

Solubility and Solutions—Preface

Solubility, the ability of one substance to dissolve in another, is an important part of chemistry—in the lab, in the environment, and in the body. Many chemical reactions are carried out in solution in order to control the concentrations of reactants and the rates of reactions. In nature, minerals dissolve in lakes and streams, where they may affect the survival, growth, and reproduction of aquatic organisms. Dissolved ions in the bloodstream regulate nerve transmission and energy production. The purpose of *Solubility and Solutions*, Volume 12 in the Flinn ChemTopic™ Labs series, is to provide high school chemistry teachers with laboratory activities that will help students investigate the principles and properties of solutions. Five experiments and five demonstrations allow students to study the factors that affect solution formation, the nature of solute–solvent interactions, and the concentration and composition of solutions.

Solutes and Solvents

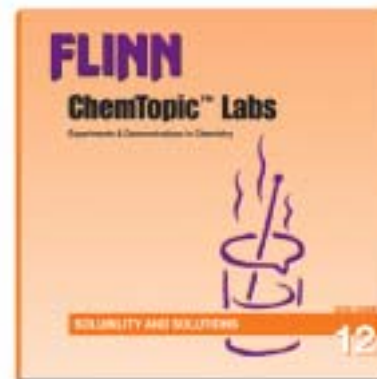
Understanding how reaction conditions will affect the rate at which a solute dissolves in a solvent can help students build a conceptual model of solution formation. In “Factors Affecting Solution Formation,” an inquiry-based activity, students design a series of tests to determine the effects of the crystal size of the solute, the temperature of the solvent, and the mixing of the solution. In “It’s in Their Nature,” students examine the solubility patterns of ionic, polar, and nonpolar compounds in a variety of solvents. The results allow students to classify compounds and to understand how solute–solvent interactions influence both the solubility of a pure substance and the energy involved in forming a solution. The remarkable strength of solute–solvent interactions is dramatically illustrated in the demonstration “Sorting Out Solutions.” As the size of the dissolved or dispersed particles in a solution changes, so do the properties of the mixture. In the demonstration “Solutions, Colloids, and Suspensions” students observe how these mixtures are distinguished from one another based on the size characteristics of the dispersed particles—their settling behavior, diffusion through a membrane, and ability to scatter light.

Solubility and Saturated Solutions

The solubility of a solute depends on temperature. The most common solute used in solubility curve determinations is potassium nitrate, whose solubility increases more than 1700% as the temperature increases from 0 to 100 °C. “Solubility and Temperature” is a unique, microscale-based adaptation of the classic solubility curve experiment involv-

ing potassium nitrate.

Graphical analysis of the results allows students to determine at a glance whether a solution is unsaturated, saturated or supersaturated. If heat is absorbed when a solute dissolves, then the reverse process, when a solute recrystallizes from solution, should release heat. This lesson is readily apparent in “Instant Hand Warmers,” an applied chemistry demonstration, where students learn to appreciate the chemistry behind the “instant heat—any place, any time” guarantee. Finally, in “Alka-Seltzer® and Gas Solubility,” students learn that generalizations are not always valid and that the effect of temperature on the solubility of a gas may be different than what they might predict.



Solution Concentration and Composition

Preparing and analyzing accurate concentrations of solutions is an important skill in the chemistry laboratory. The technology-based experiment “Preparing and Diluting Solutions” gives students the opportunity to develop this key analytical skill as they prepare their own solutions and investigate the relationship between the concentration of a solution and its absorbance. Many properties of a solution, the so-called colligative properties, depend not only on the concentration of a dissolved solute, but also on the number of particles that are formed in solution when the solute dissolves. In “Freezing Point Depression,” students measure the freezing point depression obtained for a variety of solutes and correlate the results with the concentration and composition of the solution.

Safety, Flexibility, and Choice

Depend on Flinn Scientific to give you the information and resources you need to teach chemistry safely and effectively. The selection of experiments and demonstrations in *Solubility and Solutions*—combined with complete sample data and teachers notes—encourages and empowers every teacher to find “solutions” that will help reach their students, in their classrooms, and using their resources. Each experiment and demonstration in *Solubility and Solutions* has been thoroughly tested and retested. You know they will work! Use the experiment summaries and concepts on the following pages to locate the concepts you want to teach and to choose activities that will help you meet your goals.