LAB REPORT 2

(Magnetism)

BS CYS-A

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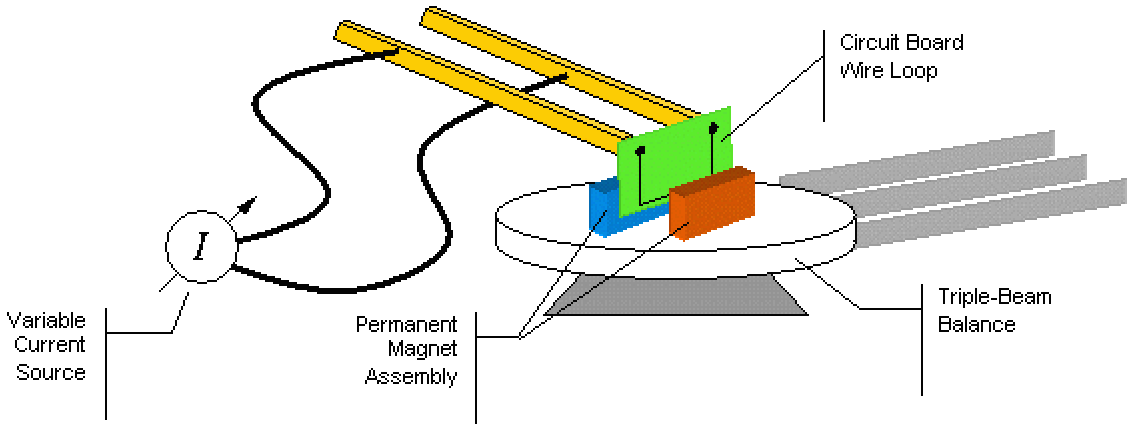


Note: The diagram shows the basic experimental setup for all the four experiments. The change in some factors is described under modification and implementation headings in each experiment.

Lab Experiment No 1

Magnetic Force vs. Current (F ∝ I):

Objective

To investigate how the magnetic force on a current-carrying conductor varies with the current passing through it.

Apparatus

- Basic Current Balance
- DC Power Supply
- Ammeter
- Electronic Balance
- Hook-up Wires with Banana Plugs
- Permanent Magnets
- Ruler

Modification: The current flowing through the conductor is varied while keeping the magnetic field strength, conductor length, and angle constant.

Implementation: Adjust the power supply to deliver different current levels, ensuring the conductor remains perpendicular to the magnetic field ($\theta = 90°$).

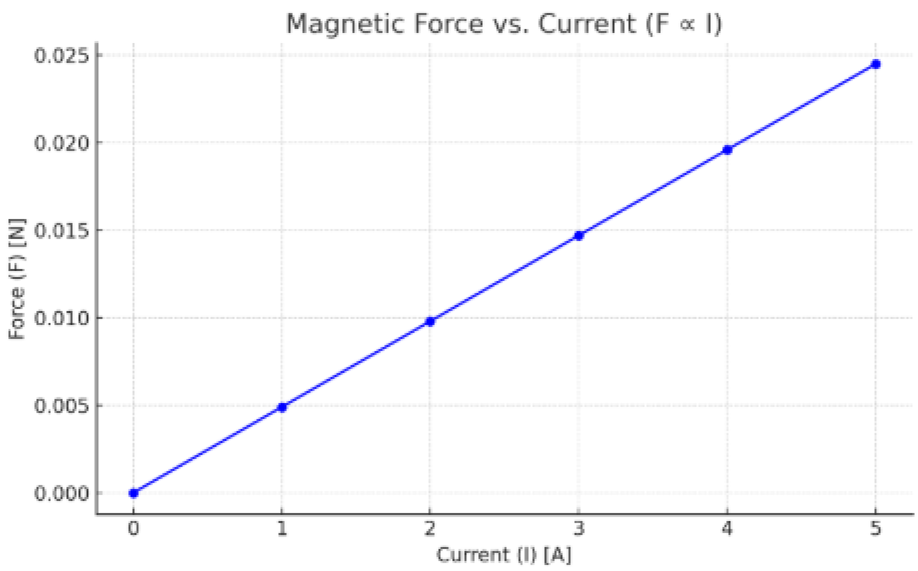
Procedure

1. Set up the apparatus with the conductor placed horizontally between the magnetic poles, ensuring it is perpendicular to the magnetic field ($\theta = 90°$, so $\sin(\theta) = 1$).
2. Measure and record the initial mass reading on the balance without current.
3. Gradually increase the current in increments (e.g., 1 A) up to a maximum safe value (e.g., 5 A), recording the balance reading at each step.
4. Calculate the change in mass (Δm) for each current value.
5. Compute the magnetic force using $F = \Delta m \times g$, where $g = 9.8\ m/s^2$.

Observations and Calculations

Current (I) [A]	Mass Reading [g]	Δm [g]	Force (F) [N]
0	165.00	0.00	0.000
1	165.50	0.50	0.0049
2	166.00	1.00	0.0098
3	166.50	1.50	0.0147
4	167.00	2.00	0.0196
5	167.50	2.50	0.0245

Graph



Conclusion

The magnetic force increases linearly with the current, confirming the direct proportionality between force and current as per the equation $F = I \times L \times B \times \sin(\theta)$.

