Experiment 20: Solubilities: An Investigation

Prelab Lecture

What is this lab about?

Two things. First, it's to determine the solubilities of various ionic compounds. Second, it's to give you another chance at designing your own experimental methods, i.e. your own approach to answering a scientific question.

What is solubility?

Solubility is the amount of a substance that dissolves in a fixed volume of water. The fixed volume of water is usually either a liter or 100 mL. The most typical way to report solubility is in grams (of solute) / 100 mL of water. For the sake of understanding the relative numbers of ions that are in solution as a result of dissolving, it is also useful to calculate moles/100 mL of water.

Why are solubilities important?

Two weeks ago we talked about the ways that ions can get in water, and mentioned that dissolving ionic solids in water is one way to do it. However, not all solids can dissolve to the same extent. For example, silver chloride (AgCl) has a solubility of about 10^{-6} g/100 mL of water, while sugar has a solubility that can exceed 100 g/ 100 mL of water. Studying solubilities helps us to understand the sources of ions in water, and the propensity of various compounds to contribute ions to water.

How do we do the calculations?

To calculate g/100 mL of water, you do the following:

$$\frac{g(solute)}{100\,mL(H_2O)} = \frac{g(solute)}{mL(H_2O)} x\,100$$

To calculate moles/100 mL of water, use

$$\frac{moles(solute)}{100\,mL(H_2O)} = \frac{g(solute)}{100\,mL(H_2O)} / Molar\ Mass(solute).$$

How do we calculate Molar Mass?

You write down the molecular formula, then after looking up the atomic masses of all the elements in the compound, add up the atomic masses of all of the atoms in the molecule.

Is there anything we need to look out for in the calculations?

Yes. Some ionic compounds are in hydrated form, which means that water molecules are part of the ionic crystal. For example, Copper Sulfate is most commonly found in the form $CuSO_4*5H_2O$, which means that for each copper sulfate there are 5 water molecules. When calculating the molar masses, it's critical to include the mass of any water molecules in the crystal.

Group Work: You'll be working in groups of 3 or 4 again. As before you should assign a recorder. You may choose to assign other roles to people in the group, as mentioned in the lab manual.

Wait!!!!! You haven't told us how to determine the solubilities!!!!!!

Part of the goal of today's lab is for you to figure out your own methods for figuring out how much material will dissolve.

Lab Report

Since this is an experimental design lab your lab report will be in oral form. You should briefly summarize your purpose, the procedure or procedures you developed, your results, a brief evaluation of how good you thought your results were, and finally ways that your procedure might be improved.

Each group will do a joint oral report. There will be one notebook record turned in for the group by the recorder.

Honor

All work may be done collaboratively by each group of 4.