18.3 This problem asks that we compute, for a plain carbon steel wire 3 mm in diameter, the maximum length such that the resistance will not exceed 20  $\Omega$ . From Table 18.1 for a plain carbon steel  $\sigma = 0.6 \times 10^7 (\Omega-m)^{-1}$ . If *d* is the diameter then, combining Equations 18.2 and 18.4 leads to

$$l = R\sigma A = R\sigma \pi \left(\frac{d}{2}\right)^2$$

= 
$$(20 \ \Omega) \left[ 0.6 \ x \ 10^7 \ (\Omega - m)^{-1} \right] (\pi) \left( \frac{3 \ x \ 10^{-3} \ m}{2} \right)^2 = 848 \ m$$

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