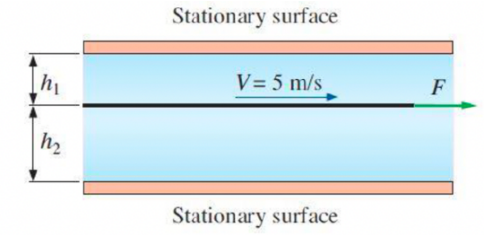
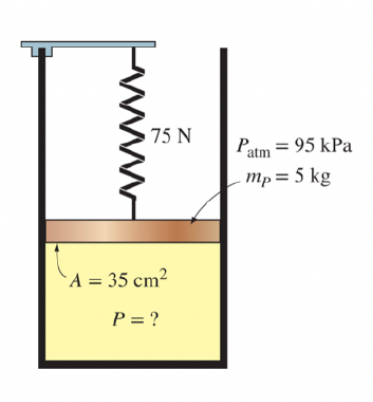
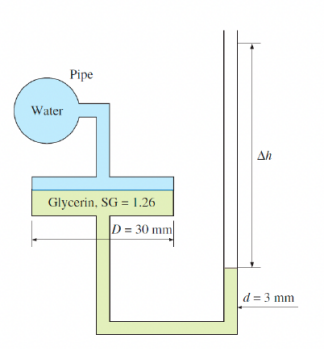
Question 1 of 5 (15 marks): A thin plate moves between two parallel, horizontal, stationary flat surfaces at a constant velocity of 5 m/s as shown in the figure. The two stationary surfaces are spaced 4 cm apart, and the medium between them is filled with oil whose viscosity is 0.9 $N \cdot s/m^2$. The part of the plate immersed in oil at any given time is 2-m long and 0.5-m wide. If the plate moves through the mid-plane between the surfaces, determine the force required to maintain this motion. What would your response be if the plate was 1 cm from the bottom surface ($h2$) and 3 cm from the top surface ($h1$)?



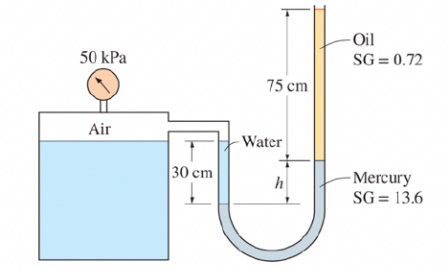
Question 2 of 5 (5 marks): A gas is contained in a vertical, frictionless piston-cylinder device. The piston has a mass of 5 kg and a cross-sectional area of 35 cm^2. A compressed spring above the piston exerts a force of 75 N on the piston. If the atmospheric pressure is 95 kPa, determine the pressure inside the cylinder.



Question 3 of 5 (15 marks): The system shown in the figure is used to accurately measure changes when the pressure is increased by ΔP in the water pipe. When $\Delta h = 70\ mm$, what is the change in the pipe pressure?



Question 4 of 5 (5 marks): The gage pressure of the air in the tank shown in the figure below is measured to be 50 kPa. Determine the differential height h of the mercury column.



Question 5 of 5 (10 marks): A steady, incompressible, two-dimensional velocity field is given by $\vec{V} = (0.523 - 1.88x + 3.94y)\hat{\imath} + (-2.44 + 1.26x + 1.88y)\hat{\jmath}$, calculate the acceleration at the point $(x, y) = (-1.55, 2.07)$.