

Goal - The goal of this lab is to determine the direction and the magnitude of the magnetic force acting on a current carrying wire while sitting in a uniform magnetic field.

Procedure -

1. Assemble the current balance kit according to the diagrams to the right.
 - a. First insert the rod with the cylinder on the end through the center of the balance bar.
 - b. Adjust the position of the rod until the rod points towards the zero mark on the scale at the back of the current balance kit. This adjustment is not easy, but it is important.
2. Connect the cylinder on the right side of the current balance kit to the positive end of the power supply that is built into the desk with a clip lead as shown in the diagram above.
3. Connect the cylinder on the left side of the current balance kit to an ammeter [at least 10 Amperes] with a second clip lead and then attach the other end of the ammeter to the negative end of the power supply with a third clip lead. Do NOT turn the current on yet!
4. Using the Hall Effect device, measure the average magnetic field strength B in the central area between the two poles of the permanent magnet.
5. Position your magnet such that the horizontal, current carrying loop of wire sits midway between the poles of the permanent magnet as shown in the diagram above right.
6. Turn on the power supply and adjust the current until it is approximately 5.0 Amperes. If at this point the balance bar is pulled down, flip the permanent magnet over to reverse the direction of the magnetic field.
7. Determine the direction of the magnetic field between the two poles of your permanent magnet using the magnetic field probe. Be sure to insert the probe between the poles of your magnet.
8. Determine the direction of conventional current flow through the horizontal section of the current loop, combine this information with the direction of the magnetic field between the two poles of your permanent magnet and then predict the direction of the magnetic force acting on the wire according to the right hand rule. How does your prediction compare with the actual magnetic force on the wire? Use a carefully drawn diagram to support your conclusion!
9. Add a counterweight (m) of 500 milligrams to the rod of the balance bar at a distance of approximately 15 cm from the center of rotation (R_1). Record the mass of the counterweight.
10. Turn on the current to the loop and adjust either the position of the counterweight or the current through the loop until equilibrium is reached. At this point record the distance of the counterweight from the center of rotation (R_1), the distance of the current carrying loop from the center of rotation (R_2), the current through the loop (I) and the width of the magnet (l)
11. Develop the equation describing the opposing torques acting on this loop while at equilibrium and from this equation determine the magnitude of the magnetic force (F_m) acting on the loop.
12. Calculate the magnetic force acting on the current loop based on $F_m = I l \times B$ and compare to the magnetic force determined from the opposing torques above.



