Worksheet 8 Solutions

(1) Power is $\left[\frac{J}{s}\right]$

$$IV = \frac{C}{s}\cdot\frac{J}{C} = \left[\frac{J}{s}\right]$$

$$I^2R = \frac{C^2}{s^2}\cdot\frac{Js}{C^2} = \left[\frac{J}{s}\right]$$

$$\frac{V^2}{R} = \frac{J^2}{C^2}\cdot\frac{1}{\frac{Js}{C^2}} = \left[\frac{J}{s}\right]$$

(2) $P = IV \Rightarrow 60 = I\cdot 120 \Rightarrow I = 0.5\ [A]$

(3) $R = \frac{\rho l}{A} = \frac{30\cdot 0.15}{2\times10^{-4}} = 22500\ [\Omega]$

(4) $R = \int dR = \int \frac{\rho dx}{A} = \int_0^{0.15} \frac{30x\,dx}{2\times10^{-4}} = 1688\ [\Omega]$

(5) current is $\frac{C}{s} \Rightarrow s = \frac{C}{A} \Rightarrow$ time $= \frac{15}{30000} = 0.0005\ [s]$

(6) $P = IV = 30000\cdot 10\,000\,000 = 300\,000\,000\,000\ [W]$ this is big

(7) $P\cdot t = U = qV$

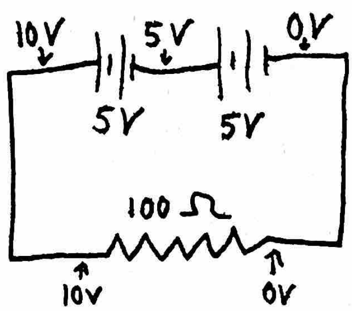
$P\cdot t = 3\times10^{11}\cdot 5\times10^{-4} = 1.5\times10^{8}\ [J]$

$q\cdot V = 15\cdot 10^{7} = 1.5\times10^{8}\ [J]$

(8) least resistance, also combining electricity (charge) from multiple regions

(9) False. Only the magnitude, but not the direction of ΔV matters. If interested, look up "positive lightning"

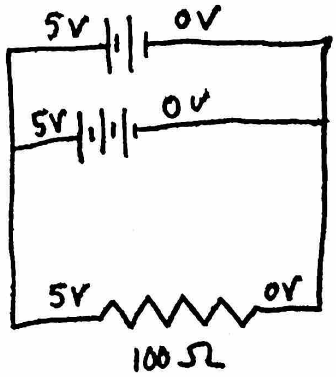
(10)



$\mathcal{E} = IR \Rightarrow I = \mathcal{E}/R = \frac{10}{100} = 0.1A$

everywhere in the circuit

(11)



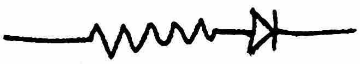
$\mathcal{E} = IR \Rightarrow I = \mathcal{E}/R = 5/100 = 0.05\ A$

However, if these are the same batteries from (10), they will last longer

(12) $R = 30 + 50 = 80\,\Omega$

(13) $\frac{1}{R} = \frac{1}{50} + \frac{1}{30} \Rightarrow R = \frac{1}{\frac{1}{50}+\frac{1}{30}} = 10 \cdot \frac{1}{\frac{3+5}{15}} = \frac{150}{8}$

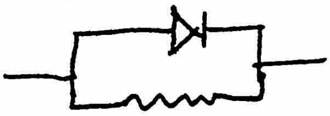
(14)



$35\,\Omega \rightarrow$

$\infty\,\Omega \leftarrow$

(15)



$\frac{1}{R} = \frac{1}{30} + \frac{1}{5} \Rightarrow \frac{30}{7}\,\Omega \rightarrow$

$30\,\Omega \leftarrow$