GEOL 235 Gas equilibrium and diffusion homework Fall 2011

1. (15 points) Given the table of Henry’s Law constants below, calculate the equilibrium concentration (assuming activity coefficient for each = 1) in mg/l for each gas at the average temperature of Missisquoi Bay bottom water (5°C). and determine the change in O2 equilibrium solubility during the height of summer when the water column can get up to 25°C. In air: N2=78%, O2=21%, CO2=390 ppmv, CO=1 ppmv, H2S=0.001ppmv, SO2=0.1 ppmv, NO=0.01 ppmv.



2. Transport of oxygen across the water column is determined largely by diffusion under low wind conditions. Calculate the flux of O2 across a 4 meter water column where the top of the water column is saturated (at equilibrium) with respect to O2 at 25C and the O2 is below detection at the sediment-water interface. Here assume the diffusion coefficient for O2 is 1.97x10-5 cm2 sec-1.

3. The following table lists soluble reactive phosphorus concentrations (ug/l) in space. Using this data determine the flux of P from the sediment to the water column at each season. D= 1.0x10-5 cm2 sec-1.

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| --- | --- | --- | --- | --- |
| **Depth (feet)** | **25-Jun-2008** | **29-Jul-2008** | **27-Aug-2008** | **1-Oct-2008** |
| 11.5 | 1.69 | 33.43 | 11.89 | 0.50 |
| 11.5 | 2.10 | 32.77 | 8.66 | 1.75 |
| 11.5 | 1.36 | 33.59 | 9.79 | 0.50 |
| 8 | 1.36 | 6.87 | 3.66 | 1.26 |
| 8 | 1.20 | 6.70 | 3.50 | 1.59 |
| 8 | 2.02 | 6.87 | 4.31 | 2.90 |
| 5 | 1.85 | 7.03 | 2.69 | 0.50 |
| 5 | 2.67 | 7.20 | 2.53 | 1.59 |
| 5 | 1.69 | 7.20 | 4.15 | 3.23 |
| 2 | 1.85 | 7.03 | 3.82 | 0.50 |
| 2 | 1.52 | 7.03 | 3.66 | 1.92 |
| 2 | 2.02 | 7.03 | 3.82 | 0.50 |
| 1 | 2.34 | 6.54 | 3.50 | 1.10 |
| 1 | 1.69 | 6.87 | 3.82 | 1.92 |
| 1 | 1.85 | 6.70 | 3.66 | 1.10 |