Circuits Lab

Name:

Click on ‘Intro’.

Take a moment to look over the simulation and find all the different materials. To build a circuit you will need several wires, a light bulb, a voltage source, a voltmeter, and an ammeter. Play with it to see how to grab and manipulate these tools.

Click the reset button when you’re done.

A few pieces of information before we start.

* To get something, click and drag it onto the screen. To rotate it, click on one of the red circles when it’s not attached. To delete or adjust it, click on the object while it’s in use. To separate a junction, click on the junction and then click on the scissor icon.
* Make sure ‘Values’ is checked.
* Just below the voltmeter and ammeter, you have a choice between icons (the battery picture) or circuit symbols (the battery symbol). You may use either of these, whichever you like better.
* When using the voltmeter, keep in mind that the positive or negative values depend on the order of the red and black things. Test this out by creating a simple circuit and switching the red and black to see how it changes from positive to negative or negative to positive. All recorded voltages should be positive.
* You may choose to show the current or not and you may leave it as electrons or use conventional. Remember that if you don’t show current, you won’t be able to see if the circuit is working.
* When you’ve made each of the 3-resistor circuits, it may save time to leave these set up because they will be used again.

Making predictions

**Series circuit with 3 resistors of equal resistance:**

1. Will each resistor have the same voltage drop? Will the voltage drop across the first resistor be equal to the voltage of the battery?
2. Will each resistor have the same current through it? Will the current through the first resistor be equal to the voltage of the battery?

**Parallel circuit with 3 resistors of equal resistance:**

1. Will each resistor have the same voltage drop? Will the voltage drop across the first resistor be equal to the voltage of the battery?
2. Will each resistor have the same current through it? Will the current through the first resistor be equal to the voltage of the battery?

**Series circuit with 3 resistors of unequal resistance:**

1. Will each resistor have the same voltage drop? Which resistor (most or least resistance) will have the greatest voltage drop?
2. Will each resistor have the same current through it? Which resistor (most or least resistance) will experience the greatest current?

**Parallel circuit with 3 resistors of unequal resistance:**

1. Will each resistor have the same voltage drop? Which resistor (most or least resistance) will have the greatest voltage drop?
2. Will each resistor have the same current through it? Which resistor (most or least resistance) will experience the greatest current?

Building Circuits

Use the simulation to build each of the following circuits below with a battery at 9 volts and 1, 2, or 3 resistors. Drag over the voltmeter and ammeter to measure voltage of the battery and current into it. Then measure the voltage and current through each resistor individually. Complete the data table as shown. If the ammeter reads zero, check if the current is flowing through the circuit.

**Series circuits (1, 2, and 3 resistors of equal resistance)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| # of resistors | Resistance of each resistor () | Total resistance () | Battery voltage (V) | Voltage across each resistor (V) | Total current (A) | Current through each resistor (A) |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |

**Parallel circuits (1, 2, and 3 resistors of equal resistance)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| # of resistors | Resistance of each resistor () | Total resistance () | Battery voltage (V) | Voltage through each resistor (V) | Total current (A) | Current through each resistor (A) |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |

**Series circuit with 3 resistors of unequal resistances**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R1 | R2 | R3 | Total |
| Resistance () |  |  |  |  |
| Current (A) |  |  |  |  |
| Voltage (V) |  |  |  |  |

1. Include a screenshot of your setup.

**Parallel circuit with 3 resistors of unequal resistances**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R1 | R2 | R3 | Total |
| Resistance () |  |  |  |  |
| Current (A) |  |  |  |  |
| Voltage (V) |  |  |  |  |

1. Include a screenshot of your setup.
2. Compare your predictions to what you measured. What was right and what was wrong?
3. Explain why the currents and voltages behave the way they do.

Making Predictions

In each of the circuits with three resistors, if you replaced the three resistors with light bulbs:

**Series circuit with 3 light bulbs of equal resistance**

1. Will each light bulb have the same brightness? If not, which light bulb is brightest?
2. If you add a fourth light bulb, will the brightness of each bulb increase, decrease, or stay the same?
3. If you add a fourth light bulb, what will happen to the total current of the circuit?

**Parallel circuit with 3 light bulbs of equal resistance**

1. Will each light bulb have the same brightness? If not, which light bulb is brightest?
2. If you add a fourth light bulb, will the brightness of each bulb increase, decrease, or stay the same?
3. If you add a fourth light bulb, what will happen to the total current of the circuit?

**Series circuit with 3 light bulbs of unequal resistances**

1. Will each light bulb have the same brightness? If not, which light bulb (most or least resistance) will be brightest?

**Parallel circuit with 3 light bulbs of unequal resistances**

1. Will each light bulb have the same brightness? If not, which light bulb (most or least resistance) will be brightest?

Building circuits

Make the following circuits and answer the questions below. Explain each of your answers.

**Series circuit with 3 light bulbs of equal resistance**

1. Does each light bulb have the same brightness? If not, which light bulb is brightest?
2. Add a fourth light bulb. Did the brightness of each bulb increase, decrease, or stay the same?
3. Add a fourth light bulb. What happened to the total current of the circuit?
4. Include a screenshot of your setup.

**Parallel circuit with 3 light bulbs of equal resistance**

1. Does each light bulb have the same brightness? If not, which light bulb is brightest?
2. Add a fourth light bulb. Did the brightness of each bulb increase, decrease, or stay the same?
3. Add a fourth light bulb. What happened to the total current of the circuit?
4. Include a screenshot of your setup.

**Series circuit with 3 light bulbs of unequal resistances**

1. Does each light bulb have the same brightness? If not, which light bulb (most or least resistance) is brightest?
2. Determine the power used by each bulb and the power produced by the battery.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Bulb 1 | Bulb 2 | Bulb 3 | Battery |
| Resistance () |  |  |  |  |
| Power (W) |  |  |  |  |

**Parallel circuit with 3 light bulbs of unequal resistances**

1. Does each light bulb have the same brightness? If not, which light bulb (most or least resistance) is brightest?
2. Determine the power used by each bulb and the power produced by the battery.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Bulb 1 | Bulb 2 | Bulb 3 | Battery |
| Resistance () |  |  |  |  |
| Power (W) |  |  |  |  |

1. Compare your predictions to what you measured. What was right and what was wrong?
2. Explain why the brightness of each bulb behaves the way it does for each circuit.
3. Why does adding a fourth bulb change the brightness and current the way it does for each circuit.