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LAB: KIRCHHOFF'S LAWS

AP PHYSICS II

Driving Question | Objective

In this lab, you will be learning about Kirchoff's Laws. This lab will help you understand the distribution of current and voltage across a circuit.

Materials and Equipment

- Modular Circuit Kit
  - Ammeter
  - Conductive Path Blocks
  - Long Bulb
  - Metal Conductive Clips
- Batteries
- Wireless Voltmeter
- Alligator Clamps in Black and Red
  - Black is Negative
  - Red is Positive
- PASCO Capstone (Current and Voltage Sensors)

Background

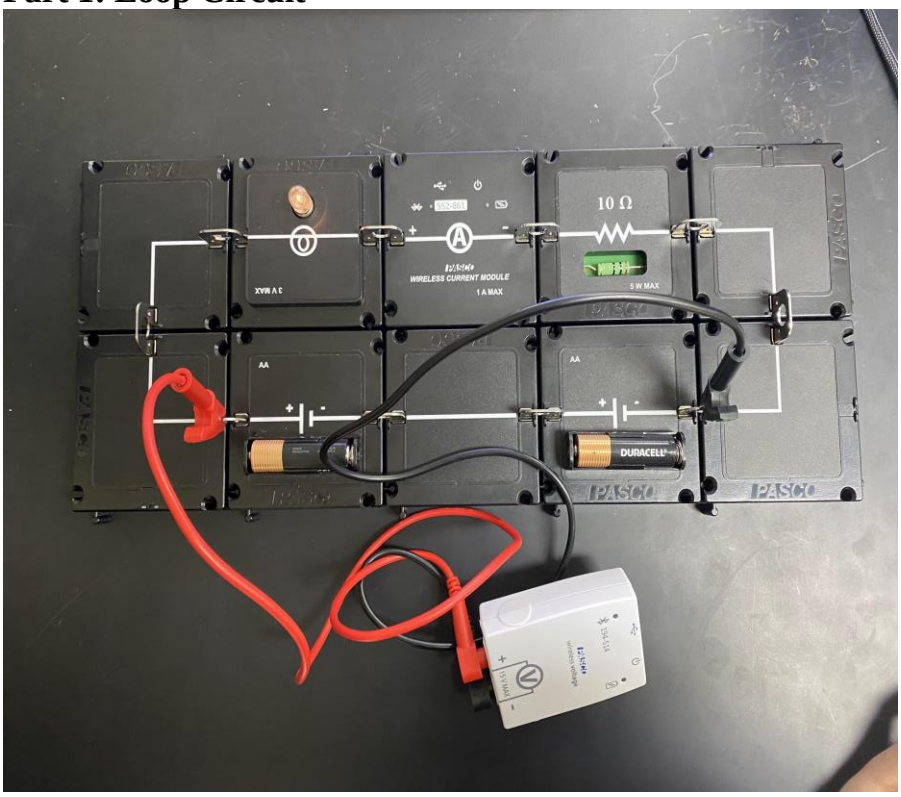
In this lab, we will discover Kirchhoff's Laws which express the relationships between current and voltage in the different parts of the circuits. These laws are used to create and analyze circuits. Within the lab, we will utilize series circuits and parallel circuits as well as resistors to understand how the paths of current and voltage are affected by these elements.

Safety

- Do not hook the alligator clips to anything other than the metal clips.
- Do not expose any materials to water.
- Do not touch the wires of the circuit while running the circuit.

Procedure

Part 1: Loop Circuit



Set Up

1. Connect the voltmeter to the PASCO file provided
2. Create a circuit similar to the picture provided.

Collect Data :

3. Use the voltmeter to measure the voltage across both batteries. Make sure the red alligator clip is attached to the positive side of the battery and the black alligator clip is attached on the negative side of the battery. When measuring battery voltage, make sure you are measuring voltage across **both** batteries. Record data.
4. Measure voltage across the 10 Ohm resistor, the ammeter, and the blub. Record data.
5. Create two new loop circuits with the order of the components different and repeat steps 3 and 4 for each circuit. **Do not create a junction circuit**.

