1) **How and why the test demonstrates your work toward one, or more, of the course learning objectives. Be specific on the course objectives you decide to mention.**

● Describe the nature of fluids and define different fluid properties such as viscosity and pressure

We are reaching a point in the course where nearly every variable of a fluid (specific weight, density, kinematic viscosity, etc) is coming into equations.

● Compute pressure and the forces (magnitude, location, and direction) associate with it in a stagnant fluid

The blind flange is exactly this! And not just our usual pressure in a body of water with an open surface, but now a pressurized vessel and how that affected things.

● Discuss what buoyancy is and determine object stability while floating or submerged in a fluid

We had to determine the center of gravity, center of buoyancy, and metacenter of our fictitious log and determine what the relation between those things mean.

● Explain the fluid dynamics in pipes and fittings

In determining the pressure in the tank, we had to consider all the losses in the system (pipes, bends, and valves alike) and compile them in Bernoulli's

● Apply the principles of conservation of energy (Bernoulli's equation) and mass to fluid flow systems

Gosh, there was barely a place Bernoulli's wasn't used. If water moved, Bernoulli's was there.

● Compute friction losses in pipes for a variety of configurations (series, parallel, network, etc.)

So far the exam is just a series system, but in determine the tank pressure we had to account for the friction loss.

● Identify and solve for different very specific industrial problems, such as, open-channel flow, cavitation, water hammer, drag, lift, forces in pipes, and learn about different instruments to measure fluid flow quantities (such as, pressure, fluid velocity, flow velocity, etc.)

First application! We used open-channel flow for the log, ensured cavitation wouldn't happen, ensured the piping we had was capable of withstand the water hammer, calculated the potential drag force of a rogue log, and calculated the reactionary forces in the pipes.

2) **How your test compares against the available solution. State the mistakes you made and what you will do next time to avoid making same mistakes. Please point out exactly where you made the mistake, say why you made the mistake, and how you should have done it. If you were taking this test again, what advice would you give yourself to ensure that you had a successful test?**

In part A, the Q used in the provided solution is the Q of the piping, but I used a calculated Q for the open-flow channel from equation 14-11. I feel like my use was justified if the open-channel can be assumed to have another source (such as being a natural river that the tank is only adding to), but if being exclusively driven by the tank, would not be appropriate.

> It will sound sassy, and please don't take it any way. I feel like mine is not inherently wrong and had a valid premise.

In trying to obtain the tank pressure, I could not identify the type of valve and used a gate valve (stated on page 19 of my work), and it was apparently a gate valve. This change the pressure in the tank (from Bernoulli's) quite a bit as a result. As a result of this inflated pressure, my reactionary force values were off.

Because of the Q differences in part A, my open-channel was much taller and my dimensions for the log were dramatically different, and the center of gravity, center of buoyancy, and metacenter.

In part E with cavitation, I seemingly had a calculator entry error and resulted in an **enormous** C value, which in turn yielded an **enormous** deltap.

In part F, again because of the original Q discrepancy yielding a different open-channel depth, my log size was far off. Process looks correct, but drag force is definitely larger in mine for a significantly larger log.

In part G, because my pressure for the air was different (due to declaring a different valve), my pressure on the flange was different. That said, location of the resultant force seems correct.

Honestly, aside from one calculator error, my processes seems to have been valid. I used the correct equations. I suppose when I was uncertain of the valve, I should have asked rather than assume. Along with, I used a provided formula to determine a Q of the channel, when I should have asked if the Q pipe is the same.

