

AP Physics B
Experiment, Magnetic Field

Name: _____

The purpose of this experiment is to measure the permeability of free space using a solenoid.

The magnetic field at the end of a solenoid is given by $B = \frac{\mu_0 N}{2L} \cdot I$ where L is the length of the solenoid, N is the number of loops, and μ_0 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.

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. In general, the experiment is fairly straight forward. You will vary the current in a solenoid and measure the magnetic flux density at one end 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 versus Current and a graph of Magnetic Field versus Number of Turns. Include an appropriate regression equation on each graph and calculate μ_0 from each equation. Look up the accepted value of μ_0 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 versus current and field strength versus turns with regression equations. Determine μ_0 from both graphs and calculate percent error.