CIVL 1112 – Assignment #2 Name: ____________________

Part 1. Solve the following three problems (you are not required to use an Excel spreadsheet)

Carbon Dioxide Removal #1

- Groundwater containing 20 mg/l of carbon dioxide will be degasified using a multiple-tray aerator with 5 trays. At this water treatment facility, 10 aerators operate in parallel. For maintenance reasons, only 8 of the aerators are available at any one time. The design population is 40,000 people, and the maximum day demand is 150 gal/person-day. The ***k*** value is 0.35, and the hydraulic loading is 4 gpm/ft.^{2}. Determine:

1. The carbon dioxide content of the product water.
2. The size of the trays if the length-to-width ratio is 2:1 and the trays are made in 1-inch increments.

Carbon Dioxide Removal #2

- Groundwater containing 35 mg/l of carbon dioxide will be degasified using a multiple-tray aerator. The design population is 150,000 people, and the maximum demand is 150 gal/person-day. The ***k*** value is 0.36, and the hydraulic loading is 3 gpm/ft.^{2}. Determine:

1. Determine the total number of trays in an aerator required to reduce the product water's carbon dioxide content by 90%.
2. Determine the number of aerators, operated in parallel, required for the water treatment facility if each tray's size is 1,000 ft^2.

Disinfection

- The following is data for a virus exposed to an experimental disinfectant. Estimate the contact time required to obtain a reduction of 1/40,000 of the original number of viruses.

Time, seconds	1	2	4	8
N/N0	3,602/10,000	1,303/10,000	168/10,000	3/10,000

Part 2. Use Excel to develop a table containing the carbon dioxide removal in a water treatment process using the aeration model we described in class.

$$\frac{C}{C_0} = e^{-kn}$$

Develop a spreadsheet where the number of aeration trays, ***n,*** varies by row, and the rate constant, k, varies by column. Also, allow the initial effluent concentration to be a parameter in your calculations. In other words, store the value of C_0 in a cell outside the table.

Part 3. Use Excel to demonstrate the effects of the coagulant on effluent turbidity (NTU) as recorded in the lab.

a. From the jar test data, plot the supernatant turbidity (NTU) as a function of the coagulant dosage. Click ***here*** for jar test data.
b. Determine the best dosage of coagulant from your observations and measurements.
c. Using the dosage found in Part b, calculate the quantity (lb.) of the coagulant needed to treat 20 million gallons per day (MGD).

Part 4. Read Chapters 3 and 4 in "*A Mind for Numbers*" by Barbara Oakley.