

Homework Questions: Section 6

Name _____

1. Why is it NECESSARY to connect a voltmeter in parallel with a circuit component?
2. Why is it NOT a good idea to connect an ammeter in parallel with a circuit component?
3. Using your data from Tables 6.10b and 6.10c, plot a graph of voltage versus current for R_x and R_y , on the same set of axes. Place voltage on the vertical axis and current on the horizontal axis. Label each axis, and put the correct unit in parentheses next to each label. Put numbered "tick-marks" along each axis to show the scale of the graph.
 - a. In what MAJOR way do the two lines differ?
 - b. What QUANTITY of the resistors does your answer to Q2a define?
 - c. On the graph, what would the line look like for a third type of resistor (call it R_z) that has a HIGHER resistance than either R_x or R_y ?
4. A circuit consists of a battery of three cells, along with bulbs in series. Bulb A (which is closer to the + battery terminal) is receiving energy at the rate of 15 W. Bulb B (which is closer to the - battery terminal) is receiving energy at the rate of 40 W.
 - a. To the right, draw a schematic diagram; label bulbs A and B.
 - b. For the following, decide if each statement applies to bulb A, bulb B, or neither.
 - i. _____ the light from the bulb is brighter
 - ii. _____ the current through the bulb is greater
 - iii. _____ the resistance of the bulb is larger
 - c. On your schematic, draw arrowtails and starbursts. NOTE: These should support your answers to Q4b.

Voltage v. Current for Resistors R_x and R_y



5. You have two circuits, each with two batteries. In circuit (S), a round bulb and a long bulb are in series. In circuit (P), a round bulb and a long bulb are in parallel.

a. To the right, draw schematics of both circuits.

b. For each of the following, decide if the statement applies to circuit S or circuit P.

i. ___ The round bulb is converting energy to heat and light at a greater rate than the long bulb.

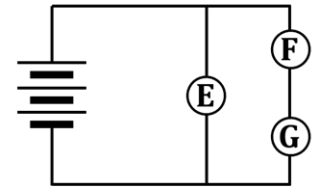
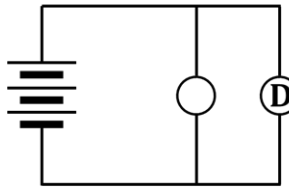
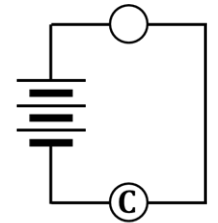
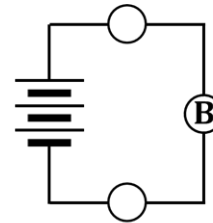
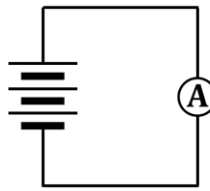
ii. ___ The long bulb is converting energy to heat and light at a greater rate than the round bulb.

iii. ___ The battery is transferring energy at a greater rate.

SCHEMATIC OF
CIRCUIT S

SCHEMATIC OF
CIRCUIT P

6. In the circuits shown, all bulbs are identical (even if they don't have a letter in them). Circle the correct answers below.



- | | | | |
|-----------------------|---------------|---------------|-------------------------------|
| a. Between A and D... | A is brighter | D is brighter | they have the same brightness |
| b. Between C and E... | C is brighter | E is brighter | they have the same brightness |
| c. Between B and C... | B is brighter | C is brighter | they have the same brightness |
| d. Between C and F... | C is brighter | F is brighter | they have the same brightness |
| e. Between D and G... | D is brighter | G is brighter | they have the same brightness |
| f. Between B and G... | B is brighter | G is brighter | they have the same brightness |
| g. Between D and E... | D is brighter | E is brighter | they have the same brightness |

7. An old string of Christmas lights has 20 bulbs connected in series. Each bulb is labeled 1.5 W.

a. Calculate the rate at which energy is being supplied when all 20 bulbs are lit.

b. Describe the energy transformations that are occurring in the circuit when the bulbs are lit.

c. Describe what happens to the rate of energy transfer if the 15th bulb in the string burns out.

8. This question relates to how riding a bicycle is, in some ways, analogous to what occurs in an electrical circuit. To answer this question, you need to imagine two things:

- (1) YOU, riding a bike
- (2) a circuit containing batteries and light bulbs

a. What is the SOURCE of energy that makes things move in... ..riding a bike?
 ...an electrical circuit?

