GG425 -- ENVIRONMENTAL GEOCHEMISTRY
Homework Set #5 -- Due Friday 27 Apr.

1. Chapter 13 problems - 1, 4, 19

2. Chapter 14 problems - 2, 4, 6

3. Chapter 18 problems - 4, 7

4. Carbon cycle and global warming questions

a. Parts of the coastal ocean sustain significantly more primary productivity (photosynthesis) due to upwelling of deep, nutrient rich waters into the shallow photic zone. Why are the deep waters nutrient rich?

b. In which ocean basin to you expect the highest and deep water lowest nutrient levels? Explain your answer.

c. Upwelling transports 6 x 10^{13} mol N/yr into coastal zone waters. This is utilized by photosynthetic organisms (phytoplankton). What annual amount of primary productivity (measured as moles of organic carbon produced per year) is sustained by this upwelling? *Assume N is the limiting nutrient for marine photosynthesis*) *and a Redfield C:N ratio of 106:16 (by moles),*

d. Coastal runoff accounts for another significant N flux into the coastal oceans (about 70% of the upwelling flux). How much Redfield organic carbon (moles) can be produced per year from this N source?

e. The area and net annual primary productivity of Earth's tropical rainforests today are about 14 x 10^{12} m^2 and 2000 g dry plant matter per m^2 respectively (dry plant matter is 45% carbon). What is the annual of primary productivity (in grams of Redfiled ratio organic carbon produced per year) from these rainforests and how does this compare to the primary productivity in marine upwelling zones?

f. Assuming perfect transfer of CO_2 from the atmosphere to the surface oceans and to the terrestrial biosphere, what would be the relative effect on CO_2 concentration in the atmosphere of a 10% drop in the rate of coastal upwelling and a removal of 15% of the tropical rainforests?