ABE 307, Fall 2017
Homework 8
Assigned: 11/27/2017
Due: 12/6/2017 (Wednesday)
Potential Points < 70

1. A glass sphere of 4 cm diameter and of density 2.63 g/cc is allowed to fall through a liquid of density 1.4 g/cc and viscosity of 1 cp. Calculate the terminal velocity of the sphere. (10)

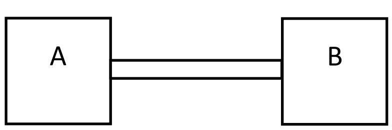
2. A hollow sphere 5 mm in diameter, with a mass of 0.05 g, is released in a column of liquid and attains a terminal velocity of 0.5 cm/s. The liquid density is 0.9 g/cm^3. The sphere is far enough from the containing walls that their effect can be neglected. (15)
   a. Compute the drag force on the sphere in dynes.
   b. Compute the friction factor.
   c. Determine the viscosity of the liquid.

3. How many gal/hr of water at 68 deg F can be delivered through a 1320-ft length of smooth 6.00 in i.d. pipe under a pressure difference of 0.25 psi. Assume that the pipe is "hydraulically smooth" (10)

4. (Problem 7A.1) Pressure Rise in a Sudden Enlargement
   An aqueous salt solution is flowing through a sudden enlargement at a rate of 450 U.S. gal/min = 0.0284 m^3/s. The inside diameter of the smaller pipe is 5 in and that of the large pipe is 9 in. What is the pressure rise in pounds per square inch if the density of the solution is 63 lb_m/ft^3. (15)

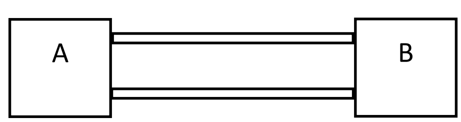
5. Flow between two tanks. (20)
   Case I: A fluid flows between two tanks A and B because $P_A > P_B$. The tanks are at the same elevation and there is no pump in the line. The connecting line has a cross-sectional area S_1 and the mass rate of flow is w for a pressure drop of $P_A - P_B$.
   Case II: It is desired to replace the connecting line by two lines, each with cross section S_{II} = ½ (S_1). What pressure difference $(P_A - P_B)_{II}$ is needed to give the same total mass flow rate as in Case 1 ? Assume turbulent flow and use the given Blasius formula for the friction factor. Neglect entrance and exit losses.
   Blasius Formula for friction factor. $f = 0.0791/(Re)^{1/4}$

CASE I



Mass flow rate w

CASE II



Sum of mass flow rates is w