



Magnetic Shielding

magnetic lines stop here

materials

- **Radioshack™ donut magnet** (rectangular magnet works fine)
- **Two pieces of cardboard** (about 5 x 7 cm)
- **Two 1/4- inch dowels, 7 cm or longer** (pencils work fine)
- **Five or six paper clips**
- **Popsicle stick, straw, any nonmetallic material**
- **Strip of metal strapping tape** (or a butter knife)
- **Hot glue gun** (Elmer's™ glue or rubber bands are fine)



assembly

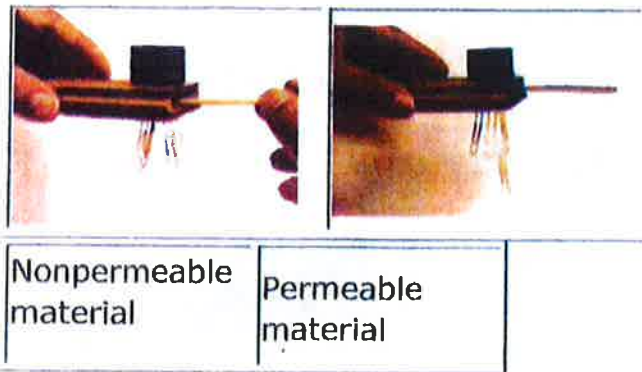
Attach dowels (or pencils) to one piece of cardboard. Placing the dowels close to the edges will give you more room to experiment. Attach the second piece of cardboard to the dowels so that you end up with a "cardboard-dowel-cardboard" sandwich. Hot glue (or tape) the magnet onto the top piece of cardboard. For the best results, center the magnet near the edge.

to do and notice

Raise the paper clips up to the bottom of the shielding sandwich one at a time and notice what happens. The paper clips should be attracted to the magnet on the top piece of cardboard and will hang from the bottom of the cardboard sandwich. If this does not happen, the magnet may be too weak, the pieces of cardboard too thick, or the dowel thickness too large. In any case, you can remedy this situation by adding another magnet to the first one. As you add more paper clips, notice what happens. If you add them carefully, they will arrange themselves so that they are evenly spaced. Insert the popsicle stick into the shielding sandwich, move it around, and notice what happens. The paper clips should be unaffected. Now insert the metal packing strap (or butter knife) into the shielding sandwich, move it from side to side and notice what happens. The paper clips should fall off. Try experimenting with various metallic coins and different materials. Make a list of the materials you tested and what happened.

what's going on?

The magnetic field lines (see below) from the magnet pass through the cardboard and air. Materials like the popsicle stick that allow magnetic lines of force to pass through them are called *nonpermeable*. The metal strapping tape (or butter knife) acts as a magnetic shield. The force lines coming from the pole of the magnet do not pass through the metal strap. Instead, they are gathered in, travel down the metal strap, and re-enters the magnet at the other pole. Materials that gather magnetic lines of force are said to be *permeable*. Only magnetic materials are permeable.



etcetera

Scientists model magnetic forces using field lines. A compass lines up along a field line, so you can trace field lines with a compass. Iron filings also line up along field lines. By sprinkling iron filings on a piece of paper laying on top of a magnet (or a couple of magnets), you can see the field lines. Field lines are defined as coming from the north pole of a magnet and returning to the south pole. Magnets have field lines that exert a force on magnets or iron. If there are no field lines, there is no force, the result is magnetic shielding.

For more magnetic activities check out the snackbook.

Original idea from Janice Van Cleeve's "ELECTRICITY AND MAGNETISM" activity book.

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No material

Nonpermeable material

Permeable material

