercise 3.3

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

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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}