

**GG325 -- PRINCIPLES OF GEOCHEMISTRY**  
Homework set #3 - Due on Friday 10/25

**1. The oceans**

a. The annual input of  $\text{SO}_4^{2-}$  into the oceans by rivers is estimated to be  $3 \times 10^{12}$  mole/yr. If  $\text{SO}_4^{2-}$  were at a steady-state concentration in sea water and the only significant sulfate input to the oceans were the river flux, what would the residence time of  $\text{SO}_4^{2-}$  in the oceans be? The mass of the oceans is  $1.4 \times 10^{24}$  g.  $\text{SO}_4^{2-}$  concentration in the oceans is 0.028 mol/kg

b. If there were no  $\text{SO}_4^{2-}$  flux out of the oceans to balance the above input flux, how long (how many years) would it take to increase the  $\text{SO}_4^{2-}$  concentration by 1%

**2. Hydrosphere composition**

a. What is the Alkalinity of seawater of the following composition:

$\text{Na}^+$	0.481 M	$\text{Mg}^{2+}$	0.0544 M	$\text{Ca}^{2+}$	0.011 M	$\text{K}^+$	0.011 M
$\text{Cl}^-$	0.560 M	$\text{SO}_4^{2-}$	0.0283 M	$\text{HCO}_3^-$	0.00238 M		

b. write the charge balance equation for this solution and substitute in the numbers above. Is this solution balanced? If not, what other ion(s) that are not listed might be present in seawater to help balance the charge?

**3 Weathering**

A sediment has a CEC of 70 meq/100 g. The following exchangeable cations make up the CEC:  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Na}^+$ ,  $\text{K}^+$  and  $\text{H}^+$ . The first 4 were measured at concentrations of 18, 5.7, 4.3 and 1.3 meq/100g, respectively. What is the ECS of  $\text{H}^+$  on this sediment?

**4. Soils**

a. Name 2 chemicals (or minerals) that precipitate from soil water as the pH changes

b. what is the name of the soil zone where the precipitation occurs?

5a. What is the "Zero Point of Charge" for a particulate phase?

b. Are particle surfaces without charge at the ZPC?