Series and Parallel Circuits Simulation Lab

Task

You will build a variety of circuits in this activity in order to analyze how they work. For each scenario, follow the building instructions carefully in order to obtain the desired outcomes.

Directions

Go to the following website:

https://phet.colorado.edu/en/simulation/circuit-construction-kit-dc

(Or embed the simulation onto the VLA site?)

You now have the raw material to create a circuit. Take a moment to look over the screen and find all the different materials. To build a circuit you will need several wires, a light bulb, a voltage source, a voltmeter, and a non-contact ammeter. Play around with it to learn how to grab and manipulate these tools. Once you are comfortable, click “Reset All” and move on to the scenarios.

Scenario 1: Simple Series Circuit

Build a simple series circuit that consists of 6 pieces of wire, 1 light bulb, and 1 battery (voltage source). In order to complete the circuit, the red circles at the end of each must overlap. Please note that the light bulb also has TWO circles. Your circuit is complete and working when the light comes on and the blue dots begin moving.

1. Include a screenshot of your circuit here.

2. What do the blue dots represent, and how do you know?

Click the checkboxes on the right side of the screen for a voltmeter and a non-contact ammeter to appear.

3. Place the voltmeter near the battery. Align the red lead to one end of the battery and the black lead to the other end. What is the voltage?

4. Place the ammeter crosshairs over the moving blue dots. What is the reading?

5. Right-click on the battery to alter the voltage and internal resistance of the battery. Make observations on how this changes the readings on the voltmeter and ammeter. Record your observations below.

6. Under Advanced, click “Show” and alter the resistivity of the wire. Record your observations.

Click “Reset All” then move on to the next scenario.

Scenario 2: Series Circuit with Multiple Resistors

Build a series circuit with one battery, 3 lightbulbs, and 8 wires. Be sure to place the lightbulbs in a series and not parallel with one another.

7. Include a screenshot of your circuit here.

8. Use the voltmeter on the battery. What is the voltage?

9. Use the non-contact ammeter over a wire. What is the amperage?

10. How do these values compare to those in Scenario 1? What is the significance?

11. Right-click on the battery to alter the voltage and internal resistance values. Describe what happens when those values are changed.

Scenario 3: Parallel Circuit

Parallel circuits provide more than one path for electrons to move. Construct a parallel circuit that contains 10 wires, 2 light bulbs, and 1 battery. The blue dots will be moving and both light bulbs will be on once your circuit is complete.

12. Include a screenshot of your circuit here.

Use the voltmeter and non-contact ammeter to measure electron flow and push.

13. What is the voltage?

14. What is the amperage? Check it close to the battery as well as close to the light bulbs.

15. How do these values compare with those of Scenario 1? Does this surprise you? Why or why not?

16. Now right click on one of the wires connected to a light bulb. Remove the wire and record your observations.

17. Does this affect the voltage, amperes, or visually change the appearance of the light bulb?

18. Replace the wire. Now remove one of the wires touching the voltage source. What happened?

Scenario 4: Create Your Own Circuit

19. Create a functioning circuit using materials of your choice. Include a screenshot of your circuit here.

20. Is your circuit in series or parallel? Explain.

21. What is the voltage and amperage of your circuit? How does it compare to the circuits in Scenarios 1-3?

22. Manipulate the voltage and resistance of the battery, and explain what happens in your circuit.

Review Questions

You may need to re-build a series circuit and a parallel circuit in order to answer these questions.

23. As the number of resistors (light bulbs) increases, what happens to the overall current within a series circuit and a parallel circuit?

24. As the number of resistors (light bulbs) increases, what happens to the overall resistance within a series circuit and a parallel circuit?

25. If one of the resistors is turned off (i.e., a light bulb goes out), what happens to the other resistors in a series circuit and a parallel circuit?