

Problem 1.36

[Difficulty: 1]

1.36 A container weighs 3.5 lbf when empty. When filled with water at 90°F, the mass of the container and its contents is 2.5 slug. Find the weight of water in the container, and its volume in cubic feet, using data from Appendix A.

Given: Data on a container and added water.

Find: Weight and volume of water added.

Solution: Use Appendix A.

For the empty container $W_c = 3.5 \text{ lbf}$

For the filled container $M_{\text{total}} = 2.5 \text{ slug}$

The weight of water is then $W_w = M_{\text{total}} \cdot g - W_c$

$$W_w = 2.5 \text{ slug} \times 32.2 \frac{\text{ft}}{\text{s}^2} \times \frac{1 \cdot \text{lbf} \cdot \text{s}^2}{1 \cdot \text{slug} \cdot \text{ft}} - 3.5 \text{ lbf} \quad W_w = 77.0 \text{ lbf}$$

The temperature is $90^\circ\text{F} = 32.2^\circ\text{C}$ and from Table A.7 $\rho = 1.93 \frac{\text{slug}}{\text{ft}^3}$

Hence $V_w = \frac{M_w}{\rho}$ or $V_w = \frac{W_w}{g \cdot \rho}$

$$V_w = 77.0 \text{ lbf} \times \frac{1}{32.2} \frac{\text{s}^2}{\text{ft}} \times \frac{1}{1.93} \frac{\text{ft}^3}{\text{slug}} \times \frac{1 \cdot \text{slug} \cdot \text{ft}}{1 \cdot \text{lbf} \cdot \text{s}^2} \quad V_w = 1.24 \text{ ft}^3$$