Lab Experiment No 2

Magnetic Force vs. Magnetic Field Strength (F ∝ B)

Objective

To examine how the magnetic force on a current-carrying conductor changes with varying magnetic field strength.

Apparatus

- Basic Current Balance
- DC Power Supply
- Ammeter
- Electronic Balance
- Hook-up Wires with Banana Plugs
- Set of Permanent Magnets (to vary B)

- Ruler

Modification: The strength of the magnetic field is altered while maintaining constant current, conductor length, and angle.

Implementation: Change the number or configuration of magnets to vary the magnetic field intensity, ensuring the conductor remains perpendicular to the field.

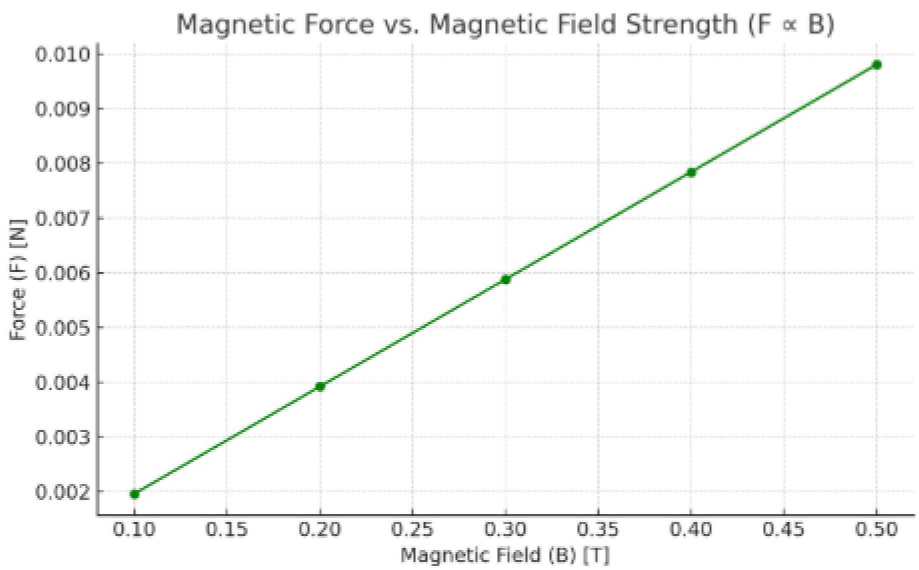
Procedure

1. Set up the apparatus with a fixed current (e.g., 4 A) and conductor length.
2. Place one magnet beneath the conductor and record the balance reading.
3. Incrementally add magnets to increase the magnetic field strength, recording the balance reading each time.
4. Calculate Δm and compute the magnetic force for each configuration.

Observations and Calculations

Number of Magnets	Magnetic Field (B) [T]	Mass Reading [g]	Δm [g]	Force (F) [N]
1	0.10	165.20	0.20	0.00196
2	0.20	165.40	0.40	0.00392
3	0.30	165.60	0.60	0.00588
4	0.40	165.80	0.80	0.00784
5	0.50	166.00	1.00	0.00980

Graph



Conclusion

The magnetic force increases proportionally with the magnetic field strength, validating the relationship $F = I \times L \times B \times \sin(\theta)$.

Lab Experiment No 3

Magnetic Force vs. Length of Conductor ($F \propto L$)

Objective

To determine how the magnetic force varies with the length of the conductor within the magnetic field.

Apparatus

- Basic Current Balance
- DC Power Supply
- Ammeter
- Electronic Balance
- Hook-up Wires with Banana Plugs
- Permanent Magnets

- Conductors of Various Length

Modification: The length of the conductor within the magnetic field is varied, with current, magnetic field strength, and angle held constant.

Implementation: Use conductors of different lengths or adjust the position of the conductor so that varying lengths are exposed to the magnetic field, maintaining perpendicular orientation.