3) **What your grade should be. Base it on the writing rubric provided in the test and the correctness of your solution. What are the strengths and weaknesses of your test?**

<u>WRITING RUBRIC (Applied to the whole test, not to particular problems)</u>

1. Purpose 0.5/10.0
2. Drawings 1.0/10.0
3. Source 1.0/10.0
4. Design considerations 0.5/10.0
5. Data and variables 0.5/10.0
6. Procedure 1.8/10.0
7. Calculations 1.0/10.0
8. Summary 0.4/10.0
9. Materials 0.5/10.0
   *there is no materials section in the solution provided, so do not have a direct comparison
10. Analysis 0.5/10.0

TOTAL 7.7/10.0

PROBLEM 1)

1. Open channel depth (y)
   a. Correct equation 1/2
   b. Area and Hydraulic radius 1/2
2. Pipe-elbow forces
   a. Free body diagram and correct forces 1/3
   b. Force in x 1/3
   c. Force in y (weight) 1/3
3. Largest wood log
   a. Size 0/2
   b. Stable? 1/2
4. Flow-nozzle flowmeter pressure drop
   a. Right equation and A1/A2 1/2
   b. C value 1/2
5. Water hammer pressure increase
   a. Wave velocity (units?) 1/2
   b. Pressure increase 1/2
6. Drag force on a stuck log
   a. Correct area 0/3
   b. Correct velocity 1/3
   c. How Cd was obtained? 1/3
7. Force on the flange
   a. Magnitude 1/2
   b. Location 1/2
8. Final actual values of the results 1/1

FINAL GRADE:

7.7+ (80/10)*(2/2 + 3/3 + 1/2 + 2/2 + 2/2 + 2/3 + 2/2 + 1/1) = 65.03

4) **Discuss the following:**

   a. **What issues did you encounter in completing the test? How did you troubleshoot them?**

      Initially thought we needed to be provided the air pressure in the tank and was hung up on that, but after confirming it was something we would calculate, I moved forward. Troubles with understanding the dimensions of the log, but after confirming that the length didn't matter by extending out the volume equation, it made more sense. Also tried to draft out the open channel with a slope to mentally chart if the slope was relevant to the potential length of the log. Made an error while trying to calculate the pressure of the air (page 20 of my work), but caught it due to checking units. Sent an email to Dr. Ayala about what I was missing in having 2 unknown forces in the y-direction, who reminded me that I did know one of them indirectly.

   b. **What steps did you take to complete the whole test? Would you change something?**

      A lot of flipping through varying chapters of the book. Prior to the exam, I should have made a condensed note sheet for equations. I know I would have missed some, but it might have saved a good chunk of time.

   c. **What new concepts have you learned?**

      I'm actually really excited about understanding **why** the resultant force is located below the pressure average in stagnant fluids. I did not understand that premise, in spite of many problems, until this exam.

   d. **Where you think engineers use those concepts (provide specific examples)?**

      In designing piping systems! Trying to determine what point is experiencing the greatest stress, if under extreme moments (like water hammer) there is risk of shearing or breaking, etc.

   e. **Where do you think you will be using everything you learned?**

      Who knows! Life is wild. The 3rd exam, for certain. The final exam after that.

   f. **Do you think what you learn is important for your professional career?**

      I'm not one to claim any knowledge is unimportant. I may not use it today, but having it to look back on if I do is better than not.

g. **How, when, where and why you might use this information or skill in the future?**

    In my senior project! I'm planning to have a gravity-driven water system with a valve whose opening and closing is controlled by a motor. It will be for watering plants.

h. **Have you been able to apply concepts you have learned in the course to what you do at work or in other courses?**

    No. But I will be able to in the future! I'm trying to plan for making a water reservoir and piping portion of my senior project, which I would have never considered before this course.

i. **What areas did you feel you were most successful, or improved the most?**

    Better handling on why the resultant force in stagnant fluids is placed where it is. Was a concept I was heavily confused about since its introduction, and even after so many problems, I could locate **where** it was but not understand **why** it was there.

j. **How do you see this course's content intersecting with your field or career?**

    This coming Spring, I have the option for what project I want to take on at Langley and working on the hydraulic system for the cockpit motion facility is one my supervisors would like me to consider.

k. **How much time did you spend on the test? How was the time organized? What would you do differently? Why?**

    13 hours, not including formatting for submission. I sat down at 6am on Saturday and closed my book at 7pm on Saturday. I would have made a formula sheet to reference rather than having so many things scattered. Finding things in the e-book is tedious.