

# 7.6 Properties of the Equilibrium Constant

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 10 marks

KEY WORDS equilibrium constant 平衡常数

## Objective

Build the skills to answer exam questions on the **properties of the equilibrium constant**.

You must be able to:

- **reverse** a reaction ( $K \rightarrow 1/K$ )
- **scale** a reaction by  $n$  ( $K \rightarrow K^n$ )
- **add** reactions ( $K \rightarrow K_1 \times K_2$ )

## 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.

### ■ Reversing a reaction

Reversing an equation **inverts** the constant:

$$K_{\text{reverse}} = \frac{1}{K_{\text{forward}}}.$$

### ■ Scaling a reaction

Multiplying all coefficients by  $n$  raises  $K$  to the power  $n$ :

$$K_{\text{new}} = (K_{\text{old}})^n.$$

### ■ Adding reactions

If you add two reactions, you **multiply** their constants:

$$K_{\text{total}} = K_1 \times K_2.$$

### ■ A worked example

If  $K = 4$  for a reaction, then the reverse has  $K = \frac{1}{4}$ ; doubling the equation gives  $K = 4^2 = 16$ ; halving gives  $K = 4^{1/2} = 2$ .

## 2 Practice

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Now apply the methods above.

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

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

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

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## 3 Exam-style questions

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**3.1** Reversing a reaction changes  $K$  to [1]

- A  $-K$
  - B  $1/K$
  - C  $K^2$
  - D  $2K$
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**3.2** A reaction has  $K = 16$ .

(a) Find  $K$  for the reaction written with all coefficients halved. [2]

(b) Find  $K$  for the reverse of the halved reaction. [2]

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

## Solutions

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**2.1**  $\frac{1}{100} = 0.01.$

**2.2**  $3^2 = 9.$

**2.3**  $2 \times 5 = 10.$

**3.1**  $B = 1/K.$

**3.2** (a)  $16^{1/2} = 4.$  (b)  $\frac{1}{4} = 0.25.$

**3.3** Adding the reactions multiplies the constants:  $K = 4 \times 3 = 12.$