Day 8.2 Manipulating K

Friday, March 15, 2019 7:28 AM

① Flip eqn = Reciprocal of K = $\frac{1}{\text{original } K}$

② Multiply coefficients by "y" = raise to the power of "y"

$(\text{original } K)^y$

③ Add eqns = Multiply All K's

1. The following equilibrium concentrations were observed for the reaction at 127°C:

$$N_2(g) + 3H_2(g) \leftrightarrow 2NH_3(g) \quad \text{original}$$

Equil $[NH_3] = 3.1 \times 10^{-2}$ M $[N_2] = 8.5 \times 10^{-1}$ M $[H_2] = 3.1 \times 10^{-3}$ M

a. Calculate the value of K at 127°C for this reaction.

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3} = \frac{(3.1\times10^{-2})^2}{(8.5\times10^{-1})(3.1\times10^{-3})^3} = \boxed{3.8 \times 10^4}$$

b. Calculate the value of K at 127°C for the reaction:

$2\ NH_3(g) \leftrightarrow N_2(g) + 3\ H_2(g)$

FLIP $K = \frac{1}{\quad} = \boxed{2.6 \times 10^{-5}}$

FLIP $K = \frac{1}{3.8 \times 10^4} = \boxed{2.6 \times 10^{-5}}$

c. Calculate the value of K at 127°C for the reaction given by the equation:
½ $N_2(g)$ + 3/2 $H_2(g)$ ↔ $NH_3(g)$

Mult. by $\frac{1}{2}$ $K = (3.8 \times 10^4)^{1/2} = \boxed{190}$

2. At 25 °C, Kc = 2.2 * 10^{-3} for the reaction ICl (g) ↔ ½ I_2 (g) + ½ Cl_2 (g) original

a. Calculate Kc at 25 °C for 2 ICl (g) ↔ I_2 (g) + Cl_2 (g)

Mult. by 2 $K = (2.2 \times 10^{-3})^2 = \boxed{4.8 \times 10^{-6}}$

b. Calculate Kc at 25 °C for 2 I_2 (g) + 2 Cl_2 (g) ↔ 4 ICl (g)

Flip and Mult. by 4

$$\frac{1}{(2.2 \times 10^{-3})^4} = \boxed{4.3 \times 10^{10}}$$

3. Given the following data at 25 °C

$\cancel{2\,NO\,(g) + Br_2\,(g) \leftrightarrow 2NOBr\,(g)}$ $\quad Kc = 2.0 * 10^3$

~~flip~~ $\cancel{2\,NO\,(g) \leftrightarrow N_2\,(g) + O_2\,(g)}$ $\quad \cancel{Kc = 1.0 * 10^{30}}$

$N_2 + O_2 \rightleftharpoons \cancel{2NO}$ $\quad Kc = \frac{1}{1 \times 10^{30}} = 1 \times 10^{-30}$

Calculate Kc for the following reaction:

GOAL $\quad ½\,N_2\,(g) + ½\,O_2\,(g) + ½\,Br_2\,(g) \leftrightarrow NOBr\,(g)$

$\frac{1}{2}Br_2 + \frac{1}{2}N_2 + \frac{1}{2}O_2 \rightleftharpoons 1\,NOBr$

$Kc = (2 \times 10^3)(1 \times 10^{-30}) = (2 \times 10^{-27})^{1/2}$

$\boxed{Kc = 4.5 \times 10^{-14}}$