Name: Ivy Period: Date:

**Electric Circuits: Ohms Law- Current, Resistance and Power Problems 1**

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

$1e = 1.60 \times 10^{-19} C$

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

1. A wire of radius 1mm and length 2m is made of platinum (resistivity=$1 \times 10^{-7} \Omega m$). If a voltage of 9V is applied between the ends of the wire, what will be the resulting current? $1.4 \times 10^{2} A$

$r = 0.001m$ $A = \pi r^2 = \pi(.001)^2 = 3.14 \times 10^{-6} m^2$

$l = 2m$

$\rho = 1 \times 10^{-7} \Omega m$

$V = 9V$

$R = \rho\frac{l}{A} = 1 \times 10^{-7} \cdot \frac{2}{3.14 \times 10^{-6}}$

$R = 0.064 = 6.4 \times 10^{-2}$

$I = \frac{V}{R} = \frac{9V}{6.4 \times 10^{-2}}$

$I = 1.4 \times 10^{2} A$

2. A wire made of a new material is 4.00 m long and 6.00 mm in diameter. It has a resistance of 15.0Ω. A potential difference of 23.0 V is applied to the wire. Find:
   a. the current through the wire
   b. the resistivity of the material
   c. Power dissipated

$1.53 \times 10^{0} A$

$1.06 \times 10^{-4} \Omega m$

$3.52 \times 10^{1} W$

$l = 4m$

$r = 0.003m$

$R = 15\Omega$

$V = 23V$

a) $I = \frac{V}{R} = \frac{23V}{15\Omega} = 1.53A$

b) $R = \rho\frac{l}{A} \Rightarrow \rho = \frac{RA}{l} = \frac{15[\pi(.003)^2]}{4} = 1.06 \times 10^{-4} \Omega m$

c) $P = IV = (1.53A)(23V) = 35.19W$

3. A 12Ω resistor has a current equal to 3A. Find the power delivered to this resistor. $1.08 \times 10^{2} W$

$R = 12\Omega$

$I = 3A$

$P = ?$

$V = IR$

$V = 3A(12\Omega)$

$V = 36V$

$P = IV$

$P = (3A)(36V)$

$P = 108W = 1.08 \times 10^{2} W$

4. A wire has a resistance equal to 5 Ω and a current equal to 3A for 6s.
   a. Find the Voltage provided by the battery
   a. What is the power being delivered to the wire during the 6s?

$1.5 \times 10^{1} V$

$4.5 \times 10^{1} W$

$R = 5\Omega$

$I = 3A$

$t = 6S$

$V = IR = (3A)(5) = 15V = 1.5 \times 10^{1} V$

$P = IV = (3A)(15) = 45W = 4.5 \times 10^{1} W$

5. A blender draws 0.25 A when connected to a 120 V outlet.

a) What is the resistance of the blender? $4.8\times10^{2}\ \Omega$

b) How much power does it use? $3\times10^{1}\ W$

c) How many electrons pass through the blender in 15s? ($1e=1.6\times10^{-19}C$) $2.34\times10^{19}$ electrons

$I=0.25A$
$V=120V$

a) $R=\frac{V}{I}=\frac{120V}{.25}=480\Omega=4.8\times10^{2}\Omega$

b) $P=I^{2}R=(.25)^{2}(4.8\times10^{2}\Omega)$
$P=30W=3\times10^{1}W$

c) $\Delta Q=I\cdot\Delta t=(.25A)(15s)$
$\Delta Q=3.75C$

$3.75C\cdot\frac{1e}{1.6\times10^{-19}C}=2.34\times10^{19}e$

6. The filaments in a toaster have a resistance of 270 Ω. If the toaster is plugged into a 120 V outlet,

a) How much current will flow through the circuit? $4.4\times10^{-1}A$

b) How much power will the toaster use? $5.3\times10^{1}W$

c) How many electrons flow through the toaster in one minute? $1.65\times10^{20}$ electrons

$R=270\Omega$
$V=120V$

a) $I=\frac{V}{R}=\frac{120V}{270\Omega}=0.44$
$I=4.4\times10^{-1}A$

b) $P=IV=(.44A)(120V)$
$P=53W=5.3\times10^{1}W$

c) $\Delta Q=I\cdot\Delta t=(.44)(60)=26.4C$

$26.4C\cdot\frac{1e}{1.6\times10^{-19}}=1.65\times10^{20}$ electrons

7. A 60W light bulb is connected to a 120V power supply.

a. How much current flows through it? $5\times10^{-1}A$

b. What is the resistance of the bulb? $2.4\times10^{2}\Omega$

c. How many electrons flow through it in 1 hour? $1.1\times10^{22}$ electrons

$P=60W$
$V=120V$

a) $I=\frac{P}{V}=\frac{60}{120}=0.5A=5\times10^{-1}A$

b) $R=\frac{V}{I}=\frac{120}{.5}=240\Omega=2.4\times10^{2}\Omega$

c) $\Delta Q=I\cdot\Delta t=(0.5)(3600s)=1800C$

$1800C\cdot\frac{1e}{1.6\times10^{-19}C}=1.1\times10^{22}$ electrons