CIVE 3331 Environmental Engineering

CIVE 3331 - ENVIRONMENTAL ENGINEERING
Spring 2003

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Purpose: Exercises related to Lecture # 8. These exercises develop skills in selected environmental water quality problems.   Direct relationships to various accreditation objectives are highlighted in **Bold** type in the following sections. The exercises start on the next page.

Relevant ABET EC 2000 Criteria: Criterion 3 Program Outcomes and Assessment

(3-a) an ability to **apply knowledge of mathematics, science,** and engineering.
(3-e) an ability to identify, **formulate**, and **solve engineering** problems.
(3-k) **an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.**

Relevant CEE Educational Objectives:

(3) Emphasize problem-identification, problem-formulation and communication skills, **problem-solving techniques** and the many facets of engineering design throughout the curriculum.

(5) Prepare every student to develop the skills for critical thinking and lifelong learning.

Relevant CEE Program Outcomes:

ii. **Students should acquire the ability to solve practical civil engineering problems by applying the knowledge of mathematics, science**, **engineering, modern techniques**, **skills and practical tools they gained in their courses.**

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Exercise_008-1

An often used chemical representation of algae is $C_{106}H_{263}O_{110}N_{16}P$.

a) Determine the mass (mg) of each element in 1g of algae.
b) Suppose there are 0.10 mg of N and 0.04 mg of P available for algal production per liter of water. Assuming adequate amounts of other nutrients, which is the limiting nutrient?
c) What mass of algae could be produced per liter of water?
d) If the nitrogen source is cut by 50% how much algae could be produced?
e) If the phosphorous source is cut by 50% hwo much algae could be produced?

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Exercise_008-2

Suppose the N and P content of some algae is as shown in the table below. The third column is milligrams of nutrient per liter of water.

Nutrient	Milligrams per gram algae	Milligrams per liter available
Nitrogen	60	0.12
Phosphorous	10	0.03

    a) What percent reduction in nitrogen is needed to control algal production to 1.0 mg/L?
    b) What percent reduction in phosphorous is needed to control algal production to 1.0 mg/L?

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Exercise_008-3

Consider a lake with 100×106 m^2 of surface area for which the only source of phosphorous is the effluent from a wastewater treatment plant. The effluent flow rate is 0.4 m^3/s and its phosphorous concentration is 10.0 mg/L. The lake is also fed by a stream with flow 20 m^3/s and no phosphorous. The phosphorous settling rate is estimated to be 10 m/yr. Estimate the average phosphorous concentration in the lake. What level of phosphorous removal at the plant is required to keep the lake concentration below 0.01 mg/L?

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