Solubility Problems

In the previous lesson, we looked at how to interpret a solubility curve in order to:

1. Determine the solubility of a substance at a given temperature.
2. Determine whether a solution was saturated, unsaturated, or supersaturated.

In this lesson, we will be looking at how to solve some additional problems involving solubility.

Recall that **solubility** is the maximum amount of solute that can dissolve in a certain amount of solute. The units of solubility are usually in terms of mass (in grams) of solute per 100 grams of solvent. Some other possible units for solubility include grams per liter (g/L), grams per 100 milliliters (g/100 mL), or moles per kilogram (mol/kg).

Solubility is usually determined experimentally. For example, you might add 36 g of salt to 100 g of water at room temperature (25°C) and find that all of the salt dissolves. You then might add another 1 g of salt and find that only 0.2 g of it dissolves. Using this information, you can determine that the solubility of salt in water at room temperature is exactly 36.2 g/ 100 g of water.

 Below are more examples of problems involving solubility.
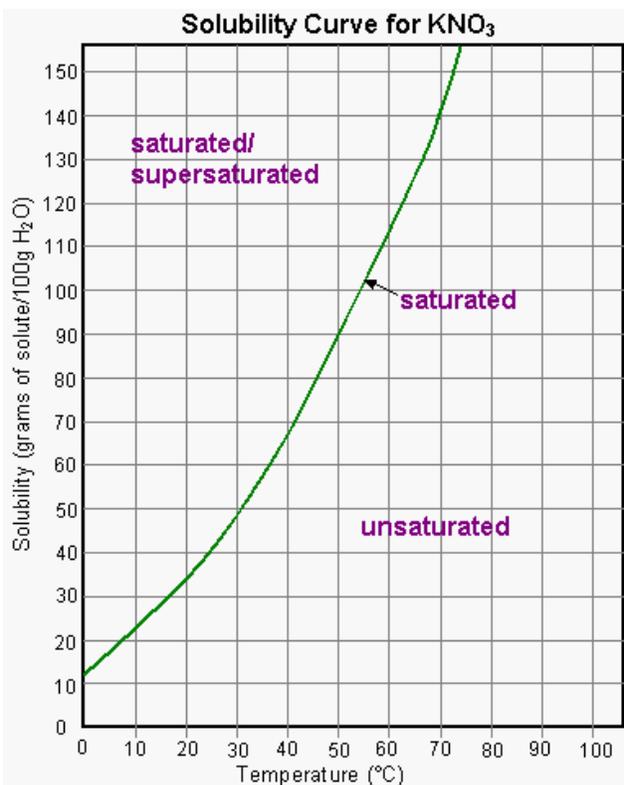
Example 1
If 25 g of a solute is the maximum amount that dissolves in 40 g of a solvent at a certain temperature, what is the solubility in grams of solute per 100 grams of solvent?

Example 2
If 30.1 g of a solute can dissolve in 350 g of water at a certain temperature, what is the solubility of the substance in g/100 g water?

Example 3
Using the solubility curve below, determine if a solution of 50 g of potassium nitrate in 100 g of water is saturated, unsaturated, or supersaturated at 50°C.

Solubility Curve for KNO₃

Example 4

A 75 mL volume of a saturated solution of KNO_3 at 70°C is cooled to 40°C. Using the solubility curve for potassium nitrate from Example 3, determine how much solid precipitates from the solution.

Example 5

What volume of water is required to dissolve 240 g of potassium nitrate (KNO_3) at 60°C?

Solubility Problems

1. If the solubility of a solid in water is 118 g/L, how much water would you need to dissolve a piece of the same solid with a mass of 45 g?

2. If 18 g of KNO_3 are dissolved in 15 mL of water at 100°C, at what temperature will the solid begin to settle out?

3. If 40 g of KNO_3 is added to 50 mL of water at 40°C, will it all dissolve? If not, how much would be leftover? If you raised the temperature to 45°C, will it all dissolve? Give evidence.

4. If 142 g of NH_4Cl are dissolved in 350 mL of water at 55°C, is the solution saturated?