

Your Name: _____

CEE 370

Fall 2019

Homework #8

Drinking Water Problems

1. Drinking Water Quality

The following mineral analysis was reported for a local well water. Determine the following in units of mg/L as CaCO₃

- total hardness,
- carbonate hardness and
- noncarbonate hardness

Mineral	Conc (mg/L)	Mineral	Conc (mg/L)
Fluoride	1.1	Silica (as SiO ₂)	13.4
Chloride	4.0	Bicarbonate	318.0
Nitrate	0.0	Sulfate	0.5
Sodium	14.0	Iron	0.5
Potassium	1.6	Manganese	0.07
Calcium	96.8	Zinc	0.27
Magnesium	30.4	Barium	0.2

2. Flocculation.

Two parallel flocculation basins are to be used to treat a water flow of 0.150 m³/s. If the design detention time is 20 min, what is the volume of each tank?

3. Gravity Settling.

Assuming a conservative value for an overflow rate, determine the surface area (in m²) of each of two sedimentation tanks that together must handle a flow of 0.05162 m³/s of lime softening floc. Use an overflow rate of 57 m³/day/m².

4. Filtration.

The water flow meter at the Westwood water plant is malfunctioning. The plant superintendent tells you the four dual-media filters (each 5.00 m x 10.0 m) are loaded at a velocity of 280 m/day. What is the flow rate through the filters (in m³/s)?

Wastewater Treatment Problems

5. Gravity Settling.

If the terminal settling velocity of a particle falling in acquiescent water having a temperature of 15°C is 0.0950 cm/s, what is its diameter? Assume a particle density of 2.05 g/cm³ and a density of water equal to 1000 kg/m³. Assume Stokes' law applies.

6. Microbial Growth.

You're operating a batch reactor. At the start (time = 0) you have 0.85 mg/L of biomass. After two full weeks of operation you find that the biomass concentration is 286 mg/L.

- What is the specific growth rate assuming simple exponential growth throughout?
- Is the value you calculated in part "a" equal to the μ_{\max} ? Why or why not? Explain.

7. Activated Sludge I.

The 500- bed Amherst General Hospital has a small activated sludge plant to treat its wastewater. The average daily hospital discharge is 1200 L/day per bed, and the average soluble BOD₅ after primary settling is 500 mg/L. The aeration tank has effective liquid dimensions of 10.0 m wide x 10.0 m long x 4.5 m deep. The plant operating parameters are as follows: MLVSS = 2000 mg/L, MLSS = 1.2 x MLVSS, and return sludge concentration = 12,000 mg/L (VSS). Determine:

- Aeration Period in hrs
- F/M ratio

8. Activated Sludge II

Using the following assumptions, determine:

- the solids retention time (days), and the
- cell wastage flow rate

for the Amherst General Hospital problem above.

Assumptions:

Suspended solids in effluent = 30 mg/L
Wastage is from the return sludge line
Yield coefficient = 0.60

Bacterial decay rate = 0.060 day⁻¹
Inert fraction of suspended solids = 66.67%
Allowable BOD in effluent = 30.0 mg/L

*Assigned: 15 Nov 19
Due: 2 Dec 19*

Your Name: _____

Answer Page

Fill in the boxes with the correct answer.

You will only get credit for a problem if you (1) fill in the box with the correct answer, (2) your answer is legible, and (3) you include attach page(s) with calculations backing up your answer, when requested for the problem.

Problem #

1	a.	<input type="text"/>	mg/L as CaCO ₃
	b.	<input type="text"/>	mg/L as CaCO ₃
	c.	<input type="text"/>	mg/L as CaCO ₃

2 m³

3 m²

4 m³/s

5 cm

6	a.	<input type="text"/>	hr ⁻¹
	b.	<input type="text"/>	

7	a.	<input type="text"/>	hours
	b.	<input type="text"/>	day ⁻¹

8	a.	<input type="text"/>	days
	b.	<input type="text"/>	L/day