$$2NO_2(g) + F_2(g) \rightleftarrows 2NO_2F(g)$$

$$R_f = k_f[NO_2][F_2]$$

$$K_c = \frac{[NO_2F]_{eq}^2}{[NO_2]_{eq}^2[F_2]_{eq}}$$

Step 1 $NO_2(g) + F_2(g) \rightleftarrows NO_2F(g) + F(g)$

Step 2 $NO_2(g) + F(g) \rightleftarrows NO_2F(g)$

$$2NO_2(g) + F_2(g) \rightleftarrows 2NO_2F(g)$$

$$K_{c_1} = \frac{[NO_2F]_{eq}[F]_{eq}}{[NO_2]_{eq}[F_2]_{eq}}$$

$$K_{c_2} = \frac{[NO_2F]_{eq}}{[NO_2]_{eq}[F]_{eq}}$$

$$\underbrace{K_{c_1}\cdot K_{c_2}}_{\downarrow} = \frac{[NO_2F]_{eq}\cancel{[F]_{eq}}}{[NO_2]_{eq}[F_2]_{eq}} \cdot \frac{[NO_2F]_{eq}}{[NO_2]_{eq}\cancel{[F]}}$$

$$K_c = \frac{[NO_2F]_{eq}^2}{[NO_2]_{eq}^2[F_2]_{eq}}$$

Properties of the Equilibrium Constant

1. When reactions are added, their equilibrium constants are multiplied
2. When you multiply a reaction by a constant, you raise the equilibrium constant to that power.
3. When you reverse the direction of a reaction, you take the reciprocal of its equilibrium constant.

$$2A(g) \rightleftarrows B(g) + C(g)$$

$$K_c = \frac{[B]_{eq}[C]_{eq}}{[A]_{eq}^2}$$

$$4A(g) \rightleftarrows 2B(g) + 2C(g)$$

$$K'_c = \frac{[B]_{eq}^2[C]_{eq}^2}{[A]_{eq}^4}$$

$$= \left(\frac{[B]_{eq}[C]_{eq}}{[A]_{eq}^2}\right)^2$$

$$K'_c = K_c^2$$

$$\sqrt{x} \cdot \sqrt{x} = x$$

$$x^{\frac{1}{2}} \cdot x^{\frac{1}{2}} = x^{\frac{1}{2}+\frac{1}{2}} = x^{1}$$

$$= x$$

$$2A(g) \rightleftarrows B(g) + C(g)$$

$$K_c = \frac{[B]_{eq}[C]_{eq}}{[A]_{eq}^2}$$

$$B(g) + C(g) \rightleftarrows 2A(g)$$

$$K_c'' = \frac{[A]_{eq}^2}{[B]_{eq}[C]_{eq}}$$

$$= \frac{1}{\dfrac{[B]_{eq}[C]_{eq}}{[A]_{eq}^2}}$$

$$K_c'' = \frac{1}{K_c}$$

$$2A(g) \rightleftarrows B(g) + C(g)$$

This reaction started with pure A at a concentration of $1.50 \frac{mol}{L}$. At equilibrium, the concentration of B was $0.50 \frac{mol}{L}$. What is the numeric value of K_c for this reaction?

$$2A(g) \rightleftarrows B(g) + C(g)$$

$$K_c = \frac{[B]_{eq}[C]_{eq}}{[A]^2_{eq}}$$

	[A]	[B]	[C]
I	1.50	0	0
C	−1.00	+0.50	+0.50
E	0.50	0.50	0.50

I + C = E

$$K_c = \frac{[B]_{eq}[C]_{eq}}{[A]^2_{eq}} = \frac{(0.50)(0.50)}{(0.50)^2}$$

$$= 1.0$$

$$aA(g) + bB(g) \rightleftarrows cC(g) + dD(g)$$

$$K_c = \frac{[C]_{eq}^{c}\,[D]_{eq}^{d}}{[A]_{eq}^{a}\,[B]_{eq}^{b}}$$

$$K_p = \frac{P_{C_{eq}}^{c} \cdot P_{D_{eq}}^{d}}{P_{A_{eq}}^{a} \cdot P_{B_{eq}}^{b}}$$

