Problem 9

Antarctica is roughly semicircular, with a radius of 2000 km (Fig. 1-5). The average thickness of its ice cover is 3000 m. How many cubic centimeters of ice does Antarctica contain? (Ignore the curvature of Earth.)
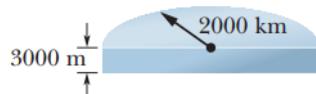

Figure 1-5 Problem 9.

Solution

Volume is area times thickness. The area of a semicircle is $\pi r^2/2$, and the thickness is 3000 m. Write the given numbers in terms of centimeters so that the volume ends up as cm^3.

$$V = \frac{\pi(2000 \text{ km})^2}{2} \times 3000 \text{ m}$$

$$= \frac{\pi}{2} \left(2000 \text{ km} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{100 \text{ cm}}{1 \text{ m}} \right)^2 \times \left(3000 \text{ m} \times \frac{100 \text{ cm}}{1 \text{ m}} \right)$$

$$\approx 1.9 \times 10^{23} \text{ cm}^3$$