Digging for Buried Treasure

Mapping the Hidden Metal

Topics: Coordinate Pairs, Mapping, Magnetism

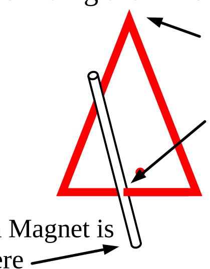
Materials List
(for 1 set-up)
- ✓ Corrugated cardboard ~10 cm x 20 cm (~4" x 8")
- ✓ 5-10 Chenille stem pieces ~1 cm (1/2")
- ✓ Chenille stem, 15 cm (6")
- ✓ Tiny, rare earth magnet
- ✓ Large stir straw, ~4 cm (~1½" long)
- ✓ Thinner stir straw
- ✓ Hole punch 3 mm (⅛")
- ✓ Optional: graph paper (for data)

This activity can be used to teach:
- Graphing & coordinates (Common Core Math Standards: Grade 5, Geometry, 1, 2)

Next Generation Science Standards
- Properties of materials (Physical Science, Grade 2, 1-1, 1-2; Grade 5, 1-3)
- Electric or magnetic interactions (Physical Science, Grade 3, 2-3; Middle School, 2-5)
- Magnets (Physical Science, Grade 3, 2-4; Middle School, 2-3)

Coordinate mapping and a pivoting magnet are utilized in a search for buried "iron treasure chests," modeling a real world use of magnetism and coordinate math!

Assembly (Directions for the teacher or students)
1. Draw and label a coordinate grid onto each piece of cardboard. For younger students, use a 2 cm (3/4") grid; for a greater challenge, use a 1 cm (3/8") grid.
2. Use a 15 cm (6") piece of chenille stem to shove the 1 cm (½") chenille stem pieces into the top layer of holes in the cardboard, thus hiding them from view.
3. Create the metal detector by inserting the rare earth magnet into one end of the larger stir straw. Punch a 3 mm (⅛") hole in the larger stir straw about 1 cm (½") away from the magnet and insert the thinner stir straw into the hole. Bend the 2 ends of the thinner stir straw to form a triangle, as shown.



To Do and Notice
1. Use the metal-detector to search each square of the coordinate grid by holding the ends of the thinner straw and moving the magnet over each square. When the magnet is near the magnetic metal (iron) core of the chenille stem piece, the straw containing the magnet will pivot as it passes over the "treasure".
2. Note the metal locations on graph paper, in a science journal or in a notebook.

The Content Behind the Activity

17th century French mathematician Rene Descartes developed coordinate graphing as a means of identifying and analyzing locations. Coordinate graphing can be used for mapping and data collection/analysis. Geologists and city planners use it when they survey land. Archaeologists use it for mapping and planning dig sites.

Commercial metal detectors generate electromagnetic pulses that induce magnetic fields around buried metal objects. They can detect magnetic and nonmagnetic metals such as gold and silver. The detectors are based on 1 of 3 methods that can generate electromagnetic pulses and then detect the buried metal's magnetic field (see website below for details). The simplified "metal detector" in this activity uses a tiny, but strong, magnet that has a permanent magnet field around it. This magnetic field causes hidden iron pieces to become a temporary magnet having poles with an opposite orientation. The resulting attraction of the nearer, opposite poles makes the magnet end of the pivoting straw move toward the piece of iron that is "buried."

Web Resources (Visit www.raft.net/raft-idea?isid=122 for more resources!)
- For more on how metal detectors work, visit How Stuff Works at: http://home.howstuffworks.com/metal-detector.htm
- For more information on Cartesian coordinates, visit Math World at: http://mathworld.wolfram.com/CartesianCoordinates.html

resource area for teaching
www.raft.net

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