32. (a) Since the lead is not displacing any water (of density ρ_w), the lead's volume is not contributing to the buoyant force F_b. If the immersed volume of wood is V_i, then

$$F_b = \rho_w V_i g = 0.90\rho_w V_{\text{wood}} g = 0.90\rho_w g \left(\frac{m_{\text{wood}}}{\rho_{\text{wood}}}\right) ,$$

which, when floating, equals the weights of the wood and lead:

$$F_b = 0.90\rho_w g \left(\frac{m_{\text{wood}}}{\rho_{\text{wood}}}\right) = (m_{\text{wood}} + m_{\text{lead}})g \ .$$

Thus,

$$\begin{aligned} m_{\text{lead}} &= 0.90\rho_w \left(\frac{m_{\text{wood}}}{\rho_{\text{wood}}}\right) - m_{\text{wood}} \\ &= \frac{(0.90)(1000\,\text{kg/m}^3)(3.67\,\text{kg})}{600\,\text{kg/m}^3} - 3.67\,\text{kg} = 1.84\,\text{kg} \ \approx 1.8 \text{ kg} \ . \end{aligned}$$

(b) In this case, the volume $V_{\text{lead}} = m_{\text{lead}}/\rho_{\text{lead}}$ also contributes to F_b. Consequently,

$$F_b = 0.90\rho_w g \left(\frac{m_{\text{wood}}}{\rho_{\text{wood}}}\right) + \left(\frac{\rho_w}{\rho_{\text{lead}}}\right) m_{\text{lead}} g = (m_{\text{wood}} + m_{\text{lead}})g ,$$

which leads to

$$\begin{aligned} m_{\text{lead}} &= \frac{0.90(\rho_w/\rho_{\text{wood}})m_{\text{wood}} - m_{\text{wood}}}{1 - \rho_w/\rho_{\text{lead}}} \\ &= \frac{1.84\,\text{kg}}{1 - \left(1.00 \times 10^3\,\text{kg/m}^3/1.13 \times 10^4\,\text{kg/m}^3\right)} = 2.0 \text{ kg} \ . \end{aligned}$$