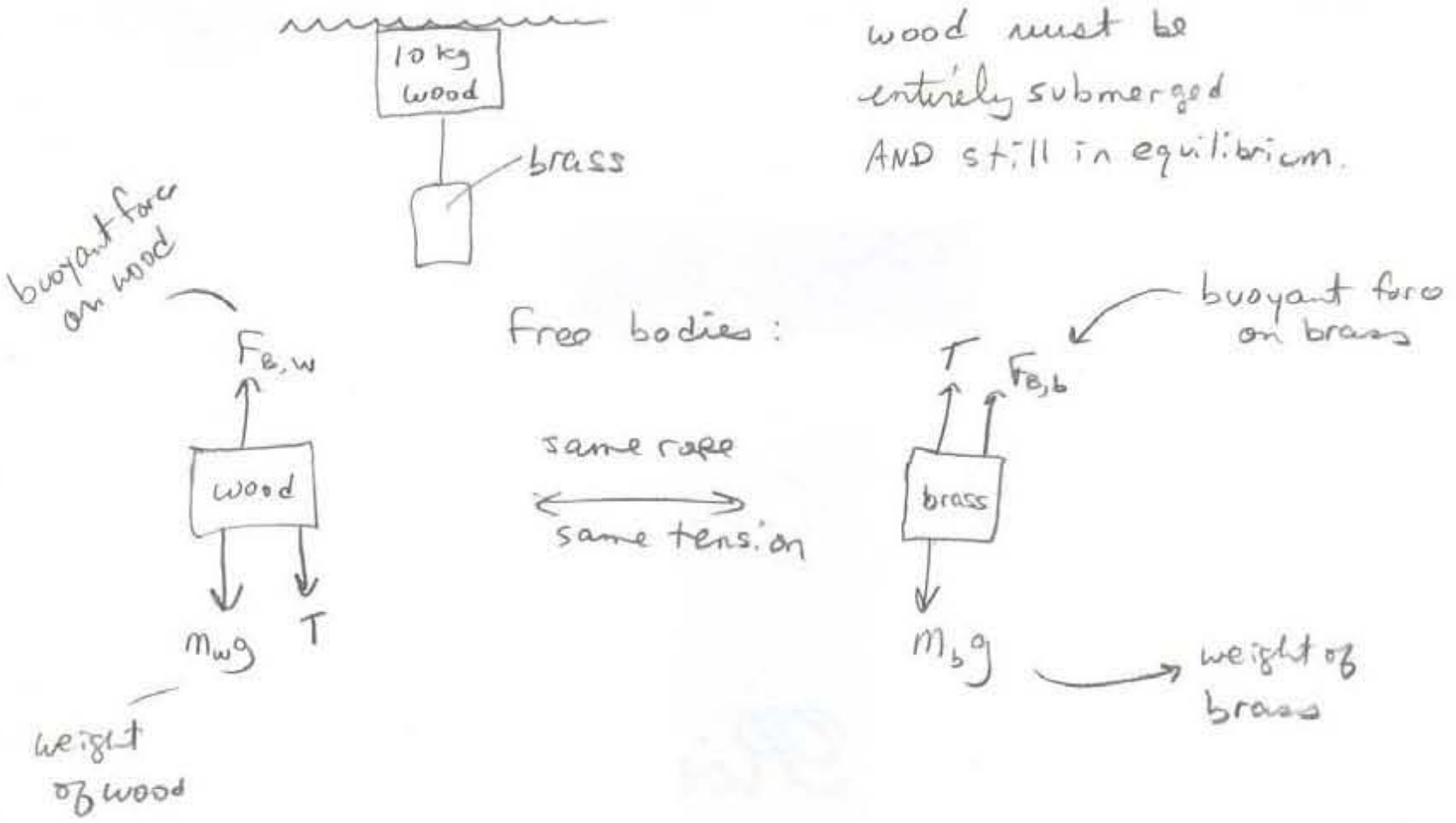
Sample Handwritten Solution



$F_{B,w} = m_w g + T$ $\qquad$ $T + F_{B,b} = m_b g$

eliminate T

$$\boxed{F_{B,w} - m_b g = m_w g - F_{B,b}}$$

Plug in for buoyant forces.

$F_B = \rho_{water} \bar{V} g$

wood: $F_{B,w} = \rho_{water} \bar{V}_{wood} g$

brass: $F_{B,b} = \rho_{water} \bar{V}_{brass} g$

Volume of wood is known:

$$\bar{V} = \frac{m}{\rho} = \frac{10\ kg}{600\ \frac{kg}{m^3}} = .017\ m^3$$

plug into boxed equation:

$$\rho_{water} V_{wood} g - m_b g = m_w g - \rho_{water} V_{brass} g$$

though V_{brass} is not known, $V_{brass} = \frac{m_{brass}}{\rho_{brass}}$:

$$\rho_{water} \bar{V}_{wood} \not{g} - m_b \not{g} = m_w \not{g} - \rho_{water} \frac{m_b}{\rho_{brass}} \not{g}$$

solve for the only unknown, m_b: [ALL ALGEBRA NOW!]

$$\left(\frac{\rho_{water}}{\rho_{brass}}\right) m_b - m_b = m_w - \rho_{water} \bar{V}_{wood}$$

$$m_b \left(\frac{\rho_{water}}{\rho_{brass}} - 1\right) = m_w - \rho_{water} \bar{V}_{wood}$$

$$m_b \left(\frac{1000 \frac{kg}{m^3}}{8000 \frac{kg}{m^3}} - 1\right) = (10\ kg) - \left(1000 \frac{kg}{m^3}\right)(.017\ m^3)$$

$$m_b = \frac{10\ kg - 17\ kg}{-.875} = \boxed{8.0 kg}$$

8 kg of brass must be added to sink the raft.