**Equilibrium**

**Chemical Equilibrium** - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

[Bailing Beakers](https://www.youtube.com/watch?v=CMs2WhGY3NE) Video

**Reversible reaction** - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Le Chatelier’s Principle**: When a system at equilibrium is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, the system will undergo a change in such a way as to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Explaining Le Chatelier’s Principle**: When you take something away from a system at equilibrium, the system **\_\_\_\_\_\_\_\_\_\_\_\_** in such a way as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

When you add something to a system at equilibrium, the system **\_\_\_\_\_\_\_\_\_\_\_** in such a way as to **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Example #1 - Le Chatelier’s Principle** A closed container of ice and water at equilibrium\_\_\_\_\_\_\_ is added to the system.

Water/Ice + Energy →

What happens to the equilibrium?

**Example # 2 - Le Chatelier’s Principle**

N2 + 3H2 → 2NH3

In a closed container, more NH3 is added to the system. Which way will equilibrium shift?

**Example #3 - Le Chatelier’s Principle**

A closed container of water and its vapor at equilibrium. Vapor is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the system.

water + Energy vapor

**Example #4 - Le Chatelier’s Principle**

A closed container of N2O4 and NO2 at equilibrium. The pressure is increased.

N2O4 (g) + Energy 2NO2 (g)

More pressure shifts to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Look for smaller number of moles (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

**Measuring Equilibrium**

* At equilibrium the concentrations of products and reactants are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* We can write a constant that will tell us where the equilibrium position is.

**Keq = [Products]coefficients**

**[Reactants]coefficients**

* + Keq = equilibrium constant
  + Square brackets [ ] means \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Calculating Equilibrium** General equation

*a*A + *b*B *c*C + *d*D

Calculate the equilibrium constant for the following reaction.

3**H2(g) + N2(g) 2NH3(g)**

If at 25oC there 0.15 mol of N2 , 0.25 mol of NH3, and 0.10 mol of H2 in a 2.0 L container.

1. Calculate Molarity
2. Create Equilibrium equation

**Calculating Equilibrium**

* If Keq > 1 Products are favored
  + More products than reactants at equilibrium
* If Keq < 1 Reactants are favored

**Equilibrium Calculations** Note: When calculating equilibrium, do NOT include solids and liquids (AKA water.) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Solids and liquids \_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_ affect the equilibrium.

Ex. Write the equation for the equilibrium constant for the following reaction:

H2O (g) + C (s) H2 (g) + CO (g)

**Keq =**

**Review Questions**

1. What types of compounds would ionize in water?
2. What would happen if we increase the temperature of a solution in which a solid is dissolved in a liquid?
3. What mass of Na2SO4 is needed to make 2.5L of 2.0M solution?
4. Why do oil and water not mix?
5. Write the equilibrium expression.
6. Which direction will equilibrium shift if more CO2 is added?

**H2CO3 (aq) CO2 (aq) + H2O (l)**

**Freezing Point Depression** - When a solute is added to a solvent, the freezing point of the solvent **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

**Vapor Pressure Lowering** - The vapor pressure of a solvent is **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** when a solute is added.

**Boiling Point Elevation** - When a solute is added to a solvent, the boiling point of the solvent **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**