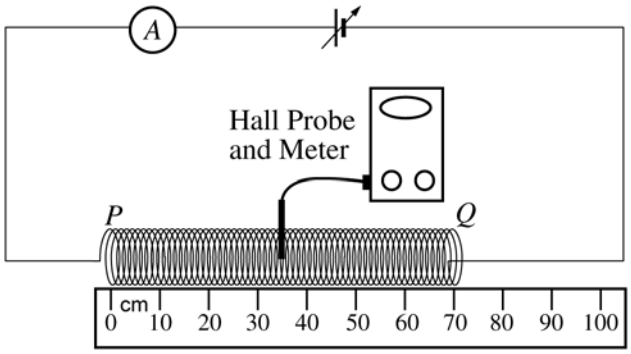


E&M. 3.

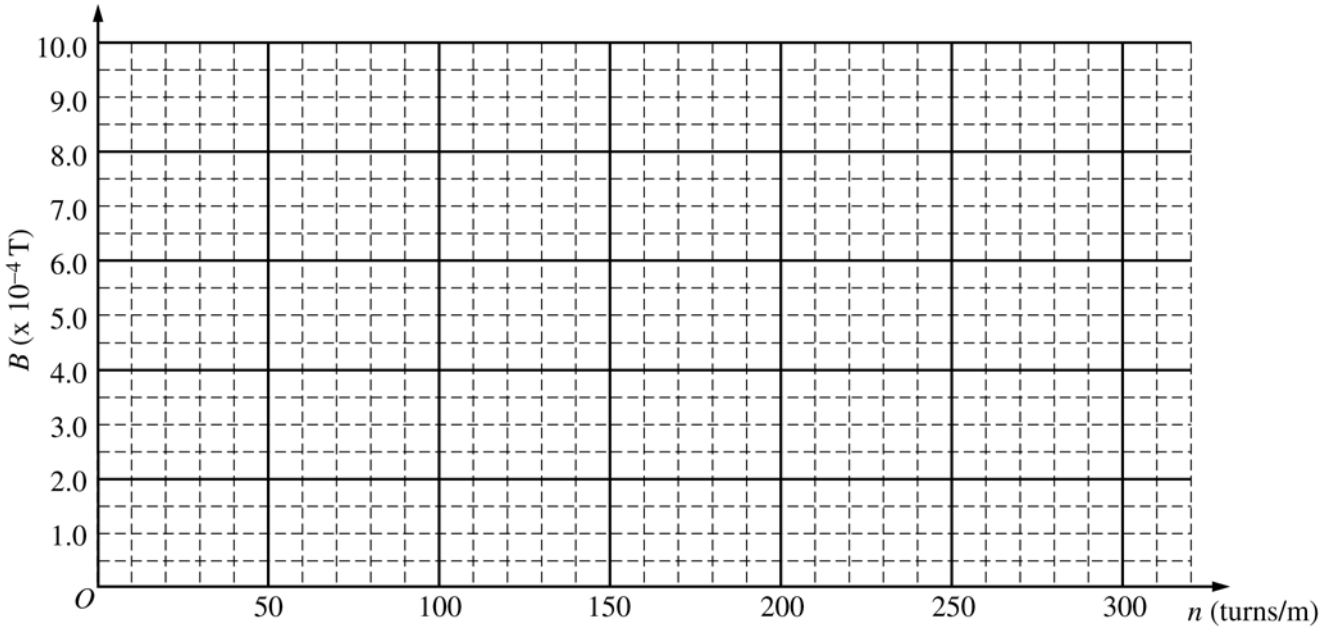
A student performs an experiment to measure the magnetic field along the axis of the long, 100-turn solenoid PQ shown above. She connects ends P and Q of the solenoid to a variable power supply and an ammeter as shown. End P of the solenoid is taped at the 0 cm mark of a meterstick. The solenoid can be stretched so that the position of end Q can be varied. The student then positions a Hall probe* in the center of the solenoid to measure the magnetic field along its axis. She measures the field for a fixed current of 3.0 A and various positions of the end Q. The data she obtains are shown below.

Trial	Position of End Q (cm)	Measured Magnetic Field (T) (directed from P to Q)	n (turns/m)
1	40	9.70×10^{-4}	
2	50	7.70×10^{-4}	
3	60	6.80×10^{-4}	
4	80	4.90×10^{-4}	
5	100	4.00×10^{-4}	

(a) Complete the last column of the table above by calculating the number of turns per meter.

*A Hall Probe is a device used to measure the magnetic field at a point.

(b) On the axes below, plot the measured magnetic field B versus n. Draw a best-fit straight line for the data points.



(c) From the graph, obtain the value of μ_0, the magnetic permeability of vacuum.

(d) Using the theoretical value of $\mu_0 = 4\pi \times 10^{-7}$ $(\text{T}\cdot\text{m})/\text{A}$, determine the percent error in the experimental value of μ_0 computed in part (c).

END OF SECTION II, ELECTRICITY AND MAGNETISM