612-1275 (10-151) Eddy Current Kit

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. Intended for children 13 years of age and up. This item is not a toy. It may contain small parts that can be choking hazards. Adult supervision is required.

Introduction:
What are eddy currents? An eddy current is an electrical phenomenon caused when a conductor is exposed to changing magnetic fields. This can cause a circulating flow of electrons within the conductor, creating a current. In fact, this causes localized portions of the conductor to become electromagnets with a polarity opposite to the magnet that induces the current. This is in accordance with Lenz's Law.

Applications of this vary from fanciful to practical. Dynamos and generators can be built on this principle. A simple mechanism involving a sliding magnet through a coil of copper wire uses this effect to generate a small amount of current and charge a battery or capacitor; some flashlights operate on this principle.

Description:
Our set consists of an aluminum pipe, a powerful neodymium magnet, and a spring scale.

How to Teach with the Eddy Current Kit:

Concepts Taught: Lenz' Law; Magnetic Breaking; Induced Current

Curriculum Fit: Magnetism, Electricity

Additional Materials Needed but not included:

657-4110 Economy Stopwatch

Theory: Observe the opposing magnetic forces produced by the eddy currents set up within the walls of an aluminum tube by a magnet falling through the tube.

Demonstration: Slow Fall of Magnet in Eddy Current Tube

1. Remove the magnet/spring scale from inside the tube. Detach the magnet from the spring scale.
2. Stand the tube vertically on the floor. The first student should hold the tube vertically, so that it does not tip over.
3. The first student should be prepared to drop the magnet down the tube. The second student should be ready with the stopwatch.
4. The first student should drop the magnet down the tube, while the second student starts the stopwatch. The students should record the time of flight of the magnet through the tube. Step 4 should be performed ten times and an average value calculated.

   Average time = _____ (s)

Discussion:

Aluminum is a good conductor, 200% better than copper by weight. Our neodymium-boron magnets produce a powerful magnetic field, affecting small magnetic objects up to a foot away. This high field strength produces a large amount of induced current in the aluminum, turning portions of it into small electromagnets. In accordance with Lenz's Law, these electromagnets have a polarity opposite to that of the neodymium magnet. This in turn attracts the magnet to the sides of the aluminum pipe, slowing it.

Although the electromagnetic force is stronger than gravity on these scales, the magnet will still fall through the tube, admittedly far slower than a non magnet. This is because the weight of the magnet exceeds the strength of the eddy currents the magnets can induce.

As an additional experiment, you can attach the magnet to the included spring scale. As you drop the magnet, its weight will appear to change. This is because the magnet also attracts the pipe, lessening the effects of gravity. The magnets will remain unchanged.

If you wish, you can take a clear, non-conductive tube, such as glass or acrylic of the same size as the aluminum pipe. This will show the speed the magnet falls when it has no conductor to work on.

Related Product:

615-0325 Lenz' Law, Rotary: A neat experiment for demonstrating Lenz's Law! Slow down the spinning aluminum disk with a neodymium magnet. This device features a free spinning aluminum disk mounted on a plastic base. Put the disk in motion and bring the neodymium magnet close to the outer portion of the disk (away from the center) and watch as it comes to a stop!

Science First® *manufactures many low-cost items that can be ordered from most science education distributors. For more information, please contact us.*