EXAMPLE 1–2 **Obtaining Formulas from Unit Considerations**

A tank is filled with oil whose density is $\rho = 850$ kg/m³. If the volume of the tank is $V = 2$ m³, determine the amount of mass m in the tank.

$\rho = 850\ kg/m^3$

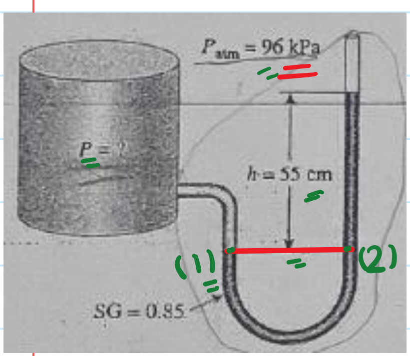
$V = 2m^3$

$m = ?$

$$\boxed{\begin{matrix}\rho = 850 \\ \text{oil} \\ V = 2m^3\end{matrix}}$$

$$\rho = \frac{m}{V} \Rightarrow m = \rho * V$$

$$m = 850 * 2 = 1700\ kg$$



EXAMPLE 1–6 **Measuring Pressure with a Manometer**

A manometer is used to measure the pressure in a tank. The fluid used has a specific gravity of 0.85, and the manometer column height is 55 cm, as shown in Fig. 1–50. If the local atmospheric pressure is 96 kPa, determine the absolute pressure within the tank.

$$Sg_f = 0.85 = \frac{\rho_f}{\rho_{H_2O}} \qquad \rho_{H_2O} = 1000\ kg/m^3$$

$$\rho_f = Sg_f * \rho_{H_2O} = 0.85 * 1000 = 850\ kg/m^3$$

$$P_1 = P_2$$

$$P_2 = \rho_f g h_f + P_{atm}$$

$\rho_f = 850\ kg/m^3$

$g = 9.807\ m/s^2$

$$P_2 = 850 * 9.807 * 0.55 * 10^{-3} + 96$$

$$P_2 = 4.58 + 96 = 100.58\ kPa$$

$$P_1 = P_2 = 100.58\ kPa$$

$\rho_f = 850\ kg/m^3$

$g = 9.807\ m/s^2$

$h_f = 55\ cm = 55 * 10^{-2}\ m$

$h_f = 0.55\ m$

$\rho g h \Rightarrow Pa * 10^{-3} = kPa$

EXAMPLE 1–7 **Measuring Pressure with a Multifluid Manometer**

The water in a tank is pressurized by air, and the pressure is measured by a multifluid manometer as shown in Fig. 1–53. The tank is located on a mountain at an altitude of 1400 m where the atmospheric pressure is 85.6 kPa. Determine the air pressure in the tank if $h_1 = 0.1$ m, $h_2 = 0.2$ m, and $h_3 = 0.35$ m. Take the densities of water, oil, and mercury to be 1000 kg/m³, 850 kg/m³, and 13,600 kg/m³, respectively.

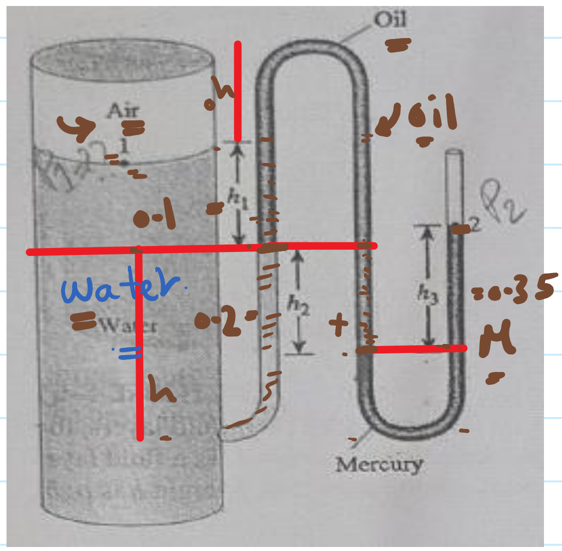
$h_1 = 0.1\ m$ $\quad \rho_o = 850\ kg/m^3$

$h_2 = 0.2\ m$ $\quad \rho_w = 1000\ kg/m^3$

$h_3 = 0.35\ m$ $\quad \rho_m = 13,600\ kg/m^3$

$P_{atm} = 85.6\ kPa$

$P_1 = ?$



* Solution

$$P_1 + \rho_w g h_1 + \rho_o g h_2 - \rho_m g h_3 = P_2$$

$P_2 = P_{atm}$

$$P_1 + 1000 * 9.807 * 0.1 * 10^{-3} + 850 * 9.807 * 0.2 * 10^{-3}$$

$$- 13600 * 9.807 * 0.35 * 10^{-3} = 85.6$$

$P_1 = \underline{\underline{129.6}}$ KPa