Name _____
Recitation 8:30 11:00 12:30

You can earn up to 20 points based on your participation and written work.

The (thought balloon) symbol is used to denote a ponder, or prediction, question. This question must be answered before you try a particular experiment. These questions will be graded for completeness, but they will not be graded as "right" or "wrong." As with last week's activity, keep your written descriptions and explanations brief, so you can spend most of your time thinking, experimenting, and discussing ideas.

Activity #1 may be trickier than it appears. It is to be completed individually. Resist the urge to help those around you! After this activity, you will work in small groups.

Activity #1


Battery


#13 Light Bulb


Wire

1. Suppose you were given a single battery, a single light bulb, and a single wire. Could you make the bulb light? If you predict that you can't light the bulb, explain why not. If you predict that you can, draw a picture clearly showing how you would make the bulb light, and briefly explain why you think it would work.

After completing your explanation, try several different arrangements with the single wire, battery, and bulb.

2. Was your prediction correct? Draw diagrams showing at least two arrangements that DO make the light bulb light, and two arrangements that DO NOT make the light bulb light.

3. Based just on this activity, what conditions seem necessary for the bulb to light?

At this point, you may discuss your results with the rest of your group. The instructor will interrupt your discussion for a whole-class discussion, and to develop techniques for drawing circuit diagrams.

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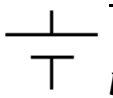
Activity #2

Equipment: 4 batteries in a holder -- *2* (#40) identical light bulbs in sockets -- *5 or 6* wire connectors -- key switch

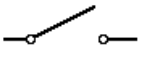
Make one of the bulbs light with your new equipment.

This arrangement is called a **circuit.** If the circuit is left connected for too long, the battery will weaken and it will have to be replaced. To avoid this, ***place a key switch in the circuit*** such that the bulb only lights when the switch is closed. Standard symbols are used to represent the various elements of the circuit. These symbols are identified below.



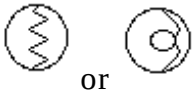
battery
(Note: longer line is battery's positive terminal.)

wire (or any connection)



switch

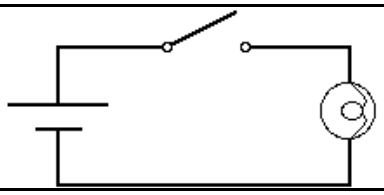
light bulbs (not standard, but typical symbols are)



or

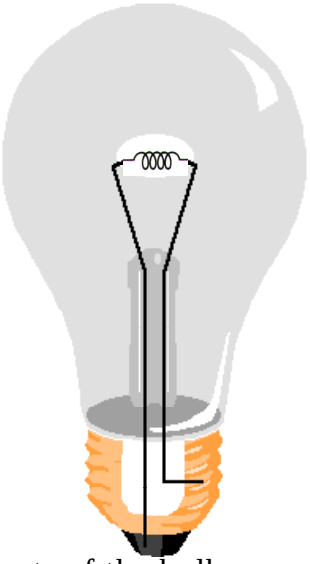
When a picture of a circuit is drawn with these symbols, it is called a circuit diagram.

Here is a diagram for the circuit you constructed at the beginning of Activity #2, with the switch open:



4. Draw 2 circuit diagrams: one for a **bulb-lighting** arrangement and another for a **non bulb-lighting** arrangement from Activity #1.

5. Compare this picture of an incandescent light bulb to the circuit drawing of the light bulb. Based on your answer to question #3, explain how you think a light bulb works. Why did you have to make the connections the way you did to get it to light, in Activity #1?



6. What parts of the bulbs seem to be conducting and what parts of the bulb seem to be non-conducting (insulating)? You may wish to add labels to the picture.

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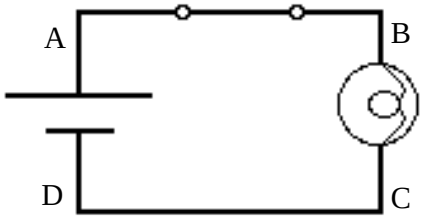
Activity #3

It will be helpful to construct a mental model of what happens in a circuit. In Activity #1, you may have decided that charge flows (through conductors) from the battery to the bulb, supplying the bulb with energy. We call this flow of charge *electrical current*.

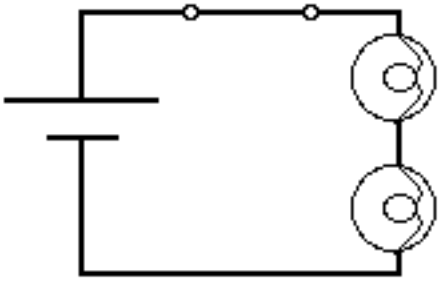
7. Which of the following do you think is true about the electrical current at various points (A, B, C, D) in the circuit drawn below? Briefly explain why you think your choice is best.



- The electrical current is largest at A.
- The electrical current is largest at B.
- The electrical current is largest at C.
- The electrical current is largest at D.
- The electrical current is the same everywhere.
- The current is the same at both A and B, where it is *smaller* than the currents at both C and D.
- The current is the same at both A and B, where it is *larger* than the currents at both C and D.

You can use this experiment to help yourself think about question #7.

Add a second bulb to your circuit as shown.
This is called ***connecting the bulbs in series.***



Two Bulbs in Series

8. When you close the switch, do both bulbs glow? How does the brightness of the two bulbs compare to each other?

9. Which answer from #7 (above) supports these observations? Why do you think so?

10. How does the brightness of each bulb compare with the brightness in the single-bulb circuit? Why do you suppose this might be the case?

(If you run out of space, continue on the back of the page.)

11. Which circuit (one or two bulbs) seems to provide a greater obstacle to the flow of electrical current? Explain.

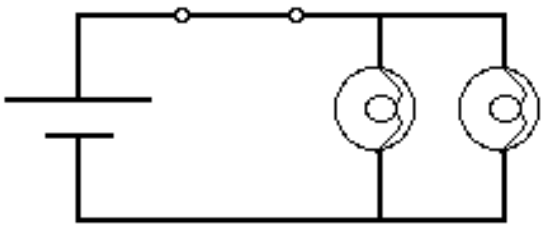
12. Predict what will happen when one bulb is unscrewed from its socket. Explain.

Conduct an experiment to test your prediction.

13. Was your prediction correct? Try to explain what you observe (a circuit diagram may help.)

Activity #4

Suppose you were to connect the two identical bulbs as shown to the right. This is called **connecting the bulbs in parallel.**



Two Bulbs in Parallel

14. Make predictions to answer the following questions:

(a) How will the brightnesses of the two bulbs compare to each other?

(b) How will the brightness of each bulb compare to the bulb in a single-bulb circuit?

(c) How will the brightnesses of these bulbs compare to the brightnesses in the series circuit?

(d) What will happen when one of the light bulbs is removed from its socket?

Conduct experiments to test your predictions.

15. Record your observations, and any conclusions you can make about bulbs in parallel -- especially in comparison with single bulb circuits and bulbs in series.

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