

DAY 13 -- Homework

1. Magnetic field A is uniform from $x = 0$ to $x = 10$, but between $x = 10$ and $x = 15$ its strength drops by half. Sketch the field lines of this field. Magnetic field B is uniform from $x = 0$ to $x = 10$, but between $x = 10$ and $x = 20$ its strength drops by half. Sketch the field lines of this field. Which of these should form a stronger attracting pole?
2. Calculate the magnetic field at the center of a solenoid that has the following characteristics:
 - Length 1 m
 - Diameter 1 cm
 - Core is Air
 - Wire is 1 mm diameter copper
 - Battery is 1.5 V with
0.25 Ω internal resistance.
3. Calculate the magnetic field at the center of a solenoid that has the following characteristics:
 - Length 10 cm
 - Diameter 1 cm
 - Core is Aluminum
 - Wire is 18 Gauge copper
 - Battery is 1.5 V with
0.25 Ω internal resistance.
4. In the above problem, use EXCEL or a calculator to determine the optimum wire diameter that will produce the greatest magnetic field. What magnetic field will be produced?
5. If the solenoid is wrapped with a superconducting (zero resistivity) wire, what will that do to the B-field equation? Discuss what factors determine the B-field of this superconducting solenoid.
6. Design an air-cored solenoid that will run off a 12 V battery with 0.1 Ω internal resistance and that creates the strongest B-field possible. Use reasonable values - for instance, no choosing wire that is 1 meter in diameter.
7. **PHY 232 Only** - Do what we never did in class. Determine an equation that gives the optimum diameter of wire for use in constructing a solenoid.