Due Mon., Jan 23

2011-12 PreAP Circuits 11

1. Wire 1 has a cross-sectional area of 2.5 cm^2. Wire 2 has a cross-sectional area of 3.0 cm^2. If they are comprised of the same materials, which has the greatest resistance?

   Let me help you understand how to use units to solve questions. We already know that W = J/s, A = C/s, and V = J/C.

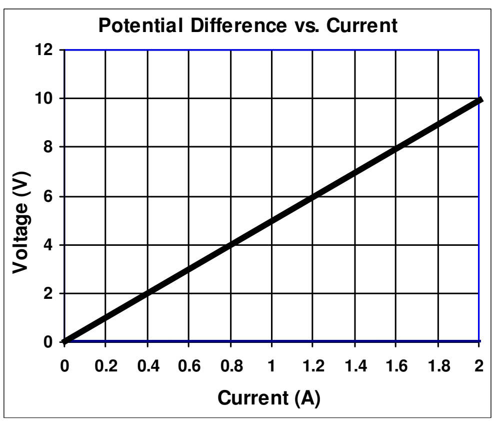
   $$15W = \frac{15J}{1\sec} \quad \textit{then} \quad \frac{15J}{1\sec}\left(\frac{4\sec}{1}\right) = 60J \qquad \textit{but} \quad \frac{15J}{1\sec} \quad \textit{can become} \quad \frac{1\sec}{15J} \quad \textit{so} \quad \frac{1\sec}{15J}\left(\frac{60J}{1}\right) = 4\sec$$

   Always put what you want to calculate on top of the fraction. If you are looking for coulombs, put coulombs on top, etc. 12 V = 12 J/C which can become 1C/12J and calculating coulombs becomes easy. Let's try this.

2. * A battery does 8 J of work to push 12mA thru a 6kΩ resistor. How many coulombs of charge flowed thru the resistor?

3. * A 660 Ω resistor has 12V of potential difference (voltage) across it. How long does it take for 5.5 C of charge to flow thru the resistor?

4. * A 560Ω and a 320Ω resistor are in parallel. If the 320Ω resistor uses 12W of power, what is the potential difference (voltage) across the 560Ω resistor?



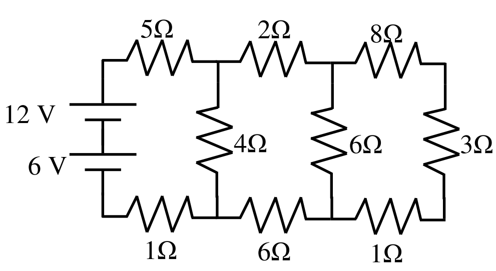
5. The potential difference across a resistor is changed. The current is recorded and graphed, as shown.
   A. Calculate the resistance of the resistor.

   B. * Calculate the power dissipated by the resistor in the first 16 seconds.

   C. Is the resistor Ohmic or Non-Ohmic?
   D. How would the graph change if the wire were made longer?

   E. Which variable did they manipulate (is independent)?
   F. Which variable is responsive (dependent)?
   G. Then why is voltage on the y-axis?

6. * Referring to the "Simplifying Complicated Circuit" notes calculate the total resistance and current of the circuit. Go step-by-step. I had to redraw it 4 times. You should, too.



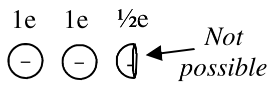
Electric Charge The unit of charge is a fundamental quantity.

Electron Charge

$1\ electron = -1.6 \times 10^{-19}\ C$

The charge of a proton is the same as an electron, only positive:
1 proton = +1.6×10^-19^C.

The smallest units of charge are the proton and the electron. You cannot have part of an electron, because it would lose its negative charge. Therefore, you cannot have less than -1.602×10^{-19}C of charge and any amount of charge must be multiples of this number. You can have 12 or 13 electrons, but not 12.2 or 12.5 electrons!



Electric charge is quantized, meaning the amount of charge must always be in multiples of e. You can never have part of an electron.

Ex: What is the charge of an object that gains 1.2 x 10^8 electrons?

Do a conversion :

$$\left(\frac{1.2\times10^{8}\cancel{e}}{1}\right)\left(\frac{-1.6\times10^{-19}\text{C}}{1\cancel{e}}\right) = -1.92\times10^{-11}\text{C}$$

Ex: How many electrons are gained or lost if an object has a charge of 4.6μC (microcoloumbs)?

$$\left(\frac{4.6\times10^{-6}\cancel{\text{C}}}{1}\right)\left(\frac{1\text{e}}{-1.6\times10^{-19}\cancel{\text{C}}}\right) = -2.875\times10^{-13}\text{e}$$

The negative means it lost e's (+ object).

And now you FINALLY know what this "coulomb" thing is.

7. * What is the charge of 15 electrons?

8. * Given the charge of 1.12×10^{-18} coulombs. How many electrons were gained or lost?

9. What is the charge of 8 protons?

10. Why can't you have the charge of 1.5 electrons?

Q2: 0.11 C (find volts first)
Q3: 305.5sec (find current first)
Q4: 62 V
Q5B: find area, since P = VI
Q6: R total = 9 ohms
Q7: −24 coulombs
Q8: 7 electrons lost