

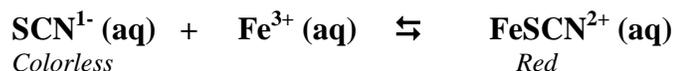
Equilibrium Notes #4

LeChatelier's Principle:

"If a stress is applied to a system, the system will adjust to offset that stress."

The stress can result from changes in concentration, temperature, and pressure.

Consider the following equilibrium system:



Concentration Effects:

1. If $\text{SCN}^{1-}(\text{aq})$ is added, the system will shift to the right and the red color will intensify. The K Value for this system will remain constant unless the temperature is changed.
2. If more $\text{Fe}^{3+}(\text{aq})$ is added, red color will intensify as the system shifts to the right. The K Value for this system will remain constant unless the temperature is changed.
3. If we remove $\text{Fe}^{3+}(\text{aq})$ by the addition of Na_2HPO_4 , the system will shift to the left. The K Value for this system will remain constant unless the temperature is changed.

Temperature Effects:

Endothermic Reactions: Heat is added $A + B + \text{Heat Energy} \rightleftharpoons C + D$

Exothermic Reactions: Heat is produced $A + B \rightleftharpoons C + D + \text{Heat Energy}$



Adding heat energy to the system will cause it to shift to the right.

Bracken Suggestion: Think of heat energy as the reactant in this example.

Adding energy to an endothermic system causes the equilibrium to shift to the right.

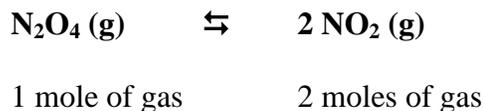
Adding energy to an exothermic system causes the equilibrium to shift to the left.

The equilibrium constant (K) value can be changed by changing the temperature!!!!

Pressure and Volume Effects:

Gases can be affected by changes in pressure

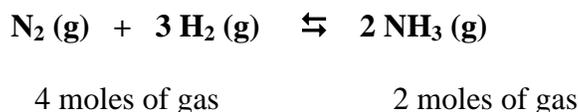
Consider this example:



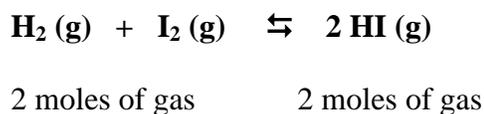
If we increase the pressure (or reduce the volume of the system), the system responds by shifting to decrease the total number of moles of gas. For this example, we would see the system shift to the left as the pressure is increased.

Likewise, a decrease in the pressure (or an increase in volume) favors the direction that increases the number of moles of a gas.

Consider this example



Decreasing the pressure will cause the system to shift to the left, favoring the formation of more moles of gas to “fill the void.”



Changing pressure will NOT affect this system since the number of moles of gas is the same on each side.

Liquids and solids are unaffected by changes in pressure because they cannot be compressed.

Inert Gas Addition:

“addition of helium, neon, argon”

While the total pressure on the system is increased, the equilibrium itself is UNAFFECTED.
NO SHIFT OBSERVED.

Catalyst:

The presence of a catalyst does not affect the equilibrium constant but it may help a system to reach equilibrium faster.

