DISSOLVING SOLIDS INTO LIQUIDS

The best way to measure the amount of a solid material is usually to weigh it. The best way to find the amount of a liquid is to find the volume. The formula for solutions is: C V = n, where C is concentration in molar, V is the volume in liters, and n is the number of mols of solute. Further, n = m/Fw , where m is the mass and Fw is the formula weight of the solute. Solving for the mass, m = C V Fw.

V = n or m = C V Fw

How do you make the solution of a solid in a liquid. First weigh the solid to get the mass. The concentration you want times the volume of solution times the formula weight of the solute will get you the mass of solute you need to weigh. Place the mass of solute in a volume measuring device such as a volumetric flask or a graduated cylinder. Use a small amount of water to dissolve the solute in the volumetric device. Add water to the volume desired and mix.

The act of dissolving a solid into a liquid is a process that happens on the surface of the particles of the solute. The smaller the particles (the larger the surface area) the faster the solute dissolves. Triple-X sugar, called 'confectioner's sugar,' has smaller particles than regular 'table sugar.' Rock candy is just regular table sugar that has been crystallized in large lumps. When you put each crystal size the chemically identical materials in your mouth, which one dissolves faster? The triple-X sugar tastes sweetest because more of it has dissolved in the same short time. (You can only taste dissolved sugar.)

Expose the surface area of the solid to more solid and the solute will dissolve faster. Mixing helps dissolve the solid. You can try this with sugar. Take two glasses of water at the same temperature and add a spoonful of sugar to each. Mix one, but not the other. In which glass does the sugar dissolve more easily?

Most solid materials will dissolve faster with increased temperature. Since the increased temperature increases the motion of the molecules, you can think of this effect as being similar to mixing. You have seen this effect. Sugar dissolves more quickly in warm tea than iced tea. Table salt dissolves more quickly in hot water than in cold.

HOW TO DISSOLVE A SOLID INTO A LIQUID

1. Increase surface area of solid by decreasing the size of particle.
2. Increase temperature of the mixture.
3. Mix.

DISSOLVING GASES INTO LIQUIDS

Gases are more easily measured by knowing the pressure, volume, and temperature of the gas. Seltzer water and ammonia water are two good examples of solutions of a gas in a liquid. Seltzer, or carbonated water, is the result of pressing carbon dioxide gas into water. Seltzer is used as the base liquid in any carbonated beverage. The bubbles in beer or sparkling wines are also due to carbon dioxide, but the CO_2 is a natural product of the fermentation process, so it does not have to be added artificially. Ammonia water, also called ammonium hydroxide solution, is made from ammonia (NH_3) being pressed into water. It is used as a weak base and as a cleaning material, particularly for glass.

Because the process is better done under pressure, it is often difficult to directly observe the actual dissolving done in most cases. The notable exception is the addition of dry ice, solid carbon dioxide, to water as described in the section on carbon dioxide.

As with a solid dissolving in a liquid, a gas dissolves in a liquid more easily with agitation or mixing, but that is where the similarity ends. Remove a carbonated beverage from its container and it becomes obvious that pressure is necessary to keep the gas in the liquid. The drink fizzes and bubbles, releasing the gas. As the beverage sits for a few hours, the taste becomes what we describe as 'flat.' Almost all of the carbon dioxide has escaped from the liquid. The only CO_2 remaining in the water will produce a partial pressure equal to the partial pressure of the gas in the atmosphere. Water carries dissolved oxygen from the partial pressure of the oxygen in the atmosphere.

As the combination of liquid and gas is NOT the favored (lowest energy) condition, an increase in temperature causes the separation. Lower temperature favors dissolving the gas into the liquid. You can verify this experimentally on your own. Leave one can of carbonated beverage at room temperature. Refrigerate a can of the same carbonated beverage. Gently heat a third can of the same beverage. Open them all and record

the results. You are likely to find that the gas stays in solution better in the cooler liquid.

HOW TO DISSOLVE A GAS INTO A LIQUID

1. Increase the gas pressure on the liquid.
2. Decrease the temperature.
3. Mix.

LIQUIDS IN LIQUIDS

A solution of two liquids is relatively uncomplicated. For the most part, liquids either mix together or they don't. When liquids will mix together, they usually do so in all proportions and are said to be miscible. If they do not mix, as oil and water, they are said to be immiscible. Using ethyl alcohol and water as examples of miscible liquids, we can have a solution of the two liquids with one drop of alcohol in a bucketful of water or one .drop of water in a bucketful of alcohol

Immiscible liquids can make a mixture of the nature of a colloidal suspension by very finely dividing one of the liquids and dispersing it through the other liquid. Milk fresh from the cow separates into a milk and a cream layer, the cream rising to the top. The cream of milk is a fatty material of a lower density, so it floats. The milk may be homogenized, a process that violently shakes the milk so that the cream forms very small ball-shaped particles. This homogenized milk will remain well mixed .with normal treatment

The stability of homogenized milk as a mixture is helped by the presence of the proteins of milk. Proteins often have areas of large amounts of available electrical charge and areas of very little charge. The areas of higher charge are more soluble in water and the areas of lower charge are more soluble in the fat of the cream. In this way the protein acts as a surface active agent, or surfactant. A surfactant is a large molecule with

one area in one liquid and another area in another. Proteins of milk on the surface of the small globules of fat in homogenized milk will keep the globules from attaching back to each other, so the milk stays homogenized. Soaps and detergents are surfactants that help get oily dirt .into suspension in water

Agitation (mixing) is usually the most important factor in making a liquid-liquid mixture. The agitation of milk to homogenize it is a good example for colloids, but many other liquids do not mix without considerable agitation. If you make a highly concentrated syrup and pour it into water, the syrup will drop to the bottom of the water and stay there until it is agitated or (in a much longer time) diffusion mixes the layers