
Experiment 13 – Properties of Solutions

Discussion

In today's lab, you'll investigate the qualitative nature of solutions. The first step is learning some common terms.

Solute refers to a compound that **dissolves** in a solvent to form a solution. A **solution** can have one or more solutes, but only one solvent. The **solvent** is the compound that is predominant in the solution. A solute is said to be dissolved when it forms a clear, but not necessarily colorless, liquid. Thus, sugar dissolves in water, but fine sand and dust form **suspensions** which are not true solutions.

Solvents can be sorted by their **polarity**. Water is very polar, while benzene, decane, and gasoline are considered **non-polar**. The term organic solvent refers to most solvents other than water that are carbon-containing. Organic solvents can be either polar or non-polar, depending upon their structure. For example, methanol and ethanol are polar organic solvents, while ether and acetone are less polar, and decane and benzene are considered non-polar organic solvents.

Solubility is a measure of how much of a compound can eventually dissolve in a solvent. If a solid does not dissolve, the compound is said to be **insoluble**. It can also be described as slightly soluble, moderately soluble, or very soluble. If the compound is a liquid (not a solid) it can dissolve and is described as **miscible**, or instead forms two layers and is called **immiscible**. Ethanol and water are miscible, while oil and water are immiscible.

Concentration refers to the amount of solute relative to the total volume of solution. A dilute solution has little solute per 100 grams of solution, while a concentrated solution has more solute. A solution is considered saturated when no more solute can dissolve in that solution without it precipitating thereafter.

A supersaturated solution is a solution that holds more solute than it normally can hold at that temperature. Given time, some solute will precipitate out of solution. In other words, the solution is unstable over time.

Procedure**A. Relative Solubility of a Solute**

In this section, you will determine whether iodine, a reddish solid, dissolves better in water or decane.

1. Take a test tube and add about 5 mL of water and 2 mL of decane. Stopper the test tube and give it a gentle shake. Note which layer was on top.
2. To this tube, add 5 mL of saturated iodine-water solution. Gently shake again and see which layer has more color.

Dispose of the test tube contents into the waste labeled “Decane Waste”.

B. Miscibility of Liquids

In this section, you will find out what liquids are miscible with water.

Take three dry test tubes and add the following pair of liquids. Stopper the test tubes and gently shake them. Are there two layers or one?

1. 1 mL of corn oil and 1 mL of isopropyl alcohol
2. 1 mL of corn oil and 1 mL of water
3. 1 mL of isopropyl alcohol and 1 mL of water

Dispose of the first two solutions in the “Corn Oil Waste” container.

C. Ionic Reactions in Solution

1. Place a small lump of pea-sized quantities of a) barium chloride, b) sodium sulfate, c) sodium chloride, and d) barium sulfate into four separate labeled test tubes.
2. Add 5 mL of water, stopper the tubes, and shake them. Which sample(s) do(es) not dissolve?
3. Mix the barium chloride and sodium sulfate together and note the results.
4. Write an equation that describes the results of these test tubes being mixed.

Dispose of all solutions in the “Barium Waste” container.

Name: _____

Section: _____

Data and Calculations for Experiment 13

A. Relative Solubility of a Solute in Two Solvents

1. a) Which liquid is denser, decane or water? _____
b) How did you decide which layer was water? _____

2. What is the color of iodine in water? _____
What is the color of iodine in decane? _____

3. Which solvent dissolves more iodine? How did you decide this? _____

B. Miscibility of Liquids

1. Which liquids were miscible with each other?

2. Which liquids were immiscible with each other?

C. Ionic Reactions in Solution

1. Write the formulas for the following substances. Include states of matter (e.g. (aq) or (s)) based on the results of your experiment:

barium sulfate _____
barium chloride _____
sodium sulfate _____
sodium chloride _____

2. Write the equation that shows the reaction of barium chloride and sodium sulfate. Use state indicators (e.g. (aq) or (s)) for all compounds.

3. Which compound is the white precipitate? How do you know this?