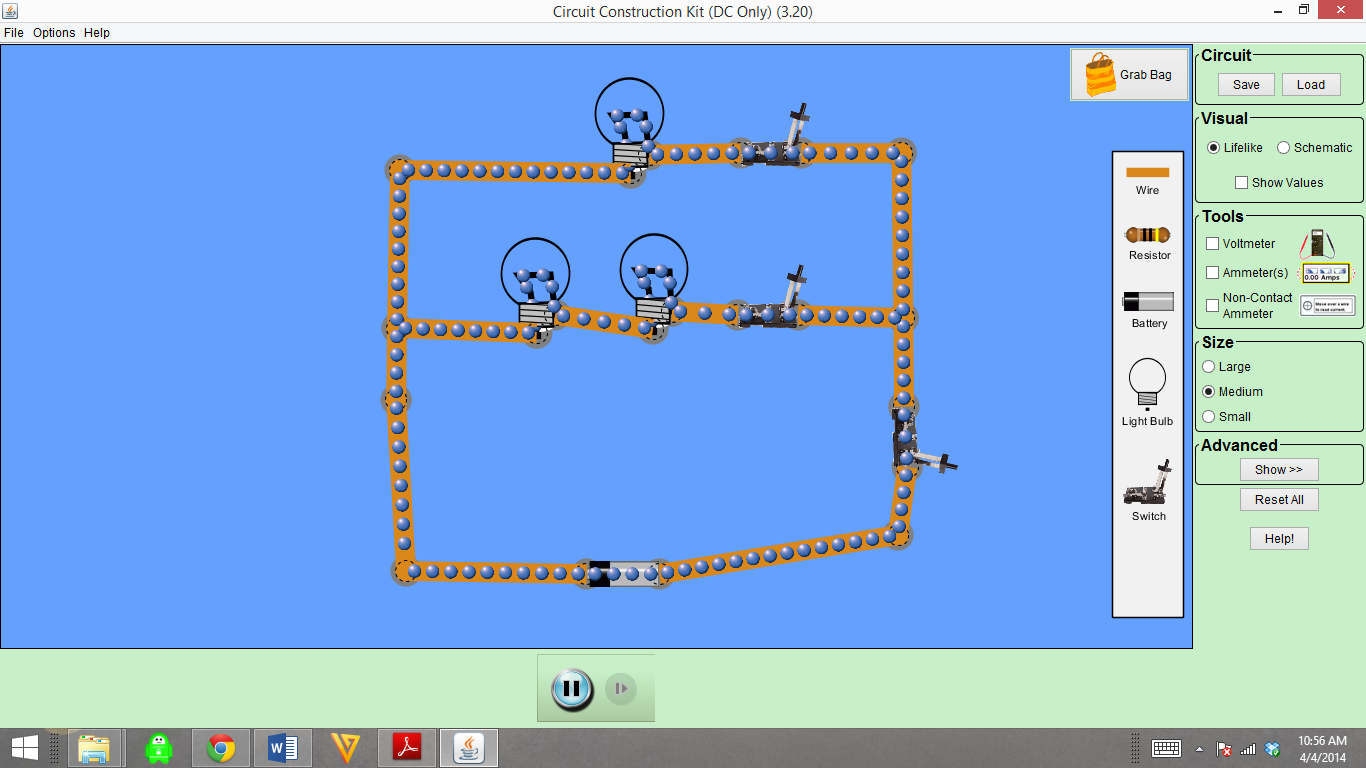
**Combined Series and Parallel Lab**

**Instructions**: Construct each of the circuits below using the PhET Circuit Simulation. **Each light bulb/resistor is 10 Ω by default. The battery has a potential difference of 9 V by default.** Complete the RVIP charts mathematically and check your answers with the “Non-Contact Ammeter” and “Voltmeter.” Then answer the questions following each diagram.

