

Temperature Affects On Solubility

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Looking at the Solubility Curve on the Solubility Notes handout, temperature seems to affect the solubility of solutes. Remember that solutes dissolve into the empty spaces between the solvent particles (in most solubility curves, water (a polar molecule is the solvent). Temperature does not affect all solutes the same. In general, there are two sections as follows.

Ionic solid solutes (in general since there are a few exception)

As you can see from the Solubility curve, in general, **as temperature increase, the solubility of the ionic solid solute increases**

Why: Even though we do not tell you and do not consider it most of the time, the same amount of water does not occur the same volume if the water is at 75 degreeC as if is at 45degreeC. (75degreeC water occupies more volume). This difference is usually not enough to be considered but it does exist. The higher temperature water particles have more kinetic energy and occupy more empty space. So if there is more empty space, you can put more solute in that empty space thereby increase the solubility of the ionic solid solute. (there are a few ionic solid solute that do the opposite, we will not consider them here. True explanation is outside scope of class).

Gas solutes

As you can again see from the Solubility curve, increasing temperature decreases the solubility of gas solutes (i.e. NH_3 , ammonia gas).

Why: In general, gas particles do not want to interact with any particles let alone liquid particles. So you must force gas particles into the liquid phase. For water (polar molecules), you are physically forcing (overcoming water coulombic force) the two water particles apart to have the gas particle in the liquid phase (ie. creating the solution). As the gas particles is forced past water particles (i.e. water particles above the gas particle), their coulombic force pulls the water particles close to each other thereby "trapping the gas particles" in the liquid phase.

As you know from above, increasing temperature causes the water particles to occupy more empty space. When the water particles occupy more space, the gas particles are not "trapped" any more (or at least not as many gas particles are trapped), and they can go into the gas phase. Therefore, the gas particles leave the liquid phase thereby decreasing the solubility of gas solutes with increasing temperature.

Solubility Curves for a Number of Water Soluble Inorganic Substances

