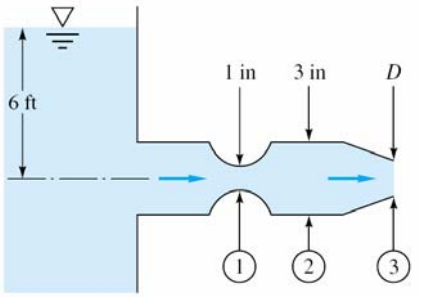
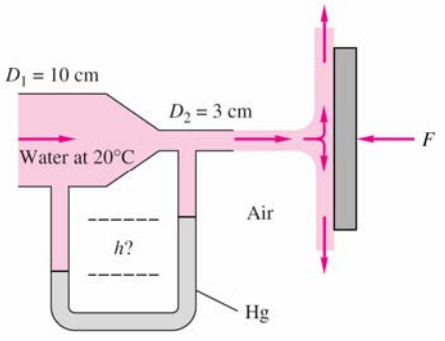
	1st Mid-Term Exam	**Time: 50 min**
	Course: *58:160, Fall 2006*	
Name:----------		**Fluid I.D. :**----------

1) The 35° water flow of below figure discharges to sea-level standard atmosphere. Neglecting losses, for what circular nozzle diameter D will cavitation begin to occur? To avoid cavitation, should you increase or decrease D from this critical value?



2) Water at 20° flows through a circular nozzle, exits into the air as a jet, and strikes a plate, as shown in the figure below. The force F required to hold the plate steady is 70 N. Assuming steady, frictionless, one-dimensional flow, estimate: (*a*) the velocities at sections (1) and (2) and (*b*) the mercury manometer reading *h*.



3) The hydraulic jump is defined as an abrupt change in the flow depth due to considerable energy losses. As can often be seen in a kitchen sink when the faucet is running, a high-speed channel flow (V_1, h_1) may "jump" to a low-speed, low-energy condition (V_2, h_2) as in the below figure. The pressure at sections 1 and 2 is approximately hydrostatic, and wall friction is negligible. (a) Use the continuity and momentum relations to find h_2 and V_2 in terms of (h_1,V_1). (b) Use energy equation to find head loss H_L in terms of (h_1, h_2).

Energy equation: $\frac{P_1}{\gamma}+\frac{V_1^2}{2g}+z_1=\frac{P_2}{\gamma}+\frac{V_2^2}{2g}+z_2+H_L$