AP CHEMISTRY • EXERCISE SHEET

7.6 Properties of the Equilibrium Constant

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

Objective

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

You must be able to:

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

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

Now apply the methods above.

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]

3 Exam-style questions

3.1 Reversing a reaction changes K to [1]

- **A** $-K$
- **B** $1/K$
- **C** K^2
- **D** $2K$

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

4 Go further

You are now ready for the real exam questions on this subtopic:

- work through the **7.6 Properties of the Equilibrium Constant** lesson on the **Learn** page;
- read the **Properties of the Equilibrium Constant** section of the AP Chemistry handout on the **Know** page.

Solutions

2.1 $\dfrac{1}{100} = 0.01$.

2.2 $3^2 = 9$.

2.3 $2 \times 5 = 10$.

3.1 B —$1/K$.

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

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