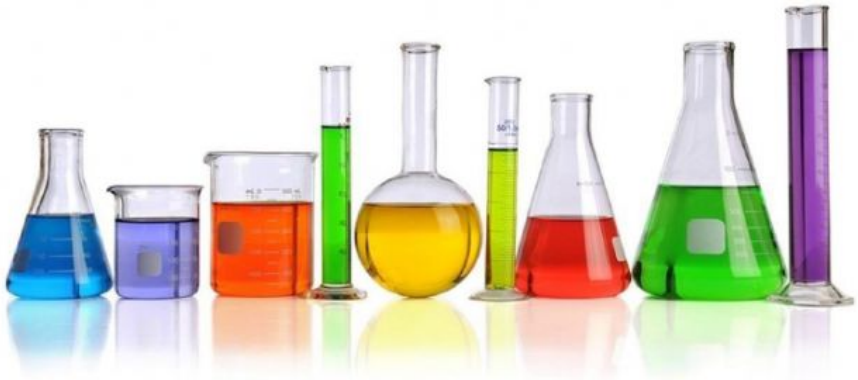
Chemical equilibrium



The law of mass action or the law of equilibrium (K) states that in a state of equilibrium, the product of the concentrations of the reatants raised to the power of the coefficient divide by the product of the concentrations of the reactants raised to the power of the coefficient will have a fixed value.

Check the following reaction eauations!

$$aA + bB \rightleftharpoons nC + mD$$

then the value of the equilibrium constant for concentration is:

$$\mathrm{K} = \frac{[C]^n \ [D]^m}{[A]^a \ [B]^b}$$

Example:

Writing the Equilibrium Constant.

Reminder: solutes (aq) or gases (g) appear; solvents (l) or solids (s) do not.

$$2S_2O_{3(g)} + O_{2(g)} \rightleftharpoons 4\,SO_{2(g)}$$

$$Kc = \frac{[SO_2]^4}{[S_2O_3]^2\,[O_2]}$$

$$Fe_2O_{3(s)} + 3CO_{(g)} \rightleftharpoons 2Fe_{(s)} + 3CO_{2(g)}$$

$$Kc = \frac{[CO_2]^3}{[CO]^3}$$

After looking at the equation and the equilibrium constant value in the previous equation, the try to determine the value of Kc from the following combinations.

1. $4NO_{2(g)} \rightleftharpoons 4NO_{(g)} + 2O_{2(g)}$

$$Kc = \frac{[.....]^{.....}\ [.....]^{.....}}{[.....]^{.....}}$$

2. $2NO_{(g)} + O_{2(g)} \rightleftharpoons 2NO_{2(g)}$

$$Kc = \frac{[.....]^{.....}}{[.....]^{.....}\ [.....]}$$

3. $N_2O_{4(g)} + O_{3(g)} \rightleftharpoons N_2O_{5(s)} + O_{2(g)}$

$$Kc = \frac{[.....]}{[.....]\ [.....]}$$

4. $NH_4CO_2NH_{2(s)} \rightleftharpoons 2NH_{3(g)} + CO_{2(g)}$

$$Kc = [\ldots\ldots\ldots]^{\ldots\ldots} \ [\ldots\ldots\ldots]$$

5. $Ti_{(s)} + 2Cl_{2(g)} \rightleftharpoons TiCl_{4(l)}$

$$Kc = \frac{\ldots\ldots\ldots}{[\ldots\ldots\ldots]^{\ldots\ldots}}$$