Name: Key Period: Date:

Electric Circuits: Current, Resistance and Power Problems 2

$$I = \frac{\Delta Q}{\Delta t} \qquad V = IR \qquad R = \rho\frac{l}{A} \qquad P = IV \qquad E = Pt$$

I. Answer the following problems. Show your work to get full credit. Show final answer in scientific notation format.

1) A current of 4.50 A flows for 11.3 s through a wire (conductor). Calculate the number of electrons that pass through a point in the conductor in this time.

$I = 4.5A$, $t = 11.3s$

$\Delta Q = I \cdot \Delta t = (4.5A)(11.3) = 50.85C$

$\frac{50.85C}{1.6\times10^{-19}} = 3.18\times10^{20}$ electrons

2) How long would it take 2.3×10^{20} electrons to pass through a point in a conductor if the current was 13.0 A?

$e = 2.3\times10^{20}$ electrons, $I = 13A$, $\Delta t = ?$

$\Delta Q = 2.3\times10^{20}\,\text{elec} \cdot \left(\frac{1.6\times10^{-19}C}{1e}\right) = 36.8C$

$\Delta t = \frac{\Delta Q}{I} = \frac{36.8C}{13}$

$\Delta t = 2.83s$

3) Calculate the current if a charge of 5.20 C passes through a point in a conductor in 12.4 s.

$\Delta Q = 5.2C$, $t = 12.4s$

$I = \frac{\Delta Q}{\Delta t} = \frac{5.2C}{12.4s} = 0.42 = 4.2\times10^{-1}A$

4) What is the potential difference across a conductor to produce a current of 6.00 A if there is a resistance in the conductor of 11.0 Ω?

$I = 6A$, $R = 11\Omega$

$V = IR = (6A)(11) = 6.6\times10^{+1}V$

5) What is the heat produced in a conductor in 35.0 s if there is a current of 14.0 A and a resistance of 9.20 Ω?

$t = 35s$, $I = 14A$, $R = 9.2\Omega$

$P = I^2R$

$P = (14)^2(9.2)$

$P = 1803.2W$

$E = Pt$

$E = (1803.2W)(35s)$

$E = 6.3\times10^{4}J$

6) 180 J of heat are produced in a conductor in 6.50 s. If the current through the conductor is 12.0 A, what is the resistance of the conductor?

$E = 180J$, $t = 6.5s$, $I = 12A$

$E = Pt$

$P = \frac{E}{t} = \frac{180J}{6.5s} = 27.69W$

$P = IV$

$V = \frac{P}{I} = \frac{27.69W}{12}$

$V = 2.31V$

$V = IR$

$R = \frac{V}{I} = \frac{2.31}{12} = 1.93\times10^{-1}\Omega$

7) What is the current through a 400 W electric appliance when it is connected to a 120 V power line?

$P = 400W$, $V = 120V$

$P = IV$

$I = \frac{P}{V} = \frac{400W}{120V} = 3.33\times10^{0}A$

8)

a. When an electric appliance is connected to a 130 V power line, there is a current through the appliance of 16.3 A. What is its resistance? _____

$V = 130V$, $I = 16.3A$ $R = \frac{V}{I} = \frac{130V}{16.3A} = 7.98 \times 10^{0}\,\Omega$

b. What is the average amount of energy given to each electron by the power line for 8 seconds? _____

Find No of electrons

$\Delta Q = I \cdot t = (16.3)(8) = 130.4C$

$130.4C \cdot \frac{1e}{1.6\times10^{-19}C} = 8.15 \times 10^{20}$ electrons

Find overall energy

$P = IV = (130V)(16.3A)$

$P = 2119W$

$E = Pt = (2119W)(8)$

$E = 16,952J$

Find Energy per electron

$\frac{16,952J}{8.15\times10^{20}} = 2.08 \times 10^{-17}\,J$

9)

a. What potential difference is required across an electrical appliance to produce a current of 15.0 A when there is a resistance of 5.30 Ω? _____

$I = 15A$, $R = 5.3\Omega$ $V = IR = (15)(5.3) = 7.95 \times 10^{1}\,V$

b. How many electrons pass through the appliance every minute? _____

$\Delta Q = I \cdot \Delta t = (15A)(60S)$

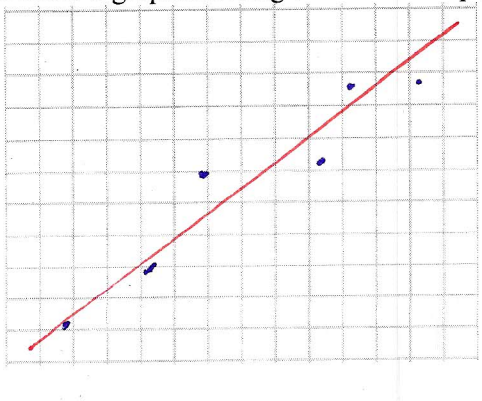
$\Delta Q = \frac{900C}{1.6\times10^{-19}} = 5.63 \times 10^{21}$ electrons

10) A student designed an experiment in order to measure the current through a resistor at different voltages.

Given the following data:

Voltage (V)	Current (I)
3.0	0.151
6.0	0.310
9.0	0.448
12.0	0.511
15.0	0.750

a. Draw a graph showing the relationship between current and voltage (V vs. I)



← Curve Fit

b) Using the graph, what is the resistance of the resistor?

To find resistance, get the slope of a curve fit

$R = \frac{V}{I} \approx 20\,\Omega$