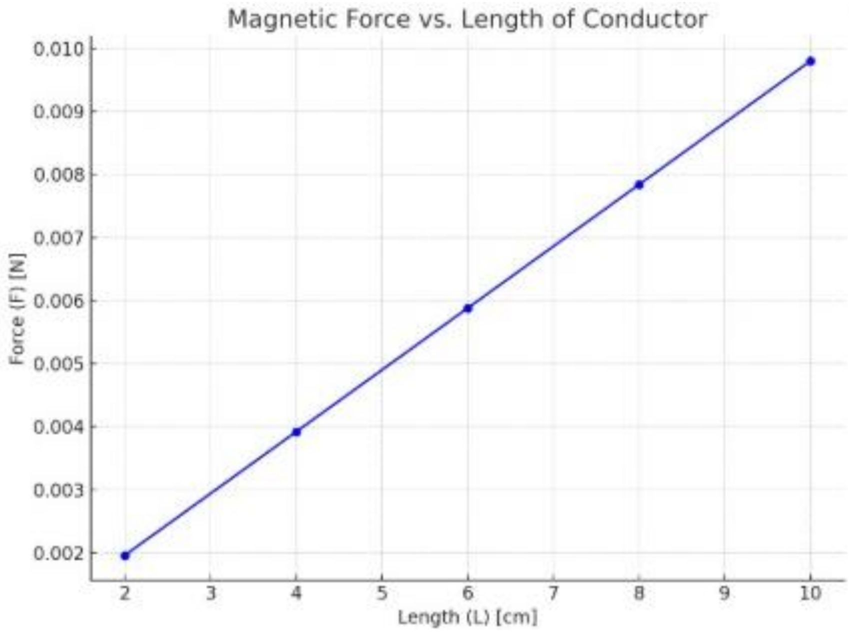
Procedure

1. Set up the apparatus with a constant current (e.g., 4 A) and magnetic field strength.
2. Place the shortest conductor within the magnetic field and record the balance reading.
3. Repeat the process with conductors of increasing lengths, ensuring each is centered within the magnetic field.
4. Calculate Δm and compute the magnetic force for each length.

Observations and Calculations

Length (L) [cm]	Mass Reading [g]	Δm [g]	Force (F) [N]
2	165.20	0.20	0.00196
4	165.40	0.40	0.00392
6	165.60	0.60	0.00588
8	165.80	0.80	0.00784
10	166.00	1.00	0.00980

Graph



Conclusion

The magnetic force is directly proportional to the length of the conductor within the magnetic field, consistent with the equation $F = I \times L \times B \times \sin(\theta)$.

Lab Experiment No 4

Magnetic Force vs. Angle ($F \propto \sin(\theta)$)

Objective

To explore how the magnetic force on a conductor varies with the angle between the conductor and the magnetic field.

Apparatus

- Basic Current Balance
- DC Power Supply
- Ammeter
- Electronic Balance
- Hook-up Wires with Banana Plugs

- Permanent Magnets
- Protractor

Modification: The angle between the conductor and the magnetic field is changed, keeping current, magnetic field strength, and conductor length constant.

Implementation: Rotate the conductor to different angles relative to the magnetic field direction, measuring the force at each angle.

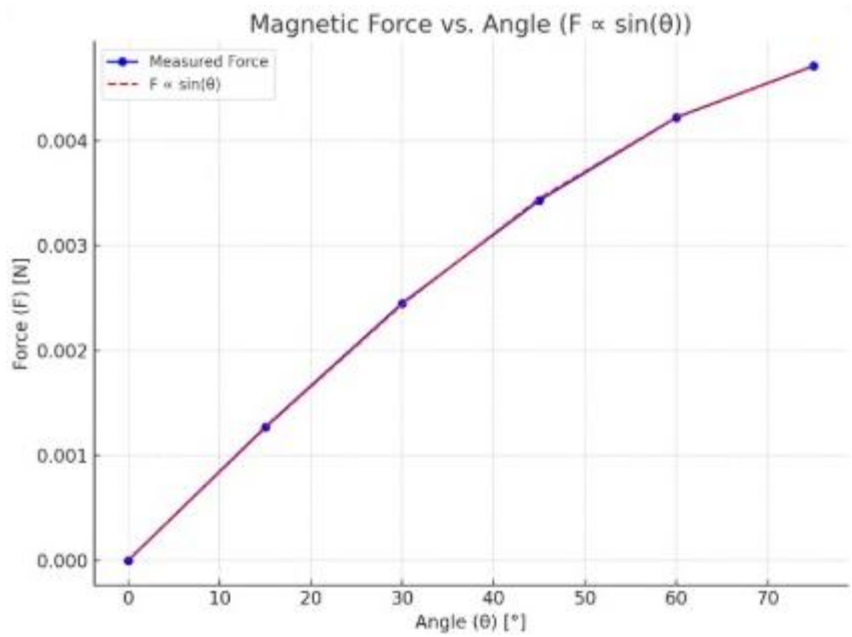
Procedure

1. Set up the apparatus with a fixed current (e.g., 4 A), magnetic field strength, and conductor length.
2. Position the conductor at 0° relative to the magnetic field and record the balance reading.
3. Incrementally increase the angle (e.g., 15°, 30°, ..., 90°), recording the balance reading at each angle.
4. Calculate Δm and compute the magnetic force for each angle.
5. Plot the magnetic force against sin(θ) to analyze the relationship.

Observations and Calculations

Angle (θ) [°]	sin(θ)	Mass Reading [g]	Δm [g]	Force (F) [N]
0	0.000	165.00	0.00	0.00000
15	0.258	165.13	0.13	0.00127
30	0.500	165.25	0.25	0.00245
45	0.707	165.35	0.35	0.00343
60	0.866	165.43	0.43	0.00422
75	0.966	165.48	0.48	0.00471

Graph



Conclusion

The experiment demonstrated that the magnetic force acting on a current-carrying conductor varies with the angle (θ) between the conductor and the magnetic field. Specifically, the force is directly proportional to the sine of this angle, as described by the equation:

$F = I \times L \times B \times \sin(\theta)$.

The End