|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 2 | 3 | 4 |
| Lab not complete, Questions not answered | Lab mostly complete. Questions answered with some errors or incomplete answers | Lab complete. Questions answered correctly and fully. | Lab completed. Questions answered with connections to previous ideas or other topics |

**Names: Date:**

**Resistors in Parallel and in Series**

**Computer Simulation**

**Procedure**

Go to <http://phet.colorado.edu/web-pages/simulations-base.html> and open the Circuit Construction Kit. In the activities described below, don’t make the circuits too large, so that you can fit two or three circuits in the work area. For “size” use “small” on the right side of the screen.

**Resistors in Series**

1. Drag and drop one resistor and one battery in the work area. Drag and drop wires to connect the battery to the resistor. Once the circuit is completed, you should see the flow of charge from positive to negative end of the battery through the circuit. This is circuit 1.
2. Use a voltmeter (check the box next to voltmeter on the right side of the display) to measure the voltage across the resistor. Use the **non-contact** **ammeter** to measure the current in the wires. Use Ohm’s Law (V=IR) to Calculate the resistance of the resistor.
3. Right click on the resistor and check “show value” box. Does this agree with your calculations? Record results below.

Voltage across resistor=

Current in the wires= Is the current the same in all wires?

Calculate R:

Value shown for R=

1. Set up another circuit with one battery and two resistors connected in series (everything is in one single loop). Right click your resistors and select “Change Value” so that one resistor is 10 Ohms and the other is 20 Ohms This is circuit 2. Use the voltmeter and the non-contact ammeter to measure the values listed below.

**Circuit 2. Two resistors in series**

Show that V1 + V2 = Vbattery

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Resistor 1** | **Resistor 2** | **Battery** |
| **Voltage across****V** |  |  |  |
| **Current through****I** |  |  |  |

Is the current almost the same in all the wires?

Calculate the resistance of Resistor 1 (R1), resistance of Resistor 2 (R­2), and the total resistance connected to the battery.

1. Set up another circuit with three resistors in series. Make the third resistor 30 Ohms. This is circuit 3. Use the voltmeter and the non-contact ammeter to measure the values listed below.

**Circuit 3. Three resistors in series**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Resistor 1** | **Resistor 2** | **Resistor 3** | **Battery** |
| **Voltage across****V** |  |  |  |  |
| **Current through - I** |  |  |  |  |

Show that V1 + V2 +V3 = Vbattery

Is the current almost the same in all the wires?

Calculate the resistance of Resistor 1 (R1), resistance of Resistor 2 (R­2), resistance of Resistor 3 (R3), and the total resistance connected to the battery.

**Resistors in Parallel**

1. Set up a second circuit with one battery and two resistors in parallel as shown below. (The diagram shows light bulbs, use resistors instead) This is circuit 2. Use the voltmeter and the non-contact ammeter to measure the values listed below. Make one resistor 10 Ohms, the other resistor 20 Ohms.



**Circuit 2. Two resistors in parallel**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Resistor 1** | **Resistor 2** | **Battery** |
| **Voltage across****V** |  |  |  |
| **Current through****I** |  |  |  |

Notice that the current coming from the battery splits. Some of it goes to resistor 1 and the rest goes to resistor 2. Show that I1 + I2 = Ibattery

Is the voltage across resistor 1 almost the same as the voltage across resistor 2, and is this almost the same as the voltage across the battery?

Calculate the resistance of Resistor 1 (R1), resistance of Resistor 2 (R­2), and the total resistance connected to the battery.

1. Set up another circuit with three resistors in parallel as shown below. This is circuit 3. Make the third resistor 30 Ohms Use the voltmeter and the non-contact ammeter to measure the values listed below.



Junction Points

**Circuit 3. Three resistors in series**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Resistor 1** | **Resistor 2** | **Resistor 3** | **Battery** |
| **Voltage across****V** |  |  |  |  |
| **Current through - I** |  |  |  |  |

Once again current splits at each junction point. Show that the current going into a junction is equal to the current coming out of the junction. Do this for both junction points.

Is the voltage across resistor 1, resistor 2, resistor 3, and the battery almost the same?

Calculate the resistance of Resistor 1 (R1), resistance of Resistor 2 (R­2), resistance of Resistor 3 (R3), and the total resistance connected to the battery.