

AP Physics B
Experiment, Magnetic Field

Name: _____

The magnetic field at the center of a solenoid is given by $B = \frac{\mu_o N}{L} \cdot I$ where L is the length of the solenoid, N is the number of loops, and μ_o is the permeability of free space. You will use the digital gauss/tesla meter to measure the field strength as a function of the current through a solenoid, and from your data you will calculate a value for the permeability of free space.

Your teacher will show you the basic operation of the gauss meter. Because magnetic fields are typically very small, it is important that you collect your measurements carefully. You will need to orient your probe exactly as your teacher shows you to get the most reliable data. Then, you will vary the current in a solenoid and measure the magnetic flux density at the center of the solenoid. Make sure to measure the length of the solenoid as well.

After the class has completed the lab, you will compile a set of class data for the magnetic field measured at a particular current.

The analysis for this experiment will consist of a graph of Magnetic Field vs. Current and a graph of Magnetic Field vs. Number of Turns. Include an appropriate regression equation on each graph and calculate μ_o from each equation. Look up and report the accepted value of μ_o and calculate percent error.

This experiment requires a minimal report. Please include the following:

- (1) Title, Names, etc. (Section 1 on the handout: Formal Lab Write Ups)
- (2) Purpose (Section 2 on the handout: Formal Lab Write Ups)
- (3) Data (Section 4 on the handout: Formal Lab Write Ups)
- (4) Analysis (Section 5 on the handout: Formal Lab Write Ups)
Include your graphs of field strength vs. current and field strength vs. turns with regression equations. Determine μ_o from both graphs, report the accepted value of μ_o , and calculate percent error for each value.

Rubric Outline

1 point: Title, purpose, etc.
2 points: Data tables
4 points: Graphs
13 points: Calculations