Ben Smithson Fluid Mechanics Pre test 2

1. - When finding force magnitude are we using static fluid principles?
- when finding horizontal forces are we using all pipes?
- what is equation 11-9
- what is a blind flange?

2. for problem A part 1 I will use forces due to static fluids. using $F = pA$

and $A = \frac{\pi D^2}{4}$ pg. 66

For problem A part 2 I will use the forces due to static fluids again for horizontal and vertical forces. I will use $F_v = \gamma \cdot V$ and find the centroid in the pipes?

For problem A part 3. I will use general energy equation to find pressure drop. $Q = Av$ $Q_1 = Q_2$ $A_1 V_1 = A_2 V_2$ and a form of bernoulis which should be complete from test 1?

For problem A part 4 we use equation 11-9? can not find.

2. For problem B part 5. we should use bernoulli's and $Q = V \cdot A$ in order to find the water flow rate.

For problem B part 6. we use the drag force equation which is

$$F_D = C_D \left(\frac{\rho V^2}{2}\right) A \quad \text{(example class)}$$

For problem B part 7. we use displacement of water flowing or bouancy and stability using $F_b = W$ (bouancy force we can see how deep the person goes in? (Bouancy example class)

3. Use same structure as 1st test and previous tests

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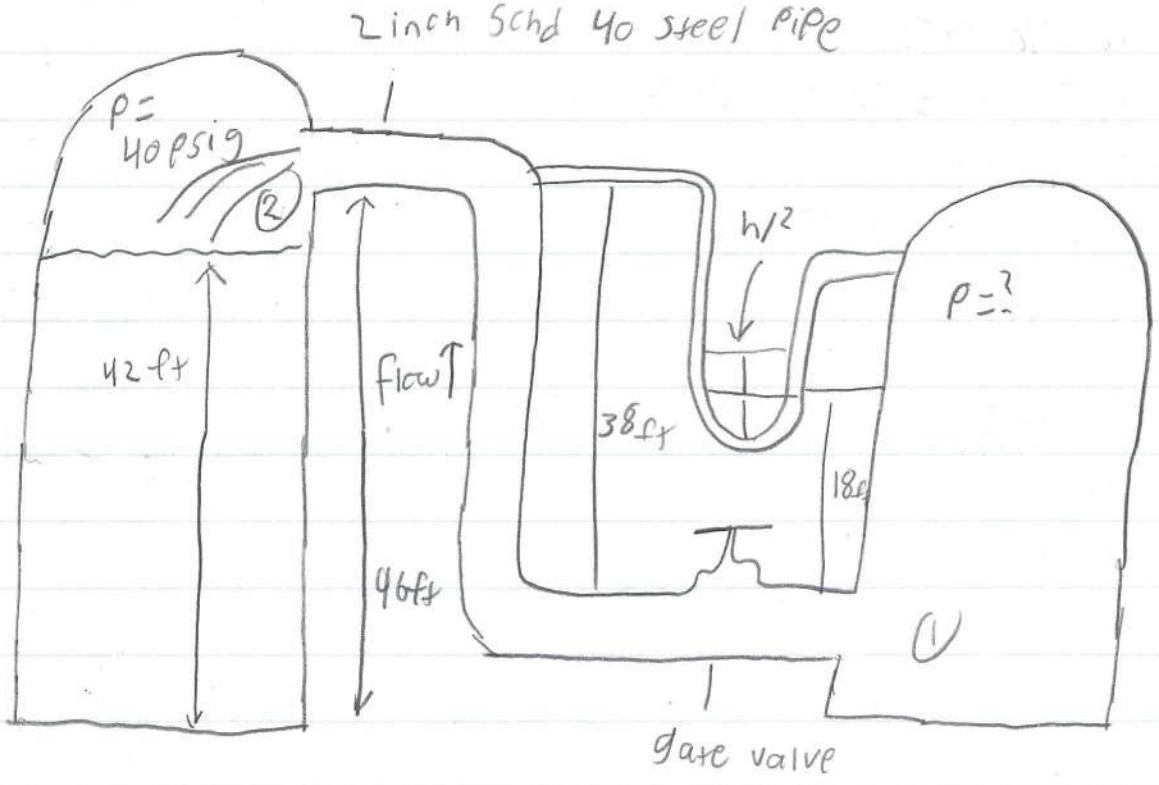
4. Part A

Purpose: Determine the force magnitude through the pipe system, then calculate the horizontal and vertical forces for the system to be supported. Also, check the pressure drop out of the nozzle and factor in the effect of a water hammer.

Diagram:



Sources: Applied Fluid Mechanics Eighth edition Mott, Untener.

