**Testing the Solubility of Common Liquid Solvents**

**Objective:  
What is the project about?**

Solutions are a special kind of mixture. Solubility is a term used to describe the amount of materials (solids, liquids, or gas) which can be dissolved in a solvent to make a solution. The research aspect of this science fair project is to test the solubility of several common liquid substances.

**What are the goals?**

Several common liquids, such as water, rubbing alcohol, and club soda, will have solids such as salts, sand, and baking soda added to them to determine which solids dissolve in which liquids at room temperature. Based on the results of this investigation a data table will be prepared and the results potted on a series of graphs. A rule of thumb for solubility in solvents is “like dissolves like.” This means that in general, polar compounds are soluble in polar solvents and non-polar compounds are soluble in non-polar solvents. One practical benefit of the results of this project is to prove or disprove this rule.

**Research Questions:**

What is a solvent?  
What is a solute?  
Which solvent was able to dissolve most or all of the solutes?  
Which solute was the most soluble in the solvents tested?

The term "universal solvent" means ability to dissolve most substances. Which solvent tested would fits this description?

Solutions are a special kind of mixture. Solubility is a term used to describe the amount of materials (solids, liquids, or gas) which can be dissolved in a solvent to make a solution. A solvent is the dissolving agent, e.g. water. A solute is a substance that is dissolved in a solution.

In this science fair project, solutions in which the solvent is a liquid will be investigated. Most liquid solvents are molecular compounds. Whether a compound will dissolve in a particular solvent depends on what that solvent is. The rule of thumb for solubility in molecular solvents is "like dissolves like." This means that in general, polar compounds (chemical compounds whose molecules exhibit electrically positive characteristics at one extremity and negative characteristics at the other) are soluble in polar solvents and non- polar compounds are soluble in nonpolar solvents. Water is an example of a polar solvent. Cooking oil is an example of a nonpolar solvent. Water is the most commonly used liquid solvent. It is sometimes called the "universal solvent" because it can dissolve more substances than any other liquid.

**Materials:**

Rubbing alcohol, club soda, cooking oil, table salt, baking soda, table sugar, Epsom salt, package of plastic drinking cups, coffee stirrers, metric measuring cup, clean playground or beach sand, and rubber or Latex disposable gloves

**Experimental Procedure:**

1. Draw a table similar to the one shown below.
2. Measure out 10 ml of water and pour into a cup.
3. Measure out a teaspoon of table salt and add it to the cup of water and stir using a coffee stirrer.
4. If all of the salt (solute) disappears then the solute is said to have dissolved in the solvent and a solution is produced. An insoluble solute will settle out of the mixture. Insoluble solutes are usually found at the bottom of the cup or floating on the surface of the liquid.
5. Record the results of each test by writing the words "soluble" if the entire solid dissolves, "insoluble" if the solid does not dissolve, or "partially soluble" if some of the solid dissolves.
6. In another clean cup add 10 ml of water, but this time add a teaspoon of sand and stir. Record the results in the table.
7. Repeat the same procedure for the Epsom salt, baking soda, and sugar. Each time used a clean cup and coffee stirrer.
8. Follow the same procedure with the rubbing alcohol, club soda, and cooking oil in place of the water.
9. Plot a bar graph with the names of the solutes along the horizontal axis and the solubility ratings in water along the vertical axis. Repeat this same procedure for each solvent tested.

**Solvents Solutes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Solvents** | **Solutes** | | | | |
| Table salt | Baking soda | Sand | Table sugar | Epsom salts |
| Water |  |  |  |  |  |
| Alcohol |  |  |  |  |  |
| Club soda |  |  |  |  |  |
| Cooking oil |  |  |  |  |  |

**Terms/Concepts:** Solution; solubility; solvent; solute; polar compound

**References:**

**References to related books** Janice VanCleave's Chemistry for Every Kid: 101 Easy Experiments that Really Work

Publisher: Jossey-Bass. Inc. **ISBN**-10: 0471620858 and **ISBN**-13: 978-0471620853  
This book contains many experiments designed to be conducted by elementary and middle school science age children. It also explains basic chemistry concepts that will be useful in conducting this science fair project.

**Links to related sites on the web**

Title: Solubility of Salts http://www.elmhurst.edu/~chm/vchembook/171solublesalts.html  
Title: What is Solubility? http://www.chemistryland.com/CHM107/Water/WaterTutorial.htm  
**NOTE**: The Internet is dynamic; websites cited are subject to change without warning or notice!

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