Tutorial for Virtual Laboratory on
Solubility Curves

This tutorial has three parts. The first deals with tips for solving the assignment and would be applicable to this experiment if it was run in either a real or virtual environment. The second deals with tips on running the Virtual Laboratory. The third deals with correlating experiment 2B which you will run this week with this virtual assignment.

Part 1; Tips for Running the Experiment:

OK, you have no instructions. So you have to think your way through this. A good place to start is to ask two questions. What is it that I know? What is it that I need to know? You know that your salt is one of the 5 unknowns, and you know how their solubility behaves as a function of the temperature. Look at the graphs, look at the scales, none of the 5 salts have the same behavior. What you need to know is which salt you got. Intrinsic to the nature of science is the possibility that there is more than one way to answer a question and you must keep this in mind. But your assignment says you must create a solubility curve for your unknown, so that’s a good way to go.

Now ask yourself, what are these plots of? Does that data represent a saturated, unsaturated or supersaturated solution? Think about the relationship between a dependent and an independent variable. Think of how you can design an experiment that elucidates this relationship.

Part 2; Tips on Operating the Virtual Lab:

First and foremost you need to familiarize yourself with the operation of the virtual lab. You should watch the video and other material available. The laboratory is "Windows intuitive" and amenable to drag and drop actions. This part of the tutorial will go over both specific ways to perform a procedure in the virtual lab, and some strategies for using the virtual lab.

You need to express solubility in units of gsalt/100g water. You can start with any quantity of water and calculate this value, or you can simply use 100 g water. You are not constrained to follow the procedures in Experiment 2B, in fact, for multiple unknowns the wet lab procedures will not work.

When you transfer solutions (transfer option of the tools menu) you can use "precise" transfer where you type in the exact value or "realistic" transfer which takes more time and introduces error. That is, you can transfer solution to a buret and "realistically" transfer it, or you can simply "pour" from the reagent container a "precise" quantity. Once again, you are not constrained to follow procedures you would need to use in the real lab.
You need to be able to observe if any solid precipitate forms at a given temperature and this can be done by setting the "species viewer" to solid which allows you to precisely read its mass. As you heat or cool this solution its solubility changes and a solid will either disappear or appear as you cross the solubility curve. You can not do this in the real lab, so take advantage of it.

The virtual lab operates at an ambient temperature of 25°C. This means that if your solution is above that temperature, it will cool to it, and if it is below that temperature, it will warm to it. There are two ways you can change the temperature of a solution. First, by dragging the Bunsen burner over it you can heat it. Second, by right clicking on the solution icon and then choosing "thermal properties" you can heat or cool it. Note, the second way is the only way you can cool it below 25°C and the second was has the option to thermally isolate the system. That means if you click "isolate from surroundings" the system will stay at the temperature. It is advised that you use this technique.

Part 3; Comparison of the Virtual Experiment to the Real Experiment:

There are some fundamental differences between the virtual lab and the real lab and these should be taken into account when designing an experiment. These differences can also give you a better understanding of the variables influencing a real experiment. For example, in the virtual lab you can add precise quantities of reagents and instantly heat or cool the system. You can not have refluxing or create a supersaturated solution. In the real lab you heated the solution up and cooled it down as this was easier than reheating between each value. Since the solubility increased as the temperature was raised you diluted the solution by adding water as it cooled. In the virtual lab you do not need to operate this way, in fact, you do not want to operate this way as it makes the calculations more complicated. In the virtual lab you can start over with any temperature and ratio of solute to solvent by clicking the mouse a few times. In the real lab you would have to reheat your water bath, re-measure your reagents and it would take a long time to get to any exact point on the solubility curve.

Note, in the virtual lab you can measure the precipitate in equilibria with the supernatant, which you cannot do in the real lab. So for example, if you add 100 g of salt to 100 g of water, and 40 g sits at the bottom, then 60 g dissolved.

As this is your first Virtual prelab or postlab of the semester it is suggested you do not wait until the last minute and take advantage of the department computing lab in SCLB 263. The attendant should be able to assist you with running the lab and you are welcome to drop by Dr. Belford's office (SCLB 277) if you need assistance running the lab. The 'learning curve' with the virtual lab is substantially less than that with Excel but you need to quickly master it. Do not procrastinate until the last moment.

One of the objectives of the virtual lab this semester is for you to look at your actual experiments from a slightly different perspective, and get a better understanding of how the lab relates to the lecture.