

Exercise walk-through

Properties of the Equilibrium Constant ■ 7.6

eXercise

You must be able to

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

Method — Reversing a reaction

Reversing an equation **inverts** the constant:

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

Method — Scaling a reaction

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

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

Method — Adding reactions

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

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

Method — 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 $K = 4^{1/2} = 2$.

Practice 2.1 ■ 1 mark

A reaction has $K = 100$. Find K for the reverse reaction.

Solution 2.1

Worked steps

$$\frac{1}{100} = 0.01 \text{ (B1).}$$

Practice 2.2 ■ 1 mark

A reaction has $K = 3$. Find K if all coefficients are doubled.

Solution 2.2

Method: Scaling a reaction

Worked steps

$$3^2 = 9 \text{ (B1).}$$

Practice 2.3 ■ 1 mark

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

Solution 2.3

Worked steps

$$2 \times 5 = 10 \quad \text{B1}.$$

Exam-style 3.1 ■ 1 mark

Reversing a reaction changes K to

A $-K$

B $1/K$

C K^2

D $2K$

Solution 3.1

Method: Reversing a reaction

A $-K$

B $1/K$



C K^2

D $2K$

Worked steps

B — $1/K$.

Exam-style 3.2 ■ 2 marks

A reaction has $K = 16$.

- (a) Find K for the reaction written with all coefficients halved.
- (b) Find K for the reverse of the halved reaction.

Solution 3.2

Worked steps

(a) $16^{1/2} = 4$ **M1** **A1**. (b) $\frac{1}{4} = 0.25$ **M1** **A1**.

Exam-style 3.3 ■ 2 marks

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

Solution 3.3

Worked steps

Adding the reactions multiplies the constants: $K = 4 \times 3 = 12$ **M1** **A1**.