

16. (a) The side surface area A for the drum of diameter D and length h is given by $A = \pi Dh$. Thus

$$\begin{aligned} q &= \sigma A = \sigma \pi Dh = \pi \varepsilon_0 E D h \\ &= \pi \left(8.85 \times 10^{-12} \frac{\text{C}^2}{\text{N} \cdot \text{m}^2} \right) (2.3 \times 10^5 \text{ N/C}) (0.12 \text{ m})(0.42 \text{ m}) \\ &= 3.2 \times 10^{-7} \text{ C} . \end{aligned}$$

- (b) The new charge is

$$\begin{aligned} q' &= q \left(\frac{A'}{A} \right) = q \left(\frac{\pi D' h'}{\pi D h} \right) \\ &= (3.2 \times 10^{-7} \text{ C}) \left[\frac{(8.0 \text{ cm})(28 \text{ cm})}{(12 \text{ cm})(42 \text{ cm})} \right] = 1.4 \times 10^{-7} \text{ C} . \end{aligned}$$