12.007 Geobiology
Spring 2009

PS 3 Due on Thursday 3/5/09

1. Identify and calculate the exact molecular weights of all the isotopologues of CO_2 and H_20. Calculate their relative abundances in a sample of seawater assuming no fractionations exist and all atoms are at their natural abundances.

2. Identify three mechanisms of isotopic fractionation.

3. A ratio of $^{32}S/^{34}S$ of 21.56 was measured for a sample of sulfate. The same ratio in the Canyon Diablo Triolite is 22.22. What is the $\delta^{34}S$ value for the sulfate sample?

4. A sample of diamond has a $\delta^{13}C$ value relative to the lab standard. The lab standard has a $\delta^{13}C$ value of -4.22 relative to VPDB. What is the diamond relative to VPDB?

5. A bacterium fixes carbon autotrophically with a $\delta^{13}C$ value of -35 per mil VPDB starting with CO_2 having a delta value of -7.8 per mil PDB. Speculate about the type of isotopes effects that might operate and carbon fixation pathway. What are the alpha and epsilon values for the processes?

6. Will the increase in the atmospheric pCO_2 reduce or enhance chemical weathering? Explain.

7. Read http://www.time.com/time/health/article/0,8599,1877434,00.html
   What is the "second genesis" referred to in the article?
   What is Phobos-Grunt? Define "transpermia" and discuss possible issues raised by this experiment.