

GG425 -- ENVIRONMENTAL GEOCHEMISTRY
Spring 2008

Homework set #3 (Due in class, Fri. March 14)

1a. What is the instantaneous ("Streeter-Phelps) BOD in mg O₂/L of an anoxic waste stream containing 0.02 gm/L labile dissolved organic carbon and 0.015 gm/L particulate organic carbon of which 30% is readily digestible (rest is refractory) as it dumps into a river. Assume a 10 fold dilution of the waste stream when it interacts with the river.

1b. If the river water was saturated with O₂ at 25°C upstream of the effluent outfall, and was moving very slowly so that it experience no aeration across its upper surface, would this water become eutrophic after interacting with the waste stream?

2. Examine the dissolved O₂ profiles in the Thames estuary in Fig 5.26 on page 13 of the lecture 16 pdf notes. Assume that 100% O₂ saturation is to 2.1 x 10⁻⁴ moles/liter O₂ in the river water.

a. Estimate the % of saturation for O₂ from this plot and then calculate the O₂ concentration in this river water (in moles/liter) in 1893 (the first datum), 1930, 1950 and 1970 for the two locations shown.

b. assume that the stoichiometry of the Redfield ratio for photosynthesis/respiration controls the concentration of both O₂ and PO₄ in this river. If the concentration of PO₄ at 100% saturation of O₂ was 1.1 x 10⁻⁸ moles/liter in this water, what was PO₄ at each point along the two profiles in this river for the time periods you examined in part "a"?

c. calculate the rate of change of O₂ along the two profiles in this river for the 3 time intervals 1893 to 1930, 1930 to 1950, and 1950 to 1970. Rationalize the values and their difference

3. Chapter 5 problems:

3, 10, 11, 13

4. Explain the possible fates of 3 different metal ions in the sediments of the same estuary:

- a) a metal adsorbed to clays that were flocculated in the estuary
- b) a metal ion bound to amorphous Fe-oxyhydroxide colloids
- c) a metal ion bound to flocculated POC