



Teacher Lesson Plan 2

Magnetic Forces of the Unknown

Overview

Students will characterize unknown objects that are placed inside observation boxes. Students use magnet probes to determine if the object contains materials that attract, repel or are indifferent to magnets. After recording magnetic attraction, students create a scan of the object's surface. Using these scans students determine the object's structure.

Time Frame

25 - 45 minutes

Objectives

Students will

- Record the magnetic attraction, repulsion or indifference of the object inside the box
- Draw a scan to show areas of attraction
- Analyze the scan to describe the structure
- Critique the magnet probe and how it is used.

Materials

For the Teacher

- ❑ Scoring Guide 2 for yourself
- ❑ Scoring Guide 2 for each student (optional)
- ❑ Scoring Guide 2 for overhead

One set of materials per group of 2-3 students:

- ❑ Observation box: Small shallow cardboard box (approximately 3×3×2) such as a jewelry box
- ❑ Random objects that fit into the box that are attracted to or repelled by magnets
- ❑ Student Guide 2 (one for each student)
- ❑ 3 pieces of scan paper or graph paper
- ❑ Ruler
- ❑ Pen
- ❑ 4 Small but strong magnets
- ❑ Scissors

For the class:

- ❑ Glue Gun
- ❑ Decorating Material - crayons, markers, construction paper, tape, etc. (Optional)
- ❑ Tape

Getting Ready

Each group will characterize an unknown object(s) that you have put in their observation boxes. Gather the materials that the students will use for the activity. The objects that go inside the boxes should attract or repel magnets. If you are using the same object or group of objects that you used in Lesson 1, you will be able to more thoroughly characterize the object.

Object ideas:

- ball of paper with a paper clip taped on the bottom



Probing the Unknown

- an assortment of paper clips taped to the bottom of the box
- other magnets
- soup or tuna cans

or

Option 2: Obtain objects with similar magnetic properties that have different shapes. For example, you can use canned foods. For comparison, have two or three of the same objects in different boxes. In doing so, you will see the different interpretations of the same object.

It is important that the object with the magnetic attraction is securely taped to the bottom of the box. If you have a strong magnet, it can move the objects. If there is paper or plastic in the box, it should be on top of the metal that is attracted to or repelled by the magnet probe since the magnet probe will be used from the bottom of the box. You may want extra scan sheets for unforeseen mistakes.

Due to the magnetic field created around magnets, students will feel attraction increase as the probe is moved closer to the object. This could complicate characterization of the object if students are not familiar with magnetic fields. Students may assume that the object is made from much more metal than it is. Suggestion: allow students to play with magnets for a few minutes to determine their properties before you begin the activity. If you have permanent magnets, you may use these to show attracting and repelling forces. Again, your unit of study should determine to what depth you use the magnets.

Motivator

Give each student group 1-2 magnets. Give them a few minutes to explore with them. Then *ask*: *What are the properties of magnets? When can they do? Is there any way to predict that a magnet can pick something up or stick to something before it actually does?* This should help define magnetic fields. Even if you choose not to use the word “magnetic field,” students should have the idea that a force from the magnet is felt before it is attached to an object.

Hold up your observation box. *Ask the students: How can I determine if there is any material that is attracted to a magnet in my box?* Students should have an idea of dragging a magnet along the bottom of the box and recording the magnetic force on the scanning guide.

Distribute Student Guide 2. Explain to the students that in lesson 1 they characterized an object based on the surface height. Now they are going to add magnetic attraction to help them characterize their objects.

Using the Magnet Probe

Student Guide 2, Procedures 1-3

Model how to drag the magnet slowly and systematically over each square. If you have magnets inside the boxes, you may want to try dragging the magnet in different ways. You may want to set a range of forces such as strong, really strong, or weak. Make sure the students are recording their data on their scan sheet in the corresponding box that shows a magnetic attraction or repulsion.



Analyzing your Data

Student Guide 2, Procedures 4-5

Students should write about the structure of their object and the effectiveness of the magnet probe. This should not be as difficult as the height probe. If students are using the same object as in Lesson 1, you may want them to record their data and add to their description on Student Guide 1.

Wrapping it Up

Go around the room and monitor the students to keep them on task. Five minutes before the end of lab, tell the students that each group should elect a presenter to describe what they think is inside the box and why.

- 1) Ask each group to describe what they believe is inside of the box. Pick a student from different groups to respond and write the characterization on the board. Or, instead of using the board, give each group an overhead sheet and an overhead marker. If some groups have the same materials ask them to explain their materials first.
- 2) Once the groups with the same objects characterized their objects, have those students open the boxes. Show the students the diverse responses on the board of the same object. Ask them why there were such differences (if any).
- 3) Repeat this for all groups of objects.

Conclusion

1) Gather the students' attention and ask them:

"What and how did you learn about the materials and shape of the object inside of the box by using the two probes?"

- 2) Pick a student from different groups to respond and write the responses on the board.
- 3) Tell the students that the process they used to determine the shape and type of material used is called characterization. Define characterization: the process of determining the properties and/or structure of material.