ANSWER KEY.

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7.6 Properties of the Equilibrium Constant

AP Chemistry | ANSWER KEY

Reverse: 1/K. Multiply coefficients by n: K^n. Add reactions: multiply the K values.

1. For $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$, K = 2.5×10^{-3}. Find K for $2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$.

Reversed: K = 1 / (2.5×10^{-3}) = 4.0×10^{2}

2. For $A \rightleftharpoons 2B$, K = 0.30. Find K for $2A \rightleftharpoons 4B$.

Doubled: K = $(0.30)^2$ = 0.090

3. For $2C \rightleftharpoons 2D$, K = 64. Find K for $C \rightleftharpoons D$.

Halved: K = $(64)^{½}$ = √64 = 8.0

4. $A \rightleftharpoons B$ has K_1 = 3.0 and $B \rightleftharpoons C$ has K_2 = 0.50. Find K for $A \rightleftharpoons C$.

Add the reactions (B cancels), multiply the K values: K = (3.0)(0.50) = 1.5

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5. Given: (1) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$, $K_1 = 4.1 \times 10^{-31}$; (2) $N_2(g) + ½O_2(g) \rightleftharpoons N_2O(g)$, $K_2 = 2.4 \times 10^{-18}$. Find K for $N_2O(g) + ½O_2(g) \rightleftharpoons 2NO(g)$.

Reverse (2): $N_2O \rightleftharpoons N_2 + ½O_2$, $K = 1/K_2$. Keep (1). Add: N_2 cancels and O_2 leaves $½O_2$ on the left.
$K = K_1 / K_2 = (4.1 \times 10^{-31}) / (2.4 \times 10^{-18}) = 1.7 \times 10^{-13}$

6. For $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$, $K = 49.0$. Find K for $HI(g) \rightleftharpoons ½H_2(g) + ½I_2(g)$.

Reverse (1/49.0), then halve (square root): $K = 1 / \sqrt{49.0} = 1 / 7.00 = 0.143$

7. A student says that when you add two reactions you add their K values. Use question 4 to show why that is wrong.

Adding gives 3.0 + 0.50 = 3.5, but $K = [C]/[A] = ([B]/[A])([C]/[B]) = K_1 \times K_2 = 1.5$. The expressions multiply, so the K values multiply.

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