1. (20 pts.) A 12V car battery (assumed to be ideal, with no internal resistance) is to be used to operate the engine's starter. The starter motor acts as a resistor with resistance 0.0500Ω. The resistance in the wires and connections totals 0.0100Ω.

   a. (10 pts.) What is the power available to the starter?

   b. (10 pts.) Now suppose that the connections between the battery and the cables become corroded and that this corrosion increases the total resistance in the wires and connections by 0.0900Ω. What is the power available to the starter now?

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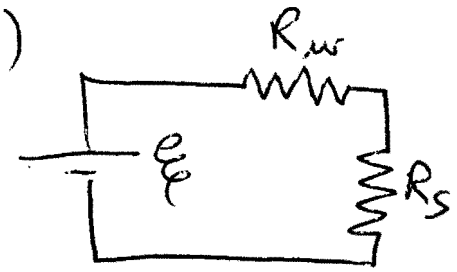
(a)



$\mathcal{E} = 12\,V$

$R_w = 0.01\,\Omega$

$R_s = 0.05\,\Omega$

$$I = \frac{12\,V}{0.01 + 0.05} = \frac{12\,V}{0.06\,\Omega} = 200\,A$$

$$P_s = I^2 R_s = (200)^2 (0.05) = \boxed{2{,}000\,W}$$

(b) $R_w = 0.1\,\Omega$ Now

$$I = \frac{12\,V}{0.1 + 0.05} = \frac{12}{0.15} = 80\,A$$

$$P_s = I^2 R_s = (80\,A)^2 (0.05) = \boxed{320\,W}$$