34. Let F_o be the buoyant force of air exerted on the object (of mass m and volume V), and F_{brass} be the buoyant force on the brass weights (of total mass m_{brass} and volume V_{brass}). Then we have

$$F_o = \rho_{\text{air}} V g = \rho_{\text{air}} \left(\frac{mg}{\rho} \right)$$

and

$$F_{\text{brass}} = \rho_{\text{air}} V_{\text{brass}} g = \rho_{\text{air}} \left(\frac{m_{\text{brass}}}{\rho_{\text{brass}}} \right) .$$

For the two arms of the balance to be in mechanical equilibrium, we require $mg - F_o = m_{\text{brass}} g - F_{\text{brass}}$, or

$$mg - mg \left(\frac{\rho_{\text{air}}}{\rho} \right) = m_{\text{brass}} g - m_{\text{brass}} g \left(\frac{\rho_{\text{air}}}{\rho_{\text{brass}}} \right),$$

which leads to

$$m_{\text{brass}} = \left(\frac{1 - \rho_{\text{air}}/\rho}{1 - \rho_{\text{air}}/\rho_{\text{brass}}} \right) m .$$

Therefore, the percent error in the measurement of m is

$$\begin{aligned} \frac{\Delta m}{m} &= \frac{m - m_{\text{brass}}}{m} = 1 - \frac{1 - \rho_{\text{air}}/\rho}{1 - \rho_{\text{air}}/\rho_{\text{brass}}} = \frac{\rho_{\text{air}}(1/\rho - 1/\rho_{\text{brass}})}{1 - \rho_{\text{air}}/\rho_{\text{brass}}} \\ &= \frac{0.0012(1/\rho - 1/8.0)}{1 - 0.0012/8.0} \approx 0.0012 \left(\frac{1}{\rho} - \frac{1}{8.0} \right) , \end{aligned}$$

where ρ is in g/cm^3. Stating this as a *percent* error, our result is 0.12% multiplied by $\left(\frac{1}{\rho} - \frac{1}{8.0} \right)$.