

36. The problem intends for the children to be completely above water. The total downward pull of gravity on the system is

$$3(356 \text{ N}) + N\rho_{\text{wood}}gV$$

where N is the (minimum) number of logs needed to keep them afloat and V is the volume of each log: $V = \pi(0.15 \text{ m})^2(1.80 \text{ m}) = 0.13 \text{ m}^3$. The buoyant force is $F_b = \rho_{\text{water}}gV_{\text{submerged}}$ where we require $V_{\text{submerged}} \leq NV$. The density of water is 1000 kg/m^3 . To obtain the minimum value of N we set $V_{\text{submerged}} = NV$ and then round our “answer” for N up to the nearest integer:

$$3(356 \text{ N}) + N\rho_{\text{wood}}gV = \rho_{\text{water}}gNV \implies N = \frac{3(356 \text{ N})}{gV(\rho_{\text{water}} - \rho_{\text{wood}})}$$

which yields $N = 4.28 \rightarrow 5$ logs.