

Midterm 1

CENG 340–Introduction to Environmental Engineering

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As you work through the exam, please write down what you know (in equation form when possible)

1. A small well-mixed pond has been contaminated with 10 mg/L of a toxic chemical. The chemical is conservative. The pond volume is 2500 m³ and has a negligible inflow and outflow (before treatment). To rid the pond of the contaminant an environmental engineer decided to flush clean water through the pond at a rate of 400 $\frac{\text{m}^3}{\text{day}}$. Determine how long it will take to reduce the chemical concentration to 5 percent of its original value.
2. During a hydrofracking operation the surfactant 2-butoxyethanol was accidentally released into an adjacent river. The gas company claims that since 2-butoxyethanol is biodegradable the problem is of no concern. The *unbalanced* reaction for aerobic degradation of 2-butoxyethanol is as follows:
 - (a) Why might the engineers be wrong? What environmental concern may occur?
 - (b) If the 2-butoxyethanol is contained in a xx by yy by 4 s deep area, and the dissolved oxygen concentration is 8 mg/L. how much oxygen must be added to the system?
 - (c) You've been asked to order a tank to hold the oxygen that will be used over the course of treatment. What size (volume) tank do you need to store the oxygen.
3. Short Answer:
 - (a) What is alkalinity (in words)?
 - (b) Why is alkalinity important? Name one phenomena or system (natural or engineered) where alkalinity may play role.
 - (c) For what kind of reactions (in general) is it appropriate to use equilibrium?
4. Last week (during parents weekend), a Bucknell parent approached me and asked me how to remove manganese from a river on their property that's a result of acid-mine drainage. I told them that lime (which is fairly inexpensive) would be added to the river water to precipitate