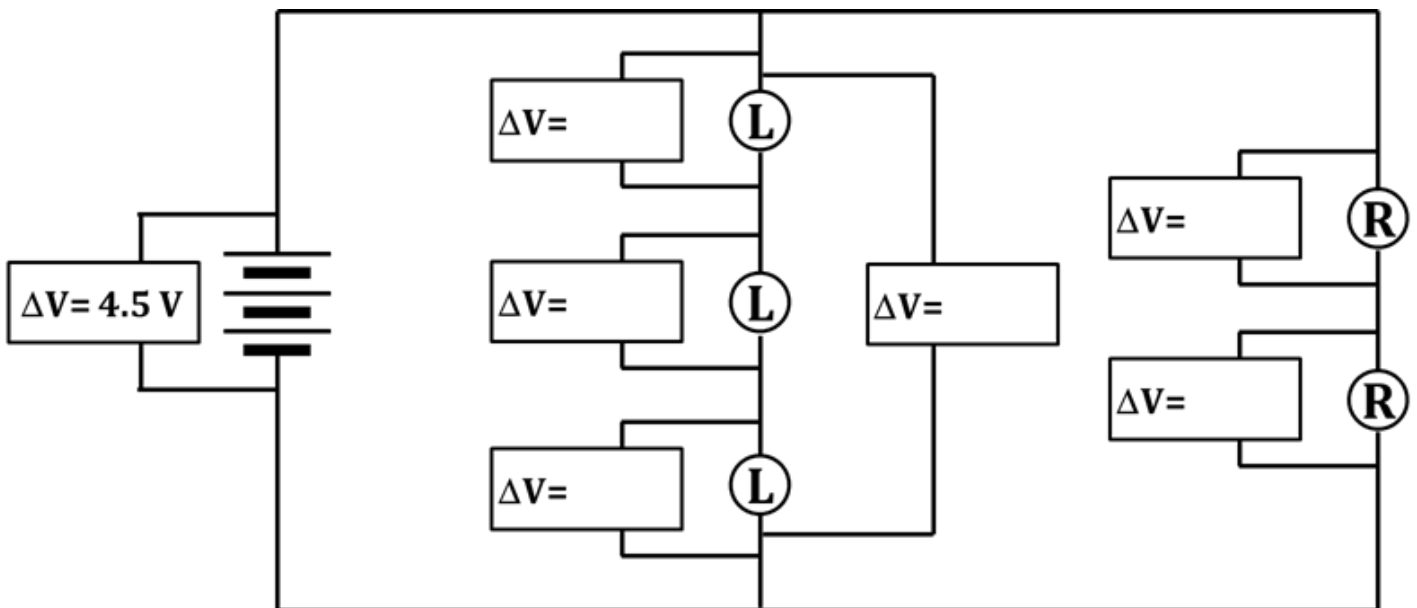
b. What is the DESTINATION of the energy from Q6a in... ..riding a bike?
 (i.e., Where do WE WANT it to go?)
 ...an electrical circuit?

c. What is the THING (or THINGS) that enable(s) the energy transfer to occur in... ..riding a bike?
 (i.e., this helps the energy get from one place to another)
 ...an electrical circuit?

d. Circle the correct choice here, which relates to your answer from Q6c:

During the energy transfer process, the thing (or things) is/are... USED UP RECYCLED/REUSED

9. Complete the diagram below by putting the correct pressure-difference values into each voltmeter.
 Note that the voltmeter placed across the battery has the correct readout of 4.5 V.



10. You need to design a 1200-watt hair dryer for use in American homes. For any question below that asks WHICH VARIABLE?, include the VARIABLE SYMBOL, the NAME of the quantity, and the UNIT.

a. Use the electrical power equation $P = I \Delta V$ to help you answer the following few questions.

- i. The value for WHICH VARIABLE is given in the problem statement?
- ii. WHICH VARIABLE will the homes' electrical systems provide?
- iii. You were told the numerical value for your answer to Q10aii way back in your Section 5 HW, Q3. Report that numerical value – and unit – here.
- iv. Based on your answers to Q10ai and Q10aii, you should now be able to calculate WHICH VARIABLE for the hair dryer?
- v. Now, calculate the value, with unit, for the quantity you mentioned in Q10aiv.

b. i. Recall that Ohm's law is the equation $\Delta V = I R$. At this point in the process – and with the help of Ohm's law – you can calculate WHICH VARIABLE for the hair dryer?

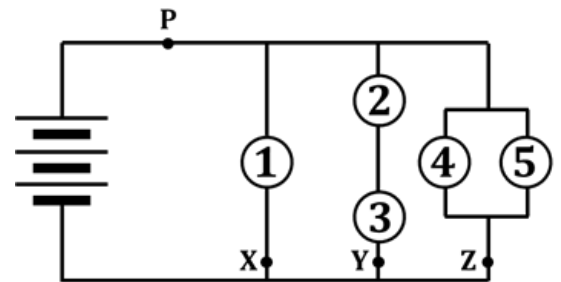
ii. Now, calculate the value, with unit, for the quantity you mentioned in Q10bi.

c. Summarize your answers to the various parts of Q10 by filling in the blanks:

“To design the specified hair dryer, I know that the _____ consumed will be 1200 watts. Since the _____ in the electrical outlets of American homes is always _____, I can use those two numbers to calculate the _____ in the hair dryer to be exactly _____. Then, from Ohm's law, I am further able to calculate that the _____ of the hair dryer should be exactly _____. So all I need to do is find a material or a device with that amount of _____ and put that into the hair dryer's circuit.”

11. Answer the questions below, based on the circuit shown.

- a. Where is the current the greatest: through point X, Y, or Z?
- b. Where is the current the least: through point X, Y, or Z?
- c. If a shorting wire is placed around bulb 5, what will be the effect on the circuit?



d. Besides bulb 5, placing a shorting wire around which other bulb(s) will have the same effect as your answer to Q11c?

e. If another bulb is inserted at point P, what will be the effect on the circuit?

f. Explain your answer to Q11e; WHY IS IT that that's what happens?