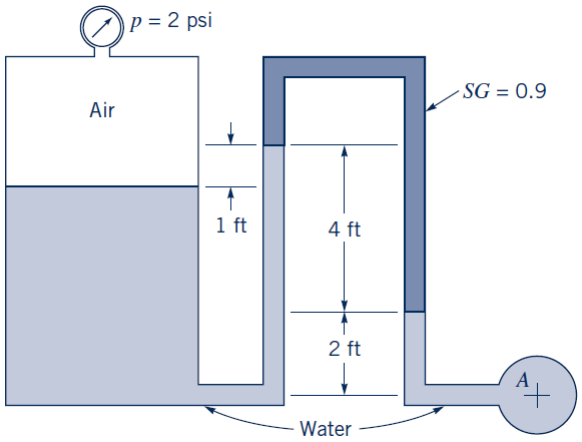
Homework set 3

Due: 2:10 PM – September 21, 2018

• Fluid Statics

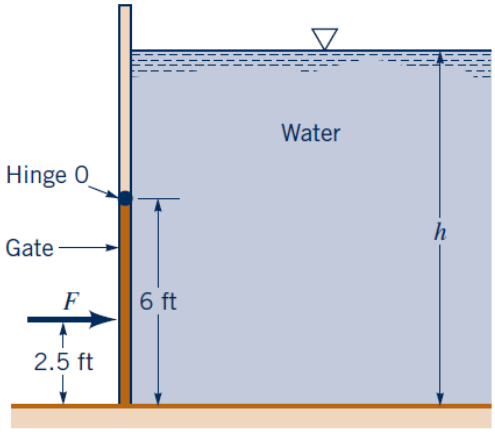
Problem 1

Determine the pressure of the water in pipe A shown in figure below, if the gage pressure of the air in the tank is 2 psi.



Problem 2

A rectangular gate 6 ft tall and 5 ft wide in the side of an open tank is held in place by the force F as indicated in the figure below. The weight of the gate is negligible, and the hinge at O is frictionless. (a) Determine the water depth, h, if the resultant hydrostatic force of the water acts 2.5 ft above the bottom of the gate, i.e., it is collinear with the applied force F. (b) For the depth of part (a), determine the magnitude of the resultant hydrostatic force. (c) Determine the force that the hinge puts on the gate under the above conditions.



• Fluid Kinematics

Problem 3

Recall for yourself the definitions and differences between the Lagrangian velocity and the Eulerian velocity.

Problem 4

The velocity field of a flow is given by $V = (3y + 2)\hat{i} + (x - 8)\hat{j} + 5z\hat{k}$ ft/s, where x, y, and z are in feet. Determine the fluid speed at the origin (i.e., $x = y = z = 0$) and on the y axis (i.e., $x = z = 0$).

Problem 5 .

Determine the acceleration field for a three-dimensional flow with velocity components $u = -3x$, $v = 2x^2y^2$, and $w = 4x - y$. Is the flow steady or unsteady? Which acceleration (convective or local) is primarily contributing to the total acceleration?

TEXTBOOK

Munson, B.R., Okiishi, T.H., Huebsch, W.W., and Rothmayer, A.P., "Fundamentals of Fluid Mechanics", 7th Edition, 2013, John Wiley & Sons.