



## Curiosity Guide #509

### Electromagnetism

Accompanies Curious Crew, Season 5, Episode 9 (#509)

#### Electromagnetic Pendulum

Investigation #7

#### Description

Let's see if we can swing this!

#### Materials

- 22-gauge magnet wire
- 2 cow magnets
- Drill
- Nine-sixteenths-inch drill bit
- Saw
- Measuring tape
- Pencil
- Hammer
- Nails
- Pocket hole cutter
- Pocket screws
- 4 pieces of wooden board in the following dimensions
  - Two pieces 2 by 4 by 24 inches long
  - One piece 1 by 12 by 24 inches wide
  - One piece 1 by 6 by 24 inches wide
- Alligator clip
- Sandpaper
- Tape

## Procedures

- 1) Cut the boards to proper size.
- 2) Drill a single centered nine-sixteenths-inch hole through the face of each 2 by 4, eight inches in from the end.
- 3) Attach the 2 by 4 boards to the 1 by 12 so that they stand centered on end with 16 inches between them.
- 4) Secure with nails or pocket screws.
- 5) Cut 4 saw slots 2 inches deep into the 1 by 6. When assembled, there should be 2 cuts centered above the faces of each 2 by 4. There should be  $1 \frac{1}{4}$  inch between each pair of cuts.
- 6) Secure the top board with nails or pocket screws so that the saw slots are not covered.
- 7) Make two coils of magnet wire, each with an inside diameter of one inch, at least 50 turns and three feet of extra leads on both ends.
- 8) Final wraps of the leads can hold the coils in place.
- 9) Insert the cow magnets in the 2 by 4s and use them to position the coils.
- 10) Feed each lead up through the saw slots on both sides and bend the wires over the top of the board, so the coils are centered around the cow magnet.
- 11) Secure the bends of the wire with tape.
- 12) Cut some of the extra lead length.
- 13) Sand the enamel off the final two inches of each lead to expose the metal.
- 14) Either twist the leads together or use alligator clips to connect them.
- 15) Hold the wires in place by securing them on the top with tape.
- 16) Slide the magnets slightly back through the holes so the coils can swing.
- 17) Gently swing one of the coils from side to side.
- 18) What do you notice?
- 19) What happens if you slide out the cow magnet, reverse it and put it back?

## My Results

### Explanation

When the first pendulum swings, its movement near the magnet causes an electric current to begin to flow through the wire. The current travels to the second coil. Because a coil of wire that carries electricity acts like a magnet, it also has a magnetic field. This will either attract or repel from the second cow magnet. As soon as the second magnet begins to move, it begins another current flow that magnetizes the first coil where it reacts to that cow magnet. If either the coil or magnet on the first side is reversed, it will also change the swinging direction of the second coil.

**Did you know?** A coil of wire that carries electricity is also called a solenoid.

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