MASSACHUSETTS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING

2.06 Fluid Dynamics

RECITATION #1, Spring Term 2013

Topics: Fluid Statics Examples

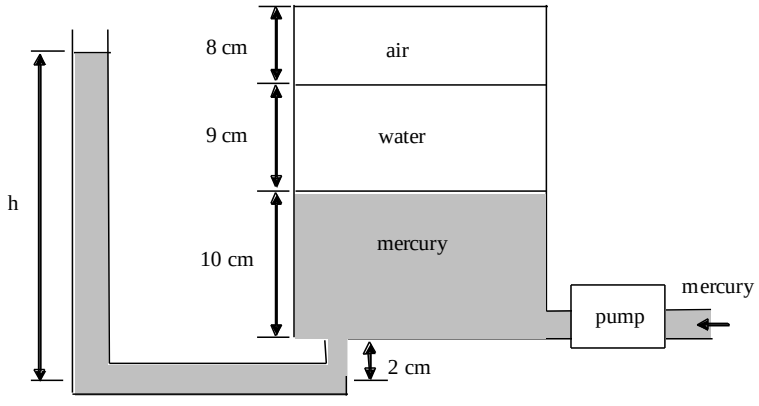
Problem 1

A pump slowly introduces mercury into the bottom of the closed tank shown in the figure below. At the instant shown, the air pressure p_a= 75 kPa. The pump stops when the air pressure rises to 120 kPa and an engineer closes a valve at the exit of the pump at that time. All fluids remain at 20^{o}C. At that temperature, the density of water and mercury are 998 and 13,550 kg/m^3, respectively.

a) What is the manometer reading *h* when the air pressure reaches 120 kPa, if it is connected to standard sea-level ambient air p_{atm}=101.35 kPa?
b) Sketch a profile of the pressure distribution in the tank.
c) What is the pressure at the bottom of the tank initially (when p_a= 75 kPa)? What is it at the end of the process (when p_a= 120 kPa)?

With the valve still closed, a hole forms at the top of the tank so that the air becomes in contact with the ambient air.

d) If the cross-sectional areas of the tank and manometer are 0.1m^2 and 0.001 m^2 respectively, what is the new manometer reading *h*?



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