CE 3305 – Fluid Mechanics Exam 1

Purpose

Demonstrate ability to apply fluid mechanics and **problem solving principles** covering topics such as: Fluid properties, viscosity, vapor pressure, fluid statics and pressure.

Instructions

1. Put your name on each sheet you submit.
2. Use additional sheets as needed.
3. Begin each problem on a separate page. Ok to disassemble to keep pages in order.
4. Do not write on the back of sheets (I won't look)
5. Use the problem solving protocol in the class notes. The discussion sections can simply be the word "discussion"
6. Label and/or underline answers, be sure to include units.

Allowed Resources

1. Your notes
2. Your textbook
3. The mighty Internet with following proviso
4. **You may not communicate with other people during the exam**

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1. Argon gas is used as a sheilding gas for welding for fabrication of metal objects. A 200-liter tank has an empty mass of 50 kg.

   Determine:

   (a) The total weight of the 200-liter tank of argon at a pressure of 3,500 psia at a temperature of 313^{o}K.

   (b) The argon pressure if the tank is submersed in the North Sea to repair an underwater pipeline, where the ambient water temperature is 6^{o}C

   (c) The additional ballast (mass) required for the tank to be neutrally bouyant in seawater ($\rho_{sw} = 1025\frac{kg}{m^3}$)

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2. The figure below is a schematic of a sliding plate viscometer used to measure the viscosity of a fluid. The top plate is moving to the right with a constant velocity in response to a force of 3 Newtons.

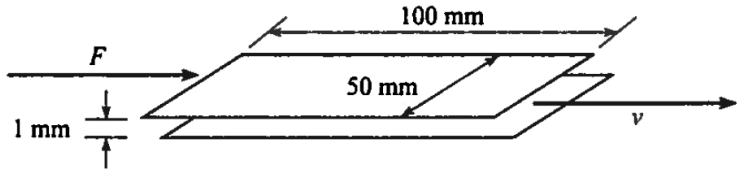

Figure 1:

Determine:

(a) The speed of the plate if the viscosity is $\mu = 5 \times 10^{-2}\ \frac{N \cdot s}{m^2}$

(b) The speed of the plate if the viscosity is $\mu = 7 \times 10^{-2}\ \frac{N \cdot s}{m^2}$

(c) The viscosity if the speed of the plate is $10.001\ \frac{m}{s}$

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3. A large atmospheric tank used for quenching rocket motors is filled with a Class A auto-foaming fire supressant liquid (specific weight 7595 N/m^3). The supressant is restrained by a circular gate as shown.[1]

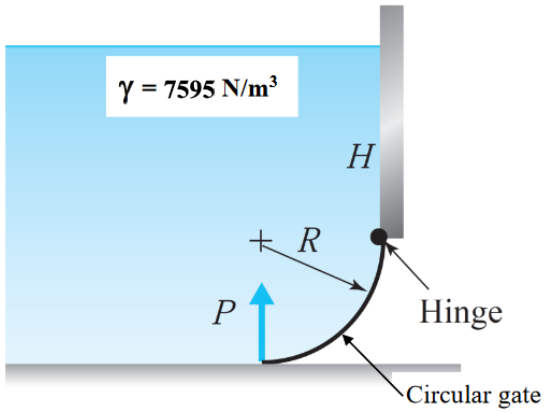

Figure 2:

The dimensions of interest are: R = 1.5 m, H = 6 m, Gate width (into the plane of the image) b = 3 m.

Determine:

(a) The liquid pressure at the hinge.

(b) The liquid pressure at the bottom of the gate

(c) The horizontal and vertical force of the liquid acting on the circular gate

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[1] When a rocket motor quench is needed, the gate is lifted and the suppressant rapidly flows over the test area.