CH 105 SI

Session 15

Equilibrium Practice

1. Write the equilibrium expression, K_c, for the following reactions:
   a. $2\ SO_2(g) + O_2(g) \leftrightarrow 2\ SO_3(g)$

$$K_c = \frac{[SO_3]^2}{[SO_2]^2[O_2]}$$

   b. $CaCO_3(s) \leftrightarrow CaO(s) + O_2(g)$

$$K_c = [O_2]$$

   c. $H_2O(g) + C(s) \leftrightarrow H_2(g) + CO(g)$

$$K_c = \frac{[CO][H_2]}{[H_2]}$$

2. Calculate K_c for the following reaction if you have 0.1908 moles of CO_2, 0.0908 moles of H_2, 0.0092 moles of CO, and 0.0092 moles of H_2O in a 2.00 L reaction vessel at equilibrium.

$CO_2(g) + H_2(g) \leftrightarrow CO(g) + H_2O(g)$

$$K_c = \frac{[CO][H_2O]}{[CO_2][H_2]}$$

Concentrations are in Molarity, (moles/liter). Therefore... divide all moles by 2 L.

$$K_c = \frac{\left[\frac{.0092}{2}\right]\left[\frac{.0092}{2}\right]}{\left[\frac{.1908}{2}\right]\left[\frac{.0908}{2}\right]} = \frac{[.0046][.0046]}{[.0954][.0454]} = \frac{.00002116}{.0043316} = \boxed{4.9 \times 10^{-3}}$$

3. Consider the following reaction

$$2\ NO(g) + 2\ H_2(g) \leftrightarrow N_2(g) + 2\ H_2O(g)$$

Determine the value of the equilibrium constant, K_c, for the reaction. At equilibrium, you have a mixture of 0.100 M NO, 0.050 M H_2, 0.100 M H_2O, and .050 M N_2.

$$K_c = \frac{[H_2O]^2[N_2]}{[NO]^2[H_2]^2} = \frac{[.100]^2[.050]}{[.100]^2[.050]^2} = \frac{(.01)\times(.050)}{(.01)\times(.0025)}$$

$$= \frac{.0005}{.00025} = \boxed{20}$$

→ this would never really happen... focus on how we got here!

4. What is LeChatlier's Principle?

If a system experiences a stress or a shift in equilibrium, it will shift to counteract that stress and restore equilibrium.

5. According to LeChatlier's principle, what would happen if you increase the reactant concentration in a reaction at equilibrium?

The equilibrium reaction will favor the forward reaction to make more products.

6. According to LeChatlier's principle,what would happen if you added heat to an endothermic reaction?

endothermic:

heat + reactants ⟶ products

It will shift towards products because heat is a "reactant".

↓

not literally...
but we put heat IN an endothermic rxn...
so for this purpose we can write it as above.