**Series and Parallel Circuits Simulation**

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

|  |  |
| --- | --- |
| **Cells** | **Voltage** |
| Cell #1 |  |
| Cell #2 |  |
| Cell #3 |  |
| 1+2 in series |  |
| 1+2+3 in series |  |

1. Cells:

Drag out three individual cells. Measure the voltage across each one individually and record the value. Then connect the cells in *series* to make a battery and record the values.

Describe the advantage of batteries made by cells attached in series. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Use some wires to attach the cells in *parallel* to make a battery. Measure the voltage and describe the voltage across the whole battery. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Describe the advantage of batteries made by cells attached in parallel. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)** Simple Circuit:   
Construct a circuit with **one 9 V cell, one switch** and **one light bulb***Draw a schematic*:

Using a voltmeter and an ammeter, measure the voltage and current through the light bulb.   
**Include the meters and measurements on your schematic.**

Note the brightness of the bulb.

Observe the electrons as they move through the circuit. In this simulation the light bulb has a default resistance of 10 Ω and the wires have a resistance so low that it can be treated as 0 Ω. Do the electrons move at different speeds when they are moving through areas of high or low resistance? ***Explain why or why not***.

You can change both the voltage of the cell and the resistance of the light bulb by right-clicking on them. While an ammeter is connected, manipulate either one and summarize the following relationships:

Current vs. Voltage Current vs. Resistance

**(3)** Series circuit: Construct a circuit with **one 9 V cell, one switch** and **3 light bulbs in series**  
*Draw a schematic*, including ammeters and voltmeters.

**Measure V and I at each bulb**

|  |  |  |
| --- | --- | --- |
|  | Voltage | Current |
| Light Bulb 1 |  |  |
| Light Bulb 2 |  |  |
| Light Bulb 3 |  |  |
| Total  (at battery) |  |  |

How does the brightness of the bulbs compare to the simple circuit? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Series Circuits General Rules:**

|  |  |  |
| --- | --- | --- |
| Voltage: | Current: | Resistance: |
| VT = | IT = | RT = |

**(4)** Parallel circuit:Construct a circuit with **one 9 V cell, one switch** and **3 light bulbs in parallel**  
*Draw a schematic*, including ammeters and voltmeters.

**Measure V and I at each bulb**

|  |  |  |
| --- | --- | --- |
|  | Voltage | Current |
| Light Bulb 1 |  |  |
| Light Bulb 2 |  |  |
| Light Bulb 3 |  |  |
| Total  (at battery) |  |  |

How does the brightness of the bulbs compare to the simple circuit? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Parallel Circuits General Rules**:

|  |  |  |
| --- | --- | --- |
| Voltage: | Current: | Resistance: |
| VT = | IT = | RT = |

Change the resistances of each light bulb so that they all have different values. Are your general rules still true?   
If not, you will need to modify them…