PHYS1120

Summer 2025

1. Goal(s)

- **Determine the magnetic field resulting from a current-carrying wire as a function of distance above the wire.**
- **Determine the magnetic field produced by two current-carrying wires, with parallel and anti-parallel currents.**
- **Measure the magnetic field inside a solenoid and calculate the number of turns.**

2. Materials

- Wire demo
- Multimeters
- *Vernier* magnetometer
- *Logger Pro* software
- N-turn solenoid
- Power supply
- *Logger Pro* interface

3. Equation(s)

$$B = \frac{\mu_0 I_{\text{enc}}}{2\pi r} \text{ (Ampère's Law)}$$
$$B = \frac{\mu_0 I}{2\pi r} \text{ (Single wire)}$$
$$B = \frac{\mu_0 N I}{L} \text{ (Solenoid)}$$

4. Methods

I. Magnetic field from a single wire

a. Run current through a single wire.

b. Turn on the multimeter and record the current.

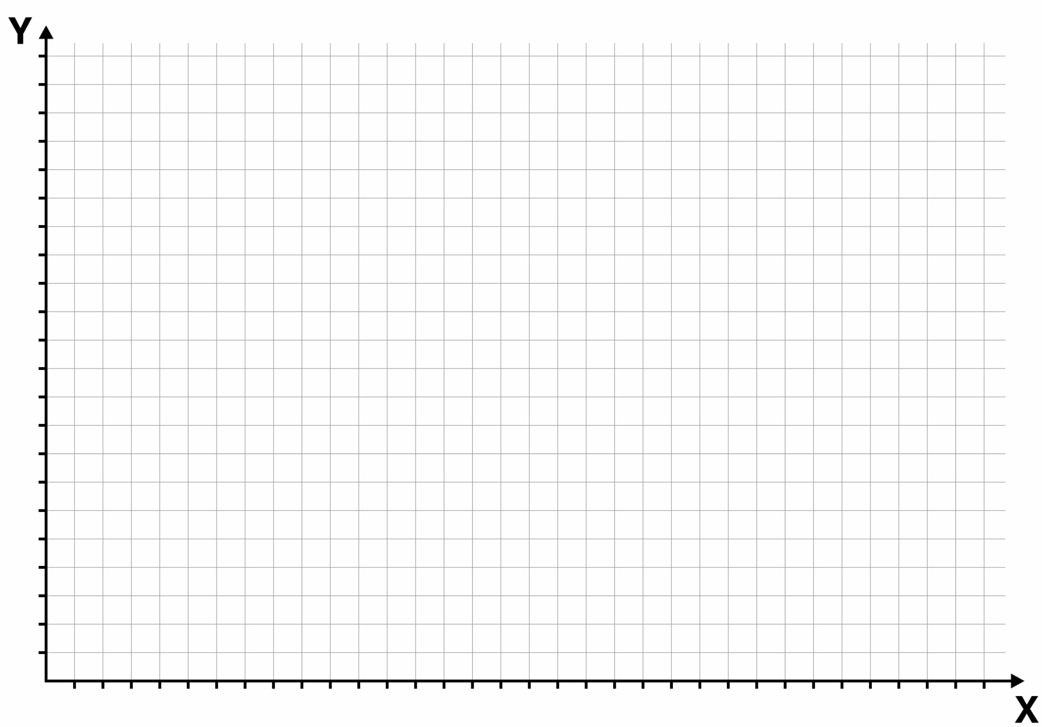
c. Plug in the magnometer into the interface and start the logger pro software.

d. Turn off the power supply and record zero the magnometer.

e. Power on the power supply and record the magnetic field strength at varying distances.

$$I = \_\_\_\_ \text{ A}$$

$\vec{B}$ (T)	r (m)	$\frac{1}{r}$ $(\frac{1}{m})$



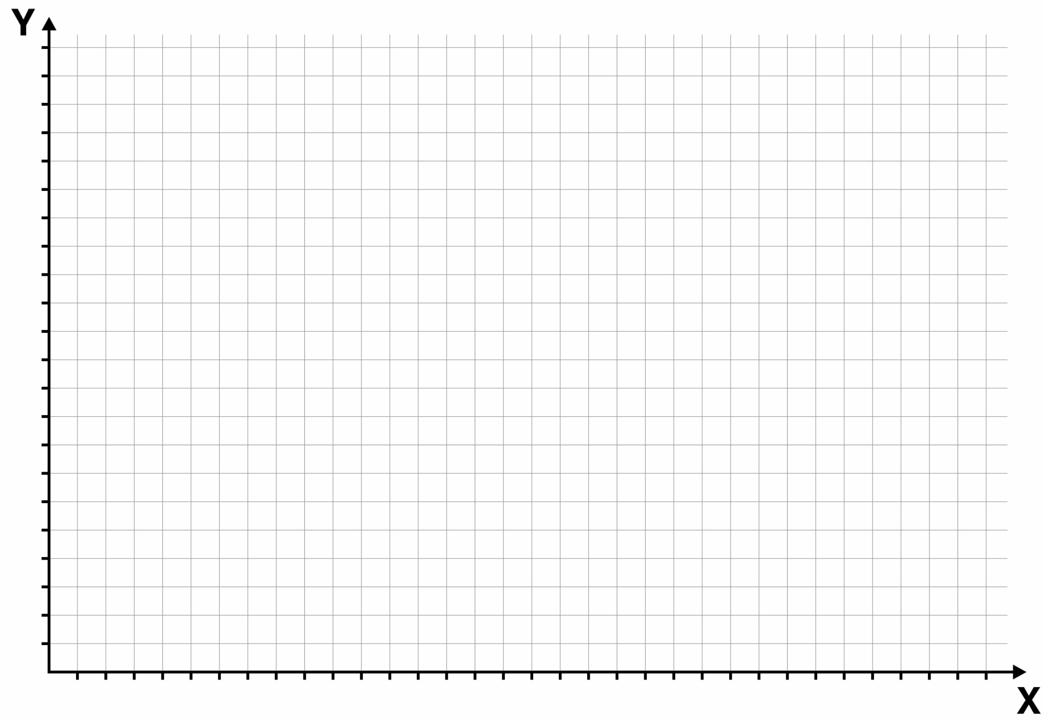
II. Magnetic field from two wires.

a. Now set up two wires with parallel currents. What do you notice about the magnetic field?

b. Now do the same for two wires with anti-parallel currents. Measure and record several measurements of the magnetic field as a function of distance.

$$I = \_\_\_\_ \text{ A}$$

$\|\vec{B}\|$ (T)	r (m)	$\frac{1}{r}$ $(\frac{1}{m})$



III. Magnetic field inside of a solenoid.

a. Now run current through a solenoid.

b. Turn on the ammeter to measure the current in the wire. Record this value

c. Turn off the power supply and zero the magnometer.

d. Place the magnometer in the center of the solenoid and record the magnetic field.

e. Using the solenoid equation, calculate the predicted number of turns of the solenoid.

$$I = \_\_\_\_ \text{ A}$$