1. **Series Circuit in a Parallel Circuit**

R2

S3

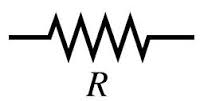
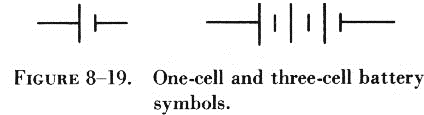
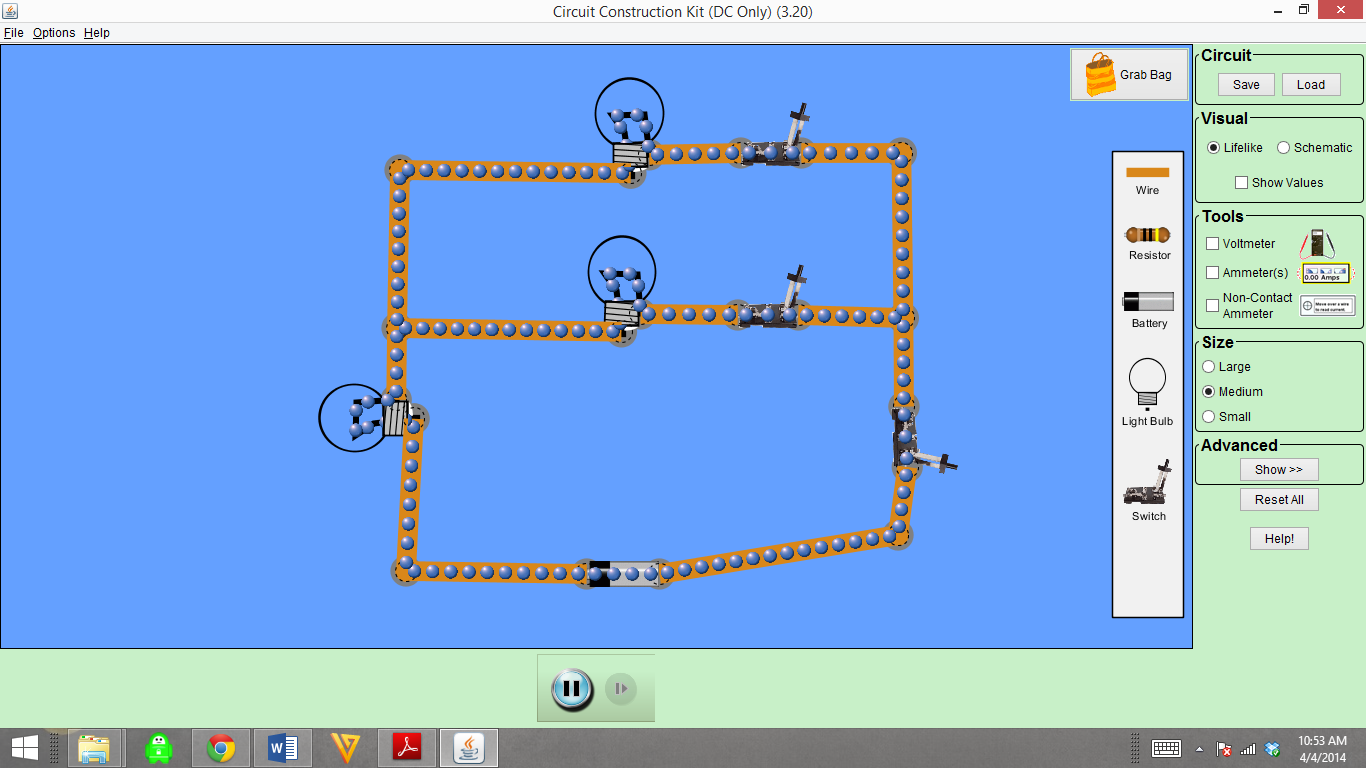
S2

S1

R3

R1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R | V | I | P |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 23 |  |  |  |  |
| battery |  |  |  |  |

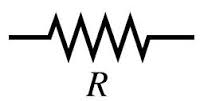
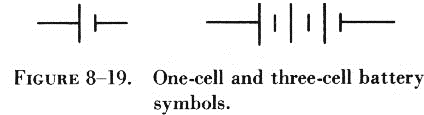
1. On a separate sheet of paper, draw a schematic version of this circuit ( and ) and then draw simplified versions to solve.
2. Explain which part of the circuit is in series. Explain which part of the circuit is in parallel.
3. Compare the current in the top branch to the current in the middle branch. Explain why.
4. Rank the light bulbs in order of brightness. In terms of current flow and resistance, explain why.
5. If bulb R­­2 were removed (right-click to remove), explain what happens to the other two bulbs and why.
6. Determine which bulbs are affected by each of the switches (S1, S2, S3). Explain why.
7. **Parallel Circuit in a Series Circuit**

R3

R2

R1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R | V | I | P |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 12 |  |  |  |  |
| battery |  |  |  |  |

1. On a separate sheet of paper, draw a schematic version of this circuit ( and ) and then draw simplified versions to solve.
2. Explain which part of the circuit is in series. Explain which part of the circuit is in parallel.
3. Rank the light bulbs in order of brightness. In terms of current flow and resistance, explain why.
4. Compare the potential difference across R3 to the potential difference across the other two bulbs. Explain why.
5. If R3 were removed (right-click to remove), explain what happens to the other two bulbs and why.
6. If R2 were removed, what kind of circuit does this become?
7. After R2 is removed, determine what happens to the brightness of each bulb and explain why. (Hint: Complete the chart if you get stuck.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R | V | I | P |
| 1 |  |  |  |  |
| 3 |  |  |  |  |
| battery |  |  |  |  |

1. **Series Circuit in a Parallel Circuit in a Series Circuit (Bonus)**

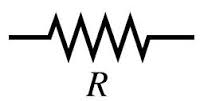
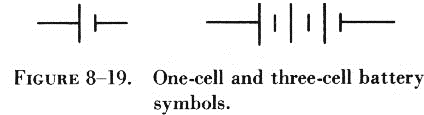
R4

R3

R2

R1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R | V | I | P |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 4 |  |  |  |  |
| 23 |  |  |  |  |
| 123 |  |  |  |  |
| battery |  |  |  |  |

1. On a separate sheet of paper, draw a schematic version of this circuit ( and ) and then draw simplified versions to solve.
2. Explain which parts of the circuit are in series. Explain which part of the circuit is in parallel.
3. Rank the light bulbs in order of brightness. In terms of current flow and resistance, explain why.