

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  $1000 \text{ kg/m}^3$ . 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.