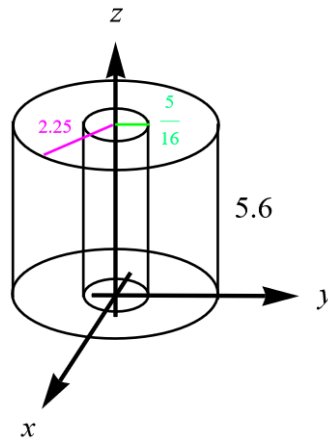


Exercise 20

An oil filter cartridge is a porous right-circular cylinder inside which oil diffuses from the axis to the outer curved surface. Describe the cartridge in cylindrical coordinates, if the diameter of the filter is 4.5 inches, the height is 5.6 inches, and the center of the cartridge is drilled (all the way through) from the top to admit a $\frac{5}{8}$ -inch-diameter bolt.

Solution

Below is an illustration of the oil filter cartridge.



The description in cylindrical coordinates (r, θ, z) is

$$\frac{5}{16} \text{ in} \leq r \leq 2.25 \text{ in}$$

$$0 \leq \theta \leq 2\pi$$

$$0 \leq z \leq 5.6 \text{ in.}$$