ENGR 121 **Homework 13**

NOTE: Use engineering format for problems 1 and 3, and use non-engineering format for problems 4-7. This is an individual assignment.

1. A local dairy farmer has a water tank (much like a water tower) on her farm to hold drinking water for her dairy cows. Rain water which consists of 95% pure water, 2% minerals, and 3% other materials (such as leaves) collects in the tank. Some water is lost through evaporation. The tank consists of a filtration process that creates a waste consisting of 8% water, 3% minerals, and 89% other materials. The drinkable water remaining after filtration consists of 98% pure water and 2% minerals. If the cows need 10,000 lb of water each week, how much rain water (by mass) must be collected weekly in the water tank? $mass_{rainwater}$=10,532.5lb

2. A biomedical engineering student is doing an internship at a research lab, where she is tasked with mixing the ingredients for a cell culture medium that will be used to grow mouse cells. The recipe being used is for D0422 (a high glucose media). A 1000g container of D0422 should contain 98.159% water, 0.058% L-Glutamine, 0.003% vitamins, 1.091% Inorganic Salts, 0.226% Amino Acids, and 0.463% Other. The student researcher finds a full 600g bottle of premixed ingredients that contains an unknown amount of water, vitamins, inorganic salts, amino acids, and other ingredients. The student also finds a full 400g bottle with an unknown amount of water and L-Glutamine. If the desired concentration of ingredients for D0422 is achieved by mixing these two bottles, then what is the:
    a. Percent wt of L-Glutamine in the 400g bottle 0.145%
    b. Percent wt of water in the 400g bottle 99.855%
    c. Percent wt of water in the 600g bottle 97.028%
    d. Percent wt of vitamins in the 600g bottle 0.005%
    e. Percent wt of inorganic salts in the 600g bottle 1.818%
    f. Percent wt of amino acids the 600g bottle 0.377%
    g. Percent wt of other ingredients in the 600g bottle 0.772%

3. Turn in your conductivity sensor calibration data and graph generated in class (or completed since then). Provide both the calibration equation (analog value as a function of salinity) and its inverted form (salinity as a function of analog value). Be sure to use proper formatting for the raw data and the graph (units, axis labels, graph title, etc.).

4. Embed your initial calibration equation (analog value as a function of salinity) into an Excel spreadsheet to compute the analog value for any given salinity value. Choose numbers ranging from 0.02% weight NaCl to 0.2% weight NaCl in increments of 0.01.

5. Embed your inverted equation from problem 3 (salinity as a function of analog value) into an Excel spreadsheet to compute the salinity for analog values ranging from 0 to 1023. Please use analog increments of 50 and also compute the final value at 1023.

6. Connect the circuitry for both solenoid valves on your fishtank. Use the circuit diagram below as a guide.