$$PV = nRT \longrightarrow P = \frac{nRT}{V}$$

$$P = \left(\frac{n}{V}\right)RT = MRT$$

$$K_p = \frac{P_{C_g}^{c} \cdot P_{D_g}^{d}}{P_{A_g}^{a} \cdot P_{B_g}^{b}}$$

$$= \frac{\left([C]_g RT\right)^c \left([D]_g RT\right)^d}{\left([A]_g RT\right)^a \left([B]_g RT\right)^b}$$

$$= \frac{[C]_g^c (RT)^c \cdot [D]_g^d (RT)^d}{[A]_g^a (RT)^a \cdot [B]_g^b (RT)^b}$$

$$= \frac{[C]_g^c [D]_g^d \cdot (RT)^c \cdot (RT)^d}{[A]_g^a [B]_g^b \cdot (RT)^a (RT)^b}$$

$$= \frac{[C]_g^c [D]_g^d}{[A]_g^a [B]_g^b} \cdot \frac{(RT)^c \cdot (RT)^d}{(RT)^a (RT)^b}$$

$$= K_c \cdot \frac{(RT)^{c+d}}{(RT)^{a+b}}$$

$$= K_c \cdot (RT)^{c+d-(a+b)}$$

$$\Delta n = c+d-(a+b)$$

$$\boxed{K_p = K_c \cdot (RT)^{\Delta n}}$$

$R = 0.08206 \frac{L\ atm}{K\ mol}$

T = Kelvin temp.

$\downarrow$ algebra

$$K_c = K_p \cdot (RT)^{-\Delta n}$$

$$aA(g) + bB(g) \rightleftarrows cC(g) + dD(g)$$

$$K_c = \frac{[C]_{eq}^{c}[D]_{eq}^{d}}{[A]_{eq}^{a}[B]_{eq}^{b}}$$

$$K_p = \frac{P_{C_{eq}}^{c} \cdot P_{D_{eq}}^{d}}{P_{A_{eq}}^{a} \cdot P_{B_{eq}}^{b}}$$

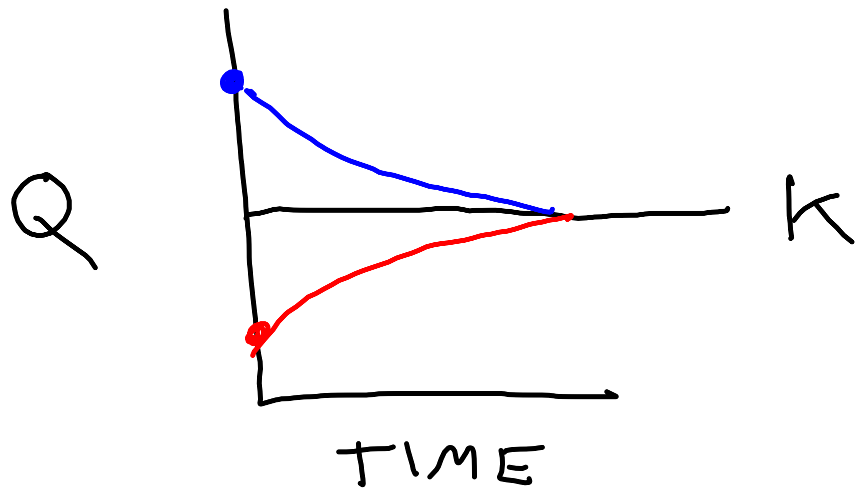
$$Q_c = \frac{[C]^{c}[D]^{d}}{[A]^{a}[B]^{b}}$$

$$Q_p = \frac{P_C^{c} \cdot P_D^{d}}{P_A^{a} \cdot P_B^{b}}$$

$Q = K$ at equilibrium

$Q > K$ left $\leftarrow$

$Q < K$ right $\rightarrow$



$$aA(g) + bB(g) \rightleftharpoons cC(g) + dD(g)$$