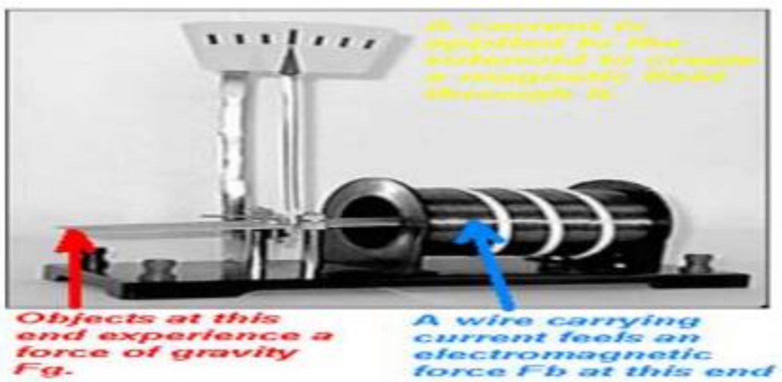
Physics Lab 2
Dr. Ishaq Musa

Experimental No. (9)

Current device

OBJECTIVE:

To measure the magnetic field strength of a solenoid for different solenoid currents, using a current balance.



A section of a straight wire of length L, carrying a current (i) and placed in a magnetic field region of magnetic flux density B, experience a force given by:

$$\overrightarrow{F} = i\overrightarrow{L} X \overrightarrow{B} \quad (24)$$

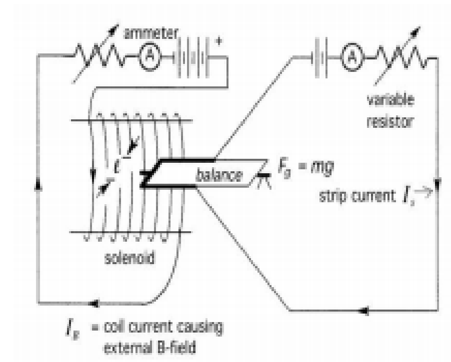
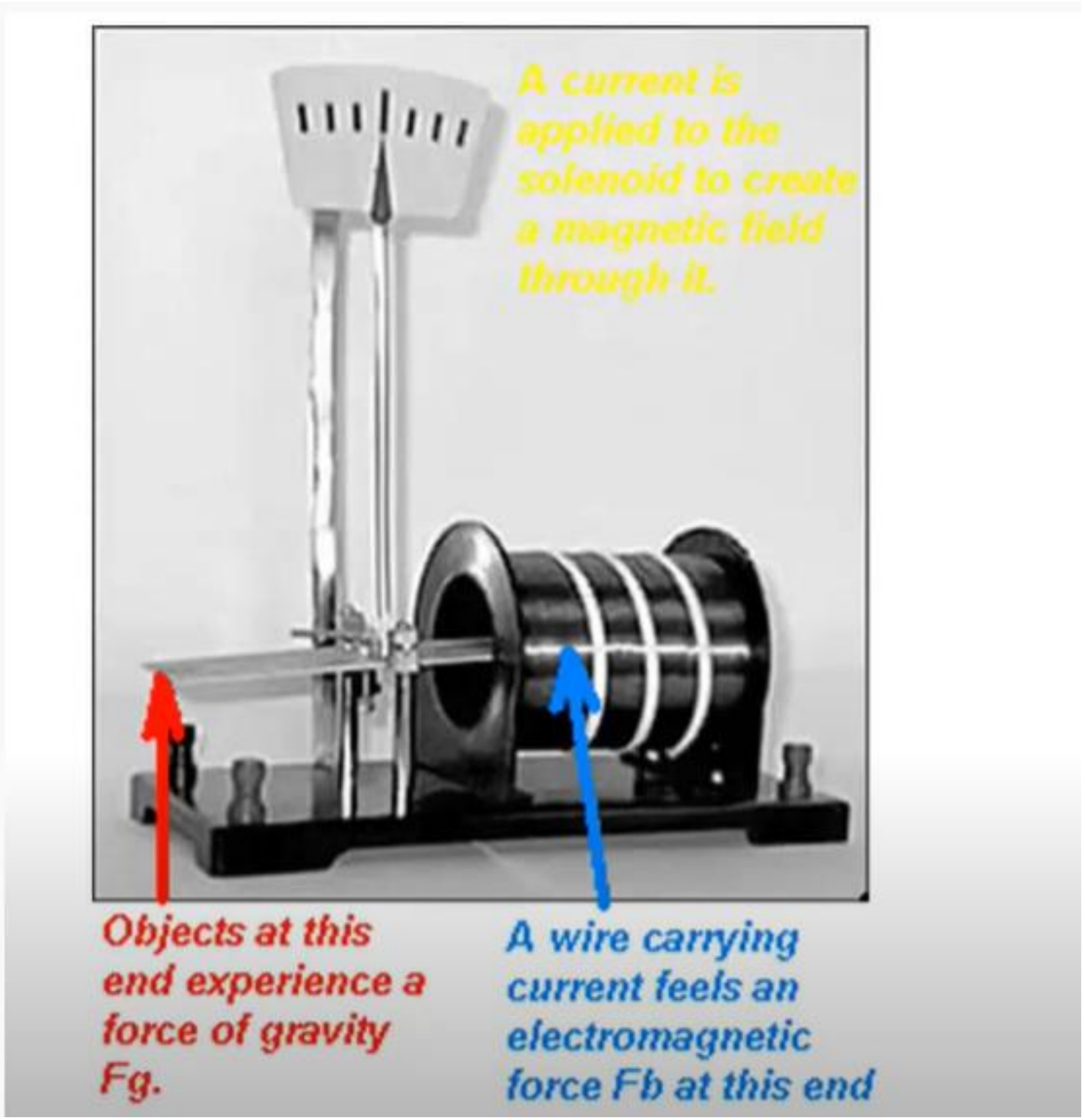
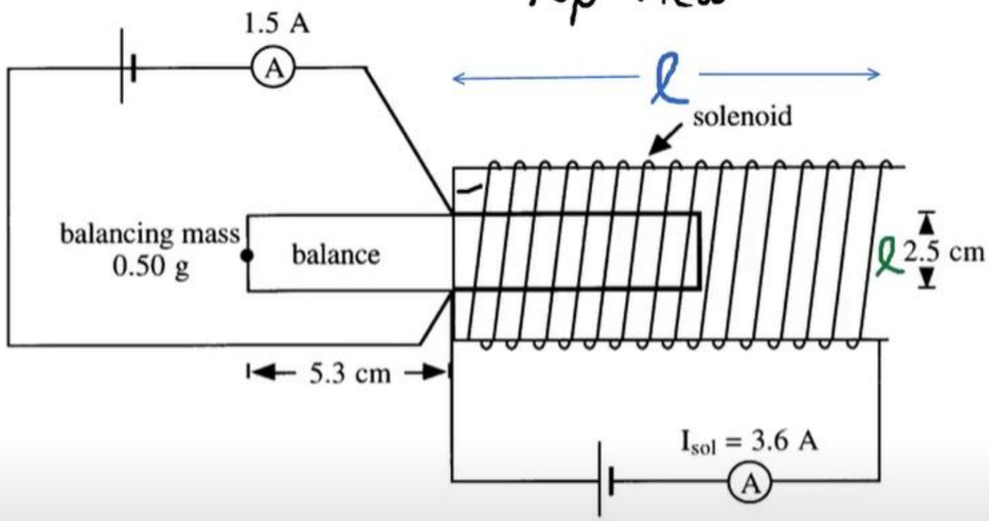


