

Experiment 17 Notes – Chem 1B

New due date for this experiment: Tuesday April 9 (after spring break), so that you can have plenty of time to study and prepare for the exam on March 28.

During the experiment

Follow the directions as written. It's important to give this reaction enough time to truly get to equilibrium at each temperature, so please resist the urge to speed things up. Cooling the mixture more quickly than the directions advise would cause an error in your calculated K value.

As you're waiting for the initial dissolving process to come to equilibrium, you can set up your buret and heat up some deionized water for rinsing.

When pouring samples into the small graduated cylinder, try your best not to pour off any solid. This may be difficult – do your best.

Once you pour your sample into the graduated cylinder, it will start to cool and you will see some precipitate start to form. This is normal and is not a problem! This solid is more soluble at high temperatures, so anytime it cools off, less will dissolve/more will precipitate.

As long as you're not pouring off solid from the flask, you've "trapped" the sample that contains the concentrations of ions that were in equilibrium with the solid at the point where you took the temperature. Solid that forms after trapping the sample won't have any adverse effect on the results, because the solid will also react with the HCl.

When you transfer the sample from the graduated cylinder to the 125-mL Erlenmeyer flask, you'll need to get all specks of that sample into the titration flask. This is why it says to rinse with warm deionized water and add this to the titration flask. There's no need to measure the amount of water added. Also, the titration flasks need to be clean, but do not need to be dry.

Titrate each sample after collecting it, as you are waiting for the dissolving mixture to gradually fall in temperature for the next sample. Every sample will use a different volume of HCl. You won't be able to back-titrate or correct anything if you accidentally miss the endpoint. Make note of the color of the indicator at the endpoint in each sample.

There are two balanced equations listed in the lab manual. The dissolving/dissolution reaction is the one we're studying and determining K_{sp} for. The titration with HCl is the way we're analyzing the data. We are NOT finding K for the titration reaction.

Graph

Make a graph in Excel. Please make sure to follow the graphing checklist. This is your last graph you'll have to make in a lab report – **please make it a good one!**

Have Excel insert a linear trendline. Show the calculation of slope “by hand.” (Choose 2 points far apart from each other, indicate them on the graph, estimate x and y values with the correct precision, calculate slope, including units, etc.)

Pay special attention to these common problem areas:

- Make sure the title includes enough descriptive detail.
- Double-check the 1, 2, 5 rule for both the x and y axes. If your smallest division is something like 0.4, please change it to either 0.1 or 0.2 or 0.5.

Evaluation of results

The most obvious error in this lab is accidentally pouring off some solid into the graduated cylinder. You're instructed not to pour off any solid, but in practice this is almost impossible. Please discuss this as one of your sources of error. Notice whether it seemed harder NOT to pour off solid at higher temperatures or lower temperatures, or if it seemed about the same at any temperature. Then, discuss:

- Would this mean that those samples would require more, less, or the same amount of HCl to titrate them? Why?
- How will this affect the calculated concentrations of tetraborate and sodium? Why?
- How will this affect the calculated K value for this sample? Why?
- How will this affect the slope and y -intercept of the graph? Why? Draw a small sketch of the graph, showing how it would change.
- How will this then affect the calculated values of ΔH and ΔS ? Why?

(By the way, this is the level of detail I would like to see when discussing all of your sources of error.)

Make sure to discuss two other different sources of error.