Electric Circuits Name _____

Physics First Honors 2012/13

Ohm's Law - Problem set 2

1. A 600 W toaster is connected to a 120 V voltage source.
   a) How much current will the toaster draw? *(5 A)*

$P = IV \quad 600 = I \cdot 120 \Rightarrow I = \frac{600}{120} = 5 \text{ Amps}$

   b) What is the resistance of the toaster?*(24. Ω)*

$V = IR \quad 120 = 5R \Rightarrow R = \frac{120}{5} = 24\ \Omega$

2. Two light bulbs, A and B are connected in circuits across a 120 V power supply. Light bulb A has a power rating of 25 W and light bulb B has a power rating of 100 W.
   a) Which bulb draws more current?

$P = IV \quad I = \frac{P}{V}$

Bulb A $I = \frac{P}{V} = \frac{25}{120} = 0.208$

Bulb B $I = \frac{P}{V} = \frac{100}{120} = 0.833 \leftarrow B$

   b) Which bulb has a greater resistance?

$V = IR \quad R = \frac{V}{I}$

Bulb A $R = \frac{120}{.208} = 577\ \Omega \leftarrow A$

Bulb B $R = \frac{120}{.833} = 144\ \Omega$

3. A 240 V clothes drier draws 16 A of current for 45 minutes.
   a) How much energy, in joules, does the drier consume? (Hint determine the power rating of the drier first - USE THE FACTOR LABEL METHOD, KEEP TRACK OF UNITS)
   (1.04 X 10^7 J)

$P = IV = 240 \cdot 16 = 3840\ W = 3840 \frac{J}{s}$

$3840 \frac{J}{s} \left(\frac{45\ min}{} \middle| \frac{60\ sec}{min} \right) = 1.04 \times 10^7 J$

   b) How much energy, in kilowatt-hours, does the drier consume? (2.88 kW-hr)

$E = P \cdot t = 3840W \cdot 45min \left| \frac{1\ kW}{1000W} \middle| \frac{1\ hr}{60min} \right| = 2.88$

4. An electric alarm clock uses a 5.0 W and runs all day, every day.
   a) How much energy, in kilowatt-hours, does the alarm clock use in one year *(43.8 kW-hr)*

$E = P \cdot t = 5W \cdot 1year \left| \frac{1kW}{1000W} \middle| \frac{365\ days}{year} \middle| \frac{24\ hrs}{day} \right| = 43.8\ kW \cdot hrs$

   b) If electricity costs $ 0.12 per kilowatt-hour, determine the yearly cost of running the clock.

$Cost = Rate \cdot Power$

$0.12(43.8) = 5.26$