Figure 21: schematic diagram

If the wire is held horizontally in a uniform horizontal magnetic field perpendicular to the length of the wire, then the force experienced by the wire is directed either upwards or downwards depending on the direction of the current in the wire. The force is given by: $F = i\ L\ B$ As shown from fig.(21) magnetic force will make a torque on the balance, the other arm should be loaded by a mass to stabilize the balance, so it will keep the balance horizontally, $i\ L\ B\ d = m\ g\ d$, So $i = \frac{g}{LB}m$ and for long solenoid $B = \mu_o n i_{solenoid}$, where, $n = \frac{Numberofturnsofthesoleniod}{lengthofthesolenoid}$


A current is applied to the solenoid to create a magnetic field through it.
Objects at this end experience a force of gravity Fg.
A wire carrying current feels an electromagnetic force Fb at this end

Top View

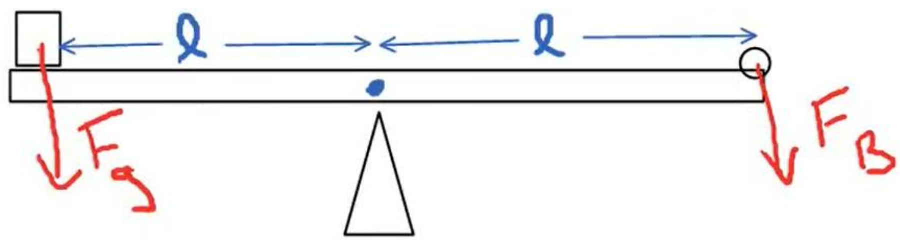


1.5A

$$F_B = BI\ell$$

$$B = \frac{\mu_0 N I_{sol}}{\ell} = \mu_0 n I$$

Side View



$$\tau = \tau$$

$$F_B \cdot \ell = F_g \cdot \ell$$

$$F_B = F_g$$

$$BI\ell = mg$$

$$B = \frac{mg}{I\ell}$$

$$\vec{F} = i\vec{L} X \vec{B}$$

The force is given by: $F = i\,L\,B$

$$i\;L\;B\;d = m\;g\;d, \quad \textbf{So}\; i = \frac{g}{LB} m$$

Magnetic field in soleniod

$$B = \mu_o n i_{solenoid},$$

$$\textbf{where, } n = \frac{Number of turns of the soleniod}{length of the solenoid}$$

Example1:-The magnetic field strength inside a certain solenoid is 0.05 T. If a 2 cm conducting strip, which is perpendicular to the magnetic field inside the solenoid, experiences a force of $3X10^{-4}$ N, the current in the conducting strip is

$$F = i\,L\,B$$

i= F/ L B = 0.0003/ 0.001= 0.3 A

Example2- A solenoid 10.0 cm long has 600 turns and carries a current of 2.0 A. if 2.0 cm segment of a current balance arm is balanced inside the solenoid when the current in it is 1.0 A. What is The magnetic force on the segment

$$B = \mu_o n i_{solenoid},$$

The force is given by: $F = i\,L\,B$