CONCEPT: THE EQUILIBRIUM CONSTANT

The equilibrium constant, K, is a number equal to the ratio of _____ to _____ at a given temperature.

- Its magnitude tells us how far to the left or to the right our chemical equation lies at a particular temperature.
- If K is greater than 1 then _____ are favored over _____ and _____ direction is favored.
- If K is less than 1 then _____ are favored over _____ and _____ direction is favored.

K =

The equilibrium constant, K, takes into account all states of matter except: _____ and _____.

EXAMPLE: Write the equilibrium expression for the following reaction.

a) $2\ N_2O_5\ (aq) \rightleftharpoons 4\ NO_2\ (aq) + O_2\ (aq)$

b) $2\ PbO\ (s) + O_2\ (g) \rightleftharpoons 2\ PbO_2\ (s)$

c) $I_2\ (s) + 3\ XeF_2\ (s) \rightleftharpoons 2\ IF_3\ (s) + 3\ Xe\ (g)$

PRACTICE: State which is greater in amount: reactants or products, based on the given equilibrium constant, K.

a) $N_2\ (g) + O_2\ (g) \rightleftharpoons 2\ NO\ (g)$ $\quad K = 1.0 \times 10^{20}$

b) $2\ CO\ (g) + O_2 \rightleftharpoons 2\ CO_2\ (g)$ $\quad K = 2.2 \times 10^{-22}$

c) $2\ BrCl\ (g) \rightleftharpoons Br_2\ (g) + Cl_2\ (g)$ $\quad K = 1$

PRACTICE: THE EQUILIBRIUM CONSTANT

PRACTICE: The decomposition of nitrogen monoxide can be achieved under high temperatures to create the products of nitrogen and oxygen gas.

$$6\ NO\ (aq) \rightleftharpoons 3\ N_2\ (aq) + 3\ O_2\ (aq)$$

a) What is the equilibrium equation for the reaction above?

b) Write the equilibrium expression for the reverse reaction.

PRACTICE: The equilibrium constant, K, for the $2\ NO\ (g) + O_2\ (g) \rightleftharpoons 2\ NO_2\ (g)$ is 6.9×10^{2}. What is the [NO] in an equilibrium mixture of gaseous NO, O_2 and NO_2 at 500 K that contains 1.5×10^{-2} M O_2 and 4.3×10^{-3} M NO_2?