

Introduction to Electric Circuits

Discovering Simple, Series, and Parallel Circuits

This activity will allow you to explore circuits with a battery, wires, light bulbs, and a voltmeter. You will discuss with your lab partner ways of connecting a circuit to measure the voltage of the battery and light the light bulbs by connecting different types of circuits. This activity is designed to allow you to discover some of the types and properties of circuits without much direction from your teacher. Later you will be performing another activity where you will make more specific measurements of the quantities in an electric circuit.

PURPOSE

Given the materials listed below, connect circuits in such a way that the light bulbs light in some circumstances, but not in others.

MATERIALS

2 small light bulbs
7 alligator-clip wires

2 size “D” batteries in battery holders
voltmeter

Safety Alert

1. If a bulb appears so bright that it looks like it might burn out, disconnect the battery and ask for help from your teacher.
2. If a wire or bulb begins getting hot, especially if you smell something burning, disconnect the battery immediately.

PROCEDURE

PART I

1. Measure and record the voltage across each battery. List your values in the spaces provided on your student answer page. Be sure to write the unit of voltage for each battery.
2. On your student answer page, draw a sketch of your circuit in the box labeled **Physical Diagram** which represents the battery, wires, and voltmeter as you were measuring the voltage across a battery. You will come back and draw the **Schematic Diagram** of each of your circuits later.
3. Place the two batteries so that their ends are touching, measure the voltage across the two batteries together, and record your value for the voltage on your student answer page.

PART II

1. Using one battery, one light bulb, and some wires, connect a circuit to light the bulb.
2. Place the voltmeter across the bulb and record the voltage, and draw a *Physical Diagram* of your circuit in the box provided on your student answer page.
3. Connect the same circuit using two batteries. What happens to the brightness of the bulb when you add a battery to the circuit? Why do think this is so? Record your answers on your student answer page.

PART III

1. Using two batteries, two light bulbs, and wires, connect a circuit in such a way that both bulbs are lit but when one bulb is disconnected, the other bulb also goes out.
2. Use the voltmeter to measure the voltage across each bulb individually when both are lit, and record the voltage across each.
3. Draw a sketch of your circuit in the *Physical Diagram* box on your student answer page, making sure to include your voltmeter in the sketch.

PART IV

1. Using two batteries, two light bulbs, and wires, connect a circuit in such a way that when you disconnect one bulb, the other bulb does not go out.
2. Use the voltmeter to measure the voltage across each bulb individually when both are lit, and record the voltage across each.
3. Draw a sketch of your circuit in the *Physical Diagram* box on your student answer page, making sure to include your voltmeter in the sketch.

Name _____

Period _____

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DATA AND OBSERVATIONS

PART I

Battery 1 voltage: _____

Battery 2 voltage: _____

| Physical Diagram | Schematic Diagram |
|------------------|-------------------|
| | |

PART II

Voltage across the bulb with one battery: _____

Voltage across the bulb with two batteries: _____

| Physical Diagram | Schematic Diagram |
|------------------|-------------------|
| | |

What happens to the brightness of the bulb when you add a battery to the circuit? Why do think this is so?

PART III

Voltage across Bulb 1: _____

Voltage across Bulb 2: _____

| Physical Diagram | Schematic Diagram |
|------------------|-------------------|
| | |

PART IV

Voltage across Bulb 1: _____

Voltage across Bulb 2: _____

| Physical Diagram | Schematic Diagram |
|------------------|-------------------|
| | |

ANALYSIS

Draw the schematic diagrams that correspond to your physical diagrams in the tables for Parts I-IV above.

CONCLUSION QUESTIONS

PART I

1. Which end of your battery is positive, and which is negative? Draw a sketch of a battery and label the ends as positive or negative.

2. What is the voltage across a new size “D” battery? Does your measurement of the voltage across each of your batteries match the voltage printed on the side of a new battery? Explain your answer.

3. a) What is the difference between the voltage across a new size “AA” battery and the voltage across a new size “D” battery?

b) Why do you think some batteries are larger than others?

PART II

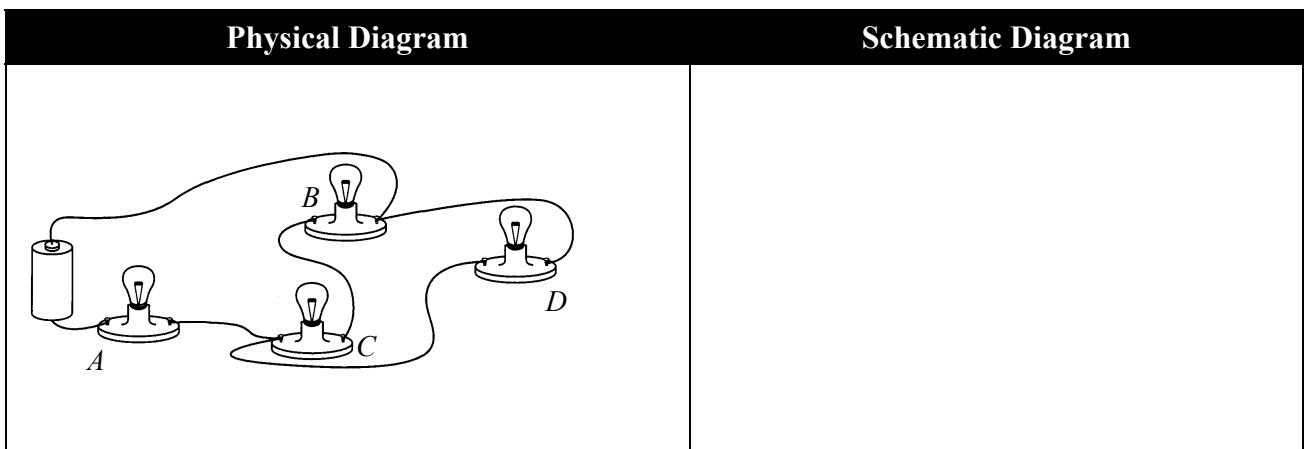
1. Explain why you connected the voltmeter to the bulb the way you did.
2. Is the voltage across the bulb always the same as the voltage across one of the batteries? Explain.

PART III

1. How many circuit loops did you create in connecting this circuit?
2. Explain the reason why both bulbs go out when you disconnect one bulb.
3. Is the voltage across each bulb always equal to the total voltage across the batteries? Explain your answer. Write a general statement comparing the voltages across each bulb.
4. If this circuit only had one bulb, would its brightness be brighter or dimmer than the brightness of either of the two bulbs connected in this circuit? Why?

PART IV

1. How many circuit loops did you create in connecting this circuit?
2. Explain the reason why one bulb stays lit when you disconnect the other bulb.
3. Write a general statement comparing the voltages across each bulb. Is the voltage across each bulb always equal to the total voltage across the batteries? Explain.
4. If this circuit only had one bulb, would its brightness be brighter or dimmer than the brightness of either of the two bulbs connected in this circuit? Why?
5. Draw the schematic diagram for the circuit pictured below.



List the bulbs in order of their brightnesses, from brightest (1) to least bright (4). If any two or more bulbs have the same brightness, state which ones. Explain how you arrived at your answer.

1. _____ 2. _____ 3. _____ 4. _____

6. Complete the table below.

| Circuit Element | Schematic Symbol |
|--------------------------------|------------------|
| wire | |
| current flowing through a wire | |
| one battery | |
| two batteries | |
| light bulb | |
| resistor | |
| voltmeter | |