# Magnetic Mapping

## *Overview:*

The electric energy in the aurora creates a magnetic field that can affect navigational compasses. Students use a compass to identify magnetic fields in the classroom.

## *Objectives:*

The student will:

- determine which classroom objects have a magnetic field and which objects do not have a magnetic field;
- understand that navigational compasses usually point to Earth's geomagnetic north pole;
- understand that magnetic fields from objects on Earth such as electrical equipment and appliances can affect navigational compasses; and
- understand that the magnetic field created by the aurora can affect navigational compasses.

## *Materials:*

- Small magnetic (navigational) compasses that show degrees
- Magnetic and non-magnetic objects
- Sticky notes
- STUDENT WORKSHEET: "Magnetic Mapping"

## *Answers to Student Worksheet:*

*Data table: (answers will vary depending on objects selected)*

1. *true*
2. *B) an aurora*
3. *because the aurora generates a magnetic field.*
4. *C) the geomagnetic North Pole*


**What is a Global Needle?**

In order to get an accurate reading from a compass, the compass needle needs to be "balanced" in the capsule, so it does not drag on the top or bottom of the capsule. Because the horizontal and vertical components of Earth's magnetic field