Design considerations:

1) Incompressible fluids
2) Static fluid
3) System is horizontal and vertical
4) Minor losses

Data 3 variables
Schedule 40 pipe
blind flange = 2inch diameter
150 gpm
water temp is 71°F

Materials:
water
ethyl alcohol
steel pipe.

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procedure: First, I will draw the diagram. Then, find the points on the diagram in order to see pressure. Next, using static flow of fluids I will find the force magnitude at the blind flange. After that, I will continue to use static flow of fluids to determine the horizontal & vertical forces required to support the system. In the last steps I will use the general energy equation to calculate pressure drop out of the nozzle. Finally, using equation 11-9 I can find the effect of the water hammer on the system to see if there will be damage.

calculations:

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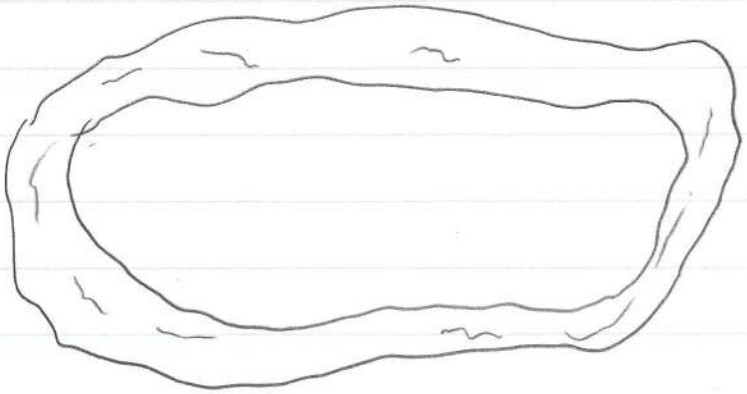
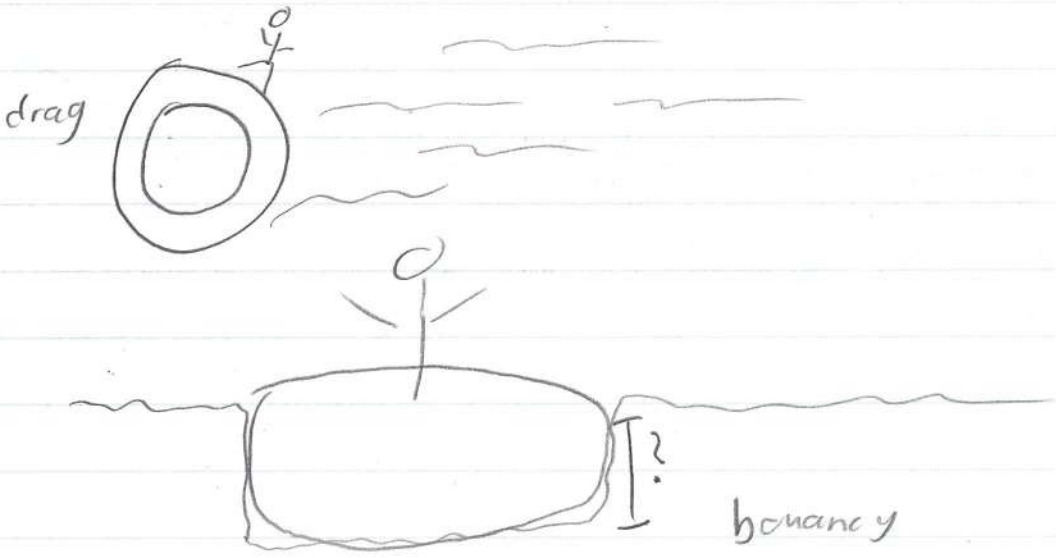
4. Part B:

Purpose: The purpose of this question is to design a lazy river that can show the flow rate, be stable, and have a reasonable drag force on individuals riding it.

Diagrams:





Source: Mott & Utener, Applied Fluid Mechanics 8th edition

Design considerations:
220 lb person is floating
4 year old = 0.1% slope
water is flowing

Data & variables
220 lb (bouancy
0.1% slope
flow rate
Static forces

Material
- water running out a nozzle to push individuals
- pool float

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procedures: First, using Q=VA I will find the reauired flow rate to push a 4 year old. Next, I will use drag force equation to see what drag the kid will feel while going around the lazy river. Finally using bouancy I can see if the river will be stable with a 220lb person riding.

Calculations:

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5. Course objectives being used:

- Describe nature of fluids & determine properties
- Compute magnitude forces associated with stagnant fluids
- Discuss what buoyancy is and determine stability.
- Explain Fluid dynamics in pipes
- Bernoulli's equation
- Identify & solve open flow / water hammer errors

Course objectives indirectly used

- friction losses are present in the system (known from first test)