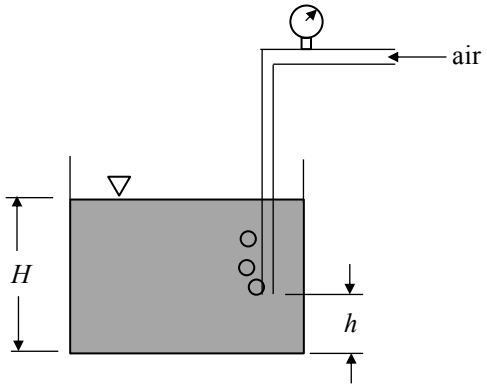
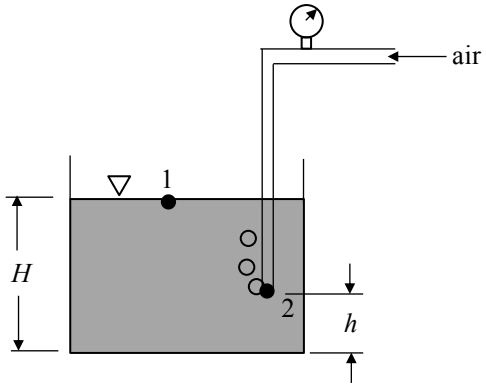
One method of determining the surface level of liquid in a tank is by discharging a small amount of air through a tube, the end of which is submerged in the tank, and reading the pressure on the gage that is tapped into the tube. The level of the liquid surface in the tank can be calculated from the gage pressure measured in the air tube.

For the system shown below, determine the depth of the liquid, H, if the gage pressure reported by the gage is 20 kPa, and the end of the tube is located a height h = 1 m from the bottom of the tank. The fluid has a specific gravity of 0.85.



SOLUTION:



The pressure at the end of the tube is,

$$p_2 = p_1 + \rho_L g(H-h) \;\Rightarrow\; p_{2,\text{gage}} = SG_L \rho_{H_2O} g(H-h) \;\Rightarrow\; \boxed{H = h + \frac{p_{2,\text{gage}}}{SG_L \rho_{H_2O} g}} \qquad (1)$$

where $\rho_L = SG_L \rho_{H2O}$ and $p_{1,\text{gage}} = 0$. Note that the pressure at the end of the tube will be nearly the same as the pressure indicated by the gage since the change in air pressure over a typical tube elevation distance (tens of meters at most) will be negligible.

Using the given data,

$p_{2,\text{gage}} = 20*10^3$ Pa
$SG_L = 0.85$
$\rho_{H2O} = 1000$ kg/m^3
$g = 9.81$ m/s^2
$h = 1$ m
$\Rightarrow \boxed{H = 3.4 \text{ m}}$