

## Mineral Weathering and Water Chemistry

This worksheet is to be completed along with the Rmarkdown file provided. The questions that are asked throughout the exercise are listed here. Please fill in your answers on this worksheet and make sure to show all your work!

**Question 1** What is the stable mineral under the following conditions:

$$\log[\text{H}_4\text{SiO}_4] = -3, \log \frac{[\text{K}^+]}{[\text{H}^+]} = 0, T = 25^\circ\text{C} \text{ and } P = 1 \text{ bar?}$$

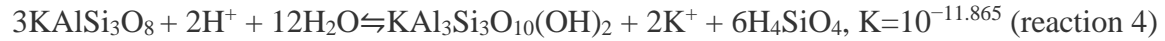
**Question 2** How you could infer which of the areas on the above plot is the stability field for gibbsite using Le Châtelier's Principle? Explain.

**Question 3** OK now it's your turn. Solve for the equilibrium lines for Muscovite - Kaolinite and Microcline - Muscovite, and then input the endpoints of segments in the chunk below to plot them. Please do your calculations on corresponding worksheet distributed to the class. *In case you need a refresher, there is a Exponent and Logarithm Rule Cheat Sheet in the repository for your reference.*

Muscovite - Kaolinite



Microcline - Muscovite



**Question 4** Why did we not derive a phase diagram boundary line for the microcline to gibbsite reaction?

**Question 5** Assign the initial proton concentration in moles per liter to the variable “mol\_1\_H\_A” in the chunk below, then run it. Use this to answer the following questions.

~No answer required here~

**Question 6** Look at the plot that was generated. Did potassium increase or decrease? What about silicic acid? Where did the potassium and silicic acid come from? What happened to the concentration of Gibbsite?

**Question 7** What changes in water chemistry occur as gibbsite is converted to kaolinite? How does this relate to the shape of the curve between B and C, and how it differs from the curve A to B?

**Question 8** You have just plotted mineral abundance versus reaction progress. Why is there an inverse relationship between kaolinite and gibbsite after this point? How does this relate to your phase diagram?