

Exercise walk-through

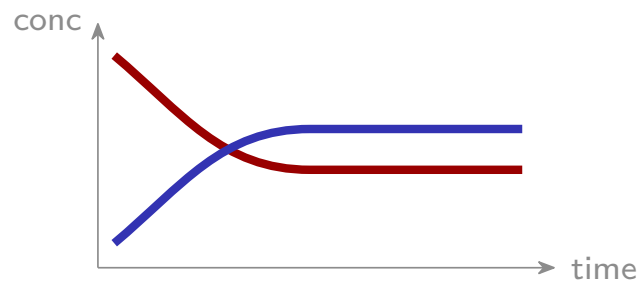
7.6

Properties of the Equilibrium Constant

AP Chemistry

What we will cover

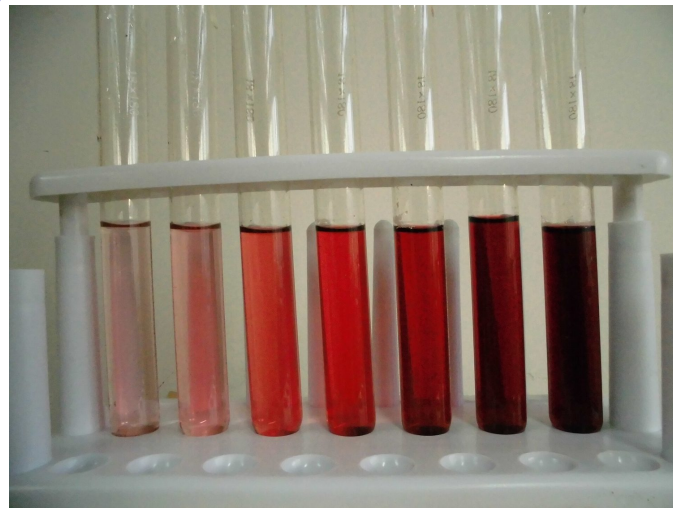
- 1 Dynamic equilibrium
- 2 The reaction quotient and K
- 3 ICE tables
- 4 Magnitude and properties of K
- 5 Le Chatelier's principle
- 6 Solubility equilibria



Dynamic equilibrium

Chemical equilibrium is
dynamic : the forward and reverse reactions run at the **same rate**, so concentrations stay constant (not zero).

Reached from **either side** – all reactant or all product gives the same mixture.



*Dynamic equilibrium: forward and reverse
still run*

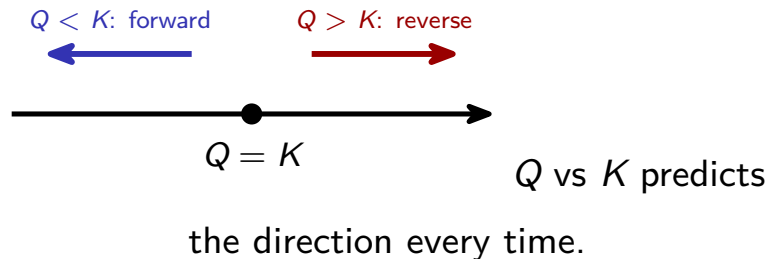
The reaction quotient and K

Equilibrium constant

$$K = \frac{[C]^c[D]^d}{[A]^a[B]^b}$$

Reaction quotient

Q has the same form at any moment. Leave out pure solids and liquids.



Exercises 2.1-2.3

2.1 A reaction has $K = 100$. Find K for the reverse reaction. [1]

2.2 A reaction has $K = 3$. Find K if all coefficients are doubled. [1]

2.3 Two reactions with $K_1 = 2$ and $K_2 = 5$ are added. Find K for the sum. [1]

Exercises 2.1·2.3

2.1 A reaction has $K = 100$. Find K for the reverse reaction. [1]

2.1

- $\frac{1}{100} = 0.01$

2.2 A reaction has $K = 3$. Find K if all coefficients are doubled. [1]

2.2

- $3^2 = 9$

2.3 Two reactions with $K_1 = 2$ and $K_2 = 5$ are added. Find K for the sum. [1]

2.3

- $2 \times 5 = 10$

Exercise 3.1

3.1 Reversing a reaction changes K to

[1]

☐

A $-K$

B $1/K$

C K^2

D $2K$

Exercise 3.1

3.1 Reversing a reaction changes K to

[1]

☐

A $-K$

B $1/K$

C K^2

D $2K$

3.1 B

- $1/K$

Exercise 3.2 (a)

3.2 A reaction has $K = 16$.

(a) Find K for the reaction written with all coefficients halved.

[2]

Exercise 3.2 (a)

3.2 A reaction has $K = 16$.

(a) Find K for the reaction written with all coefficients halved.

[2]

(a)

- $16^{1/2} = 4$

Exercise 3.2 (b)

3.2 A reaction has $K = 16$.

(b) Find K for the reverse of the halved reaction.

[2]

Exercise 3.2 (b)

3.2 A reaction has $K = 16$.

(b) Find K for the reverse of the halved reaction.

[2]

(b)

- $\frac{1}{4} = 0.25$

Exercises 3.3-3.4

3.3 Given $A \rightleftharpoons B$, $K_1 = 4$, and $B \rightleftharpoons C$, $K_2 = 3$, find K for $A \rightleftharpoons C$. [2]

3.4 At the same temperature, $A \rightleftharpoons B$ has $K = 16$ and $B \rightleftharpoons C$ has $K = 3$. Find K for $A \rightleftharpoons C$, then find K for $\frac{1}{2}C \rightleftharpoons \frac{1}{2}A$. Show the transformations. [4]

Exercises 3.3-3.4

3.3 Given $A \rightleftharpoons B$, $K_1 = 4$, and $B \rightleftharpoons C$, $K_2 = 3$, find K for $A \rightleftharpoons C$. [2]

3.3

- Adding the reactions multiplies the constants: $K = 4 \times 3 = 12$

3.4 At the same temperature, $A \rightleftharpoons B$ has $K = 16$ and $B \rightleftharpoons C$ has $K = 3$. Find K for $A \rightleftharpoons C$, then find K for $\frac{1}{2}C \rightleftharpoons \frac{1}{2}A$. Show the transformations. [4]

3.4

Adding cancels B and multiplies constants, giving $K = 16 \times 3 = 48$. Reverse and halve the sum: $K = (1/48)^{1/2}$, approximately 0.144.