

50. (a) We calculate the charged surface area of the cylindrical volume as follows:

$$A = 2\pi rh + \pi r^2 = 2\pi(0.20\text{ m})(0.10\text{ m}) + \pi(0.20\text{ m})^2 = 0.25\text{ m}^2$$

where we note from the figure that although the bottom is charged, the top is not. Therefore, the charge is  $q = \sigma A = -0.50\text{ }\mu\text{C}$  on the exterior surface, and consequently (according to the assumptions in the problem) that same charge  $q$  is induced in the interior of the fluid.

- (b) By Eq. 26-21, the energy stored is

$$U = \frac{q^2}{2C} = \frac{(5.0 \times 10^{-7}\text{ C})^2}{2(35 \times 10^{-12}\text{ F})} = 3.6 \times 10^{-3}\text{ J} .$$

- (c) Our result is within a factor of three of that needed to cause a spark. Our conclusion is that it will probably not cause a spark; however, there is not enough of a safety factor to be sure.