Voltage of both batteries	Voltage of 10 Ohm resistor	Voltage of Ammeter	Voltage of Bulb
3.054	0.612	0.013	2.428
1.921	0.493	0.011	1.408
2.012	0.469	0.011	1.043

Set Up

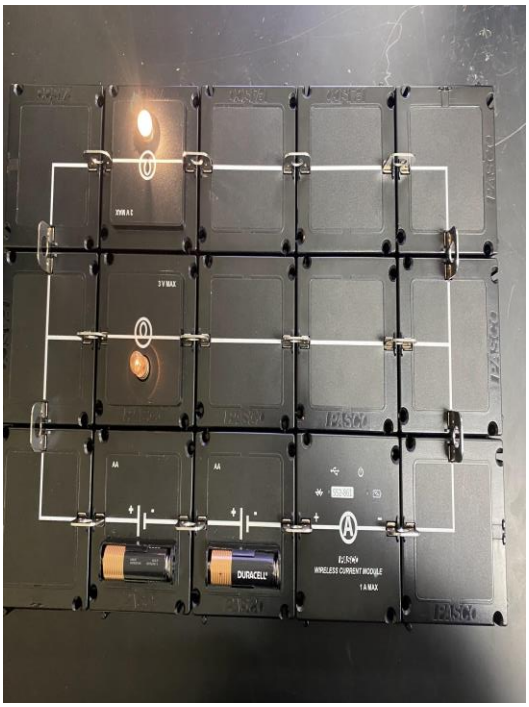
6. Connect the ammeter to the PASCO file provided
7. Create a circuit similar to the picture provided earlier.

Collect Data :

8. Choose four different locations on your circuit to place the ammeter. Then record the current measured by the ammeter.
9. Create two new loop circuits with the order of the components different and repeat steps 8 for each circuit. **Do not create a junction circuit.**

Location 1:	Location 2:	Location 3:	Location 4:
0.046 A	0.046 A	0.046 A	0.046 A
0.039 A	0.039 A	0.039 A	0.039 A
0.022 A	0.022 A	0.022 A	0.022 A

Part 2: Junction Circuit



Set Up

1. Connect the voltmeter to the PASCO file provided
2. Create a circuit similar to the picture provided.

Collect Data :

3. Use the voltmeter to measure the voltage across both batteries. Make sure the red alligator clip is attached to the positive side of the battery and the black alligator clip is attached on the negative side of the battery. When measuring battery voltage, make sure you are measuring voltage across **both** batteries. Record data.
4. Measure voltage across the next two branches using the voltmeter. Make sure you are attaching the alligator clips to each end of the branch as shown in the picture.
5. Create two new junction circuits with the order of the components different and repeat steps 3 and 4 for each circuit. **Do not create a loop circuit**.

Voltage across the batteries branch	Voltage across second branch	Voltage across third branch

2.945 V	2.932 V	2.927 V
2.944 V	2.931 V	2.926 V
2.945 V	2.932 V	2.926 V

Set Up

6. Connect the ammeter to the PASCO file provided
7. Create a circuit similar to the picture provided earlier.

Collect Data :

8. Measure the current at the battery branch by placing the ammeter next to the batteries, not in between. Record data.
9. Measure the current at the next two branches by placing the ammeter at the different branches and recording the data.
10. Create two new junction circuits with the order of the components different and repeat steps 8 and 9 for each circuit. **Do not create a loop circuit**.

Current of the batteries branch	Current of the second branch	Current of the third branch
1.000 A	0.079 A	0.020 A
1.000 A	0.056 A	0.021 A
1.000 A	0.080 A	0.002 A

Analysis Questions

1. Based on what you learned from this lab, what is the relationship between the voltage and current values in a loop circuit?

Voltage and current are directly proportional to each other in a loop circuit.

2. Based on what you learned from this lab, what is the relationship between the voltage and current values in a junction circuit?

In each branch the voltage and current are still directly proportional, but they are not necessarily the same.

3. What is your reasoning behind why the voltage values changed in each component in the loop circuit?

Each component has a different resistance so there is a different change in voltage across each of them.

4. What is your reasoning behind why the current values changed in each branch in the junction circuit?

Each branch has different components with different resistances so the current values are all different.

5. How would changing the resistance affect the outcome of the relationships this lab proved?

It would not change the relationships because the values would change proportionally. The actual relationship between the values would not change.