

Magnetic field in a Slinky solenoid

Read/study: REVIEW 27-1 to 27-3 Focus on what is a magnetic Field and connection to current carrying wires read 28-4 understand Ampere's law applied to a wire and focus on section 28-5 the **magnetic field of a solenoid** which is the theme of this lab exercise.

Questions to hand in on the due date: Reminder: no value after!

1. The main equation for a Solenoid is
$$B = \mu_0 n I$$

What is "B" in this equation?
2. What is "I" in the latter equation?
3. What is "n" in this equation, define it with two other variables for the solenoid situation?
4. What is " μ_0 " in this equation?
5. You change I and measure B and plot the data for a fixed n, what kind of graph do you get?

Problems: Attach these to your lab report. Show all work formulas and math used.

P1. A solenoid with $n = 5.0 \times 10^3$ has a current of 5.0 A going through it.
What is the magnetic field inside the solenoid?

P2. Given a 40 cm long solenoid with an internal B field measured to be of 3.0×10^{-2} T. A current of 3.0A is flowing through it, how many turns of coils are there for this solenoid?

P3. Running an experiment with a solenoid with $n = 5. \times 10^3$ per meter, you measure the B field for different currents and plot the data. It turns out to be a straight line whose slope is measured from the graph to be .00604 T/A. From the slope you calculate the permeability of free space.

- a) What value do you get?
- b) What is the % difference from the known value?