Cow Magnet

Introduction

Use a cow magnet to demonstrate a three-dimensional magnetic field, the amount of iron in breakfast cereal, and to show in an unusual way that not all metals are magnetic.

Materials

- Beaker, 1-L
- Blender
- Cotton ball
- Cow magnet
- Iron filings
- Iron fortified breakfast cereal (e.g., Total®, Special K®, etc.)
- Metal strips, various (e.g., Fe, Ni, Al, Cu, Pb)
- Paper clip
- Plastic bottle with cap, 0.5-liter
- Plastic cup, clear
- Plastic spoon
- Tape
- Test tube (to fit plastic bottle)
- Thread
- Support stand and clamp
- Water, distilled

Safety Precautions

Do not ingest the cereal or water used in this demonstration. Once food is introduced into a laboratory setting, it should be considered a chemical and no longer a food item. Keep magnet away from computers and computer screens and other electronics. Use care when handling strong magnets. The magnet can quickly snap to any magnetic object, resulting in pinched fingers or cracked magnets. Wash hand thoroughly with soap and water before leaving the classroom or laboratory. Please follow all laboratory safety guidelines.

Procedure

Activity 1

1. Measure four tablespoons of iron fillings into a half-liter clear bottle.
2. Obtain a 22 × 175 mm test tube and place it in the bottle. *Note:* A 22 × 175 mm test tube is optimal but 20 × 150 mm will also work.
3. Make sure the test tube does not slide all the way in and the lip stays at the top of the bottle so you can still screw the cap on.
4. Push about one half of a cotton ball into the test tube.
5. Slide the cow magnet down into the test tube.
6. Put the cap on the bottle and rotate the bottle around, dispersing the iron filings.
7. You have now created a three-dimensional magnetic field.

Activity 2

1. Clamp the cow magnet to a stupport stand.
2. Tie a paperclip to a string and tape the string onto the bottom of the ring stand. Measure the string so the paperclip reaches about 1 cm below the magnet.
3. The paperclip will appear to hang in the air.
4. Obtain various metal strips such as aluminum, copper, iron, lead, nickel, and zinc.
5. Choose one metal strip and, holding one end, pass the other end through the space between the paper clip and the magnet. Do not allow the metal to touch either the magnet or the paper clip.
6. Have students observe any change in the position of the paper clip.
7. Repeat steps 5 and 6 with each of the other metal strips.

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Activity 3

1. Place one cup cereal and one cup of iron-fortified water in a blender and blend until smooth.
2. Pour the slurry into a clear plastic cup and, while holding one end of the magnet to the side of the cup, stir the slurry slowly with a white plastic spoon (see Figure 2).
3. A dark spot will soon appear where the iron filings from the cereal congregate on the inside of the cup. The back of the spoon may be held behind the spot to make it more visible. *Note:* If the blender walls are not too thick, you may be able to forego the cup and just hold the magnet alongside the blender as it blends!

Disposal

The water and milk may be rinsed down the drain. The soggy cereal should be placed in the trash.

Discussion

Cow magnets are used by farmers to pick up iron such as bailing wire, etc., that a cow may ingest. If eaten, this iron can actually pierce the cow's stomach and do damage to vital organs. In fact, the problem of ingested iron has a name, Hardware Disease. The magnet keeps the iron in the center of the stomach reducing the chance of metallic objects piercing the wall of stomach.

Acknowledgments

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The *Cow Magnet* is available from Flinn Scientific, Inc.

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Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.