615-4630 (10-165) Oersted's Law Apparatus

Warranty and Parts:
We replace all defective or missing parts free of charge. Additional replacement parts may be ordered toll-free. We accept MasterCard, Visa, checks and School P.O.s. All products warranted to be free from defect for 90 days. Does not apply to accident, misuse or normal wear and tear.

How to Teach with Oersted's Law Apparatus:

Concepts Taught: Ampere's Rule, right hand rule, magnetic field, magnet, conductor, and compass.

Curriculum Fit: Magnetic Field and Magnetism.

Additional Materials Needed:

- 6 Volt Battery or low voltage power supply
- Two each conducting wire with alligator clips on both ends
- **005010 16 mm compass (four)**

Theory:

Oersted's law demonstrates that an electric current through a loop influences the direction of a magnetic field. In 1819, Professor Hans Christian Oersted, of the University of Copenhagen, Denmark, while lecturing to his class on electricity, accidentally discovered that when he laid a wire carrying an electric current parallel to a magnetic compass needle, the needle would deflect as if acted on by a magnet.

What is Ampere's Rule? It can be defined as: around a wire carrying a current towards the observer, the magnetic field curls in the anti-clockwise direction.

What is a magnetic field? It can be defined as: the lines of force around a permanently charged magnet or a moving charged particle.

What is a magnet? It can be defined as: a piece of equipment that can attract pieces of iron or steel.

What is a compass? It can be defined as: a magnetized needle, mounted on a pivot, which points in a north direction.

Caution: Always make sure the power supply is turned off before connecting leads to it or making any adjustments to the leads. Do not touch the current-carrying conductor while the power is on.

Demonstration: Magnetic Field about a Conductor

Kit Components Needed: Oersted's Law Apparatus
Additional Items Needed: 6 V battery, additional compasses, alligator clips

Procedure:

1. Put the demonstrator on a flat surface such as a lab bench.
2. Carefully place the red/white needle on the point on top of the center post of the apparatus.
3. Align the additional compasses (16 mm), up to two each (total = four), on either side of the center post with the red (north)/white (south) compass. The compasses form a 180° line on either side of the center post.
4. Loosen and remove the two screw caps located on the wire.
5. Open the alligator clip on one wire and place it on the positive terminal of the battery. Repeat using a second wire with alligator clip and place it on the negative terminal of the battery.
6. Open the free end of the alligator clip of the positive wire and attach it to the binding post that extends beyond the plastic plate.
7. Open the free end of the alligator clip of the negative wire and attach it to the other binding post.
8. With the current flowing, observe the position of the center needle and diagram the resulting needle positions of the two to four additional compasses on page 3.

Diagram 1

9. Remove the leads from the two binding posts and reverse the configuration (i.e., the alligator clip attached from the positive terminal of the battery should now be attached to the binding post that does not extend beyond the plastic plate and vice versa).
10. With the current flowing, observe the position of the center needle and diagram the resulting needle

Diagram 2

positions of the two four additional compasses below.

11. Optional -- You may wish to move the two four additional compasses further away from the center post and make observations about the needle positions in both the reversed configuration and the original binding post-battery terminal configuration.

Discussion Points:

1. This demonstration shows that:
   a. A magnetic field surrounds a conductor of electric current.
   b. The direction of the magnetic field is determined by the direction of the electric current.
   c. The strength of the magnetic field decreases with increasing distance from the electrical conductor.

Ampere devised a rule to predict the direction of a magnetic field around a straight conductor. It is called the "right hand rule". If the conductor is grasped with the right hand in such a way that the right thumb points in the direction of the current, the fingers wrap around the conductor in the direction of the magnetic field.

2. General observations as follows:
   a. When electrons flow from south to north, the N pole of the needle will be deflected toward the east and the S pole to the west
   b. When the battery is reversed, electrons will flow from north to south and the N pole of the needle will be deflected west
   c. The general rule is that if you place your left hand with its palm toward the wire on the same side as the compass needled with the extended thumb pointing in the direction the electrons are flowing; the extended fingers will then point in the direction the north pole of the compass will be deflected.

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615-0270 Magnetic Field Demonstrator - Wow your students with this handy magnetic field demonstration! Shake the unit so that the iron filings are distributed throughout the unit. This transparent acrylic case holds iron filings in such a way as to maximize the visible lines of force from a magnet placed either on top of or underneath the case. Note: Magnets not included.

615-0250 Magnetic Field Viewer, 3D - Explore the mysteries of magnets in three dimensions! Iron filings mixed with oil inside and acrylic plastic cube will react in fascinating ways to a magnetic field or electric current.