## **Solenoid Lab (Student Guide)**

You will use the following link to access the PhET simulation for this lab. By default, you will begin on the **Bar Magnet** simulation. You will need to select the **Electromagnet tab**.

<https://phet.colorado.edu/sims/cheerpj/faraday/latest/faraday.html?simulation=magnets-and-electromagnets>

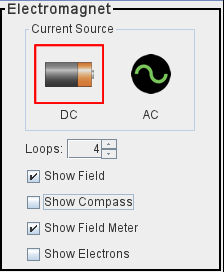
**Part I**

**Purpose**To investigate the relationship between the number of loops of an electromagnet (solenoid) and the strength of the magnetic field produced.

**Hypothesis**  
If the number of loops in the solenoid increases, then the strength of the magnetic field will… because…

**Procedure**

1. Configure the simulation with the following settings:



2. Move the Magnetic field meter to any location within the field. Once you have chosen a position, the meter should not move. This will be one of the controls for this experiment.

3. Set the voltage of the battery to be 10 V. This is another controlled variable for this part of the experiment and must not change.

4. Set the number of loops in the solenoid equal to 1 and record the magnetic field strength, which is measured in Gauss (G). Only record the value of the total field strength (denoted ).

5. By manipulating the number of loops in the solenoid, complete the following table

|  |  |
| --- | --- |
| Number of loops | Total field strength (G) |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |

6. Create a graph of the field strength (y-axis) vs. the number of loops (x-axis). Is this a proportional relationship?

**Conclusion:**

In general, what happens to the field strength of the solenoid as more loops are added? Do these results support your hypothesis?

**Part II**

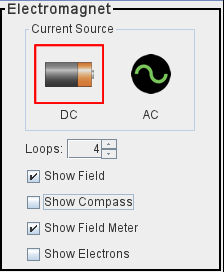
**Purpose**  
To investigate the relationship between the current intensity through an electromagnet (solenoid) and the strength of the magnetic field produced.

**Hypothesis**

If the current intensity through the solenoid increases, then the strength of the magnetic field will … because…

**Procedure**

1. Configure the simulation with the following settings:



2. Move the Magnetic field meter to any location within the field. Once you have chosen a position, the meter should not move. This will be one of the controls for this experiment.

3. Ensure that the number of loops of the electromagnet (solenoid) is set to 4. This is another control for this part of the experiment and must not change.

4. Set the voltage of the battery to 1 Volt (V) and record the magnetic field strength in Gauss (G). Only record the value of the total field strength (denoted ).

5. Copy and complete the following table.

|  |  |
| --- | --- |
| Voltage (V) | Field strength (G) |
| 1 |  |
| 2 |  |
| 3 |  |
| … |  |
| 10 |  |

6. Create a graph of the field strength (y-axis) vs. voltage (x-axis).Is this a proportional relationship?

**Conclusion**

In general, what happens to the field strength of the solenoid as the voltage increases? Do these results support your hypothesis?