

**ENCE 4323**  
Assignment No. 1  
Due 9/8/10

- 4-23** Determine the number of completely mixed chlorine contact chambers each having a detention time of 30 min that would be required in a series arrangement to reduce the bacterial count of a treated effluent from  $10^6$  to 14.5 organisms/mL if the first-order removal rate constant is equal to  $6.1 \text{ h}^{-1}$ . If a plug-flow chlorine contact chamber were used with the same detention time as the series of completely mixed chambers, what would the bacterial count be after treatment?
- 4-24** The concentration of UBOD in a river entering the first of two lakes that are connected in a series is equal to 20 mg/L. If the first-order BOD reaction rate constant ( $K$ ) equals  $0.35 \text{ d}^{-1}$  and complete mixing occurs in each lake, what is the concentration of UBOD at the outlet of each lake? The flow in the river is equal to  $4000 \text{ m}^3/\text{d}$  and the volume of the first and second lake is 20 and  $12,000 \text{ m}^3$ , respectively. Assume steady-state conditions.
- 4-25** In Prob. 4-24, if the length of the river connection between the two lakes is equal to 3 km and the velocity in the river is equal to 0.4 m/s, determine the concentration of the UBOD in the effluent from the second lake.
- 4-28** If second-order reaction kinetics are applicable ( $r = -kC^2$ ), determine the effluent concentration for each of the reactor systems shown on Fig. 4-28. To simplify the computations, assume that the following data apply:

$$k = 1.0 \text{ m}^3/\text{kg}\cdot\text{d}$$

$$Q = 1.0 \text{ m}^3/\text{d}$$

$$V_{\text{PFR}} = 1.0 \text{ m}^3$$

$$V_{\text{CMR}} = 1.0 \text{ m}^3$$

$$C_o = 1.0 \text{ kg}/\text{m}^3$$

Explain your results. What would happen if first- or zero-order kinetics are applicable?

**Note:** Figure 4-28 shows two different reactor systems:

- (a) A PFR followed by a CFTR
- (b) A CFSTR followed by PFR