Hydrogeochemistry – Fall 2018

Due November 14

Lab Exercise #5

Dissolution Kinetics

**Objectives**

* Determine dissolution rates by measuring the dissolution of a solid material over time. Calculate rate constants and the activation energy (Ea) for the dissolution reaction

**Materials**

* Beakers with insulation
* Distilled water
* Stir plates and stir bars
* Spherical candy
* Hot water
* Ice
* Kimwipes
* Scale

**Experimental procedure**

1. Weigh the spherical piece of candy to be used in the experiment (record candy + weigh boat)
2. Fill a beaker with room temperature distilled water, and record the temperature. Place a stir bar in the water and slowly mix the water.
3. Add the candy piece to the water and immediately begin a timer.
4. After two minutes, stop the timer and immediately retrieve the candy from the beaker and place it in the weight boat. Blot the candy dry with a Kimwipe and record its mass.
5. Return the candy to the water and continue to record its mass every two minutes for eight total minutes, stopping the timer each time the candy is retrieved.
6. Repeat the above experiment using chilled and heated water, recording temperature each time. Make chilled or heated water by adding mixing room temperature water with ice or hot water. Conduct the experiment at four or five different temperatures (including room temperature).

**Report**

1. Provide a table of the data your group collected, with columns for time (seconds), candy mass (g), and the cubed root of candy mass (g1/3). Note that a cubed root is equal to an exponent of one-third, such that 3√x = x1/3.
2. Plot on one graph, for all temperatures, the mass of the candy as a function of time. Differentiate each temperature using a different symbol and provide a legend.
3. Briefly, describe how the slope of the curve changes over time. What does the slope represent? Discuss why the slope changes over time.
4. Calculate the rate of the reaction, dM/dt, between 0 to 2 min for each temperature.
5. This reaction can be modeled using the following integrated, linear rate equation: M1/3 = M01/3 – *k*t; where M1/3 is the cubed root of the mass of the candy at any given time, M01/3 is the cubed root of the mass of the candy at time zero, *k* is the rate constant, and *t* is time in seconds. Plot the cubed root of mass versus time and determine the rate constant at each temperature. Provide units for the rate constant.
6. Use the results from question (5) to construct an Arrhenius plot. Calculate an activation energy.
7. Upload all tables, graphs, and associated responses to Blackboard in one Word file.