**Solubility Product Constant or Ksp--just another Keq or Kc**

Substances are considered soluble if an aqueous solution of 0.1 mol/L or greater can be made.

**Solubility of Ionic Solids in Water**

* solubility may be considered an equilibrium between the solid and its ions in soln
* any ionic solid that dissolves to any degree dissociates 100 % once it actually dissolves
* solubility refers to the amount of solid (either in moles or grams) that actually does dissolve in soln



**Old rules but still used on some sites:**

Solubility at least 0.100 molL-1 dissolves

Slightly Solubility approx. 0.001 -- 0.100 molL-1 dissolves

Insoluble (sparingly soluble) less than 0.100 molL-1 dissolves

**Factors That Affect the Solubility of Solids and Gases in Water Solutions**

**1)** **Nature of the Solute**

* only 1 g of PbCl2 can be dissolved in 100 g of water at RT
* 200 g of ZnCl2 can be dissolved in 100 g of water at RT

2) **Temperature**

* generally, for a solid, an \_\_\_\_\_\_\_\_\_\_ in T increases solubility--think salt in water
* For all gases, an \_\_\_\_\_\_\_\_\_\_ in T decreases solubility--think Diet Coke

3) **Pressure**

* pressure has little effect on the solubility of solids or liquids in solution
* for gaseous solutes, an \_\_\_\_\_\_\_\_\_\_ in P \_\_\_\_\_\_\_\_\_\_\_ solubility--think Diet Coke
* When the cap on a bottle of soda pop is removed, pressure is released, and the gaseous solute bubbles out of solution.
* This escape of a gas from solution is called **effervescence**.

The **rate of solution** is a measure of how fast a substance dissolves.

**Factors That Affect the Rate of Solution**

The **rate of solution** is a measure of **how fast a substance dissolves**.

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| --- |
| **1) Size of the particles--\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** When a solute dissolves, the action takes place only at the surface of each particle.
* When the total surface area of the solute particles is increased, the solute dissolves more rapidly.
* Breaking a solute into smaller pieces increases its **surface area** and increases its rate of solution.

**2) Stirring*** With liquid and solid solutes, stirring brings fresh portions of the solvent in contact with the solute.

 * Stirring, therefore, allows the solute to dissolve faster.
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| 3) **Amount of solute already dissolved*** When you have very little solute in the solution, dissolving takes place quickly.

 * When you have a lot of solute in the solution, dissolving takes place more slowly.

 Concentration of Soln4) **Temperature*** For liquids and solid solutes, increasing the temperature increases the amount of solute that will dissolve.
* It also increases the rate at which the solute will dissolve.
* For the gases, the reverse is true--an increase in T decreases both solubility and rate of solution.
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**Problem Type 1**

**Solubility to Ksp**

1) Write the dissociation equation. (or -1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2) Write the Ksp expression. (or -1)

Calcium fluoride, CaF2, dissolves in water to the extent of 0.00170 g per 100 mL.

What is the Ksp for CaF2?

**Problem Type 2**

**Ksp to Solubility or Concentrations of Ions**

1) Write the dissociation equation leaving space underneath. (or -1)

2) Write the Ksp expression. (or -1)

Photographic films are based on the sensitivity of AgBr to light. When light hits a crystal of AgBr, a small fraction of the Ag+ ions are reduced to silver metal. The rest of the Ag+ ions in these crystals are reduced to silver metal when the film is developed. AgBr crystals that do not absorb light are then removed from the film to "fix" the image.

Let's calculate the solubility of AgBr in water in grams per liter, to see whether AgBr can be removed by simply washing the film.

The Ksp of AgBr is 5.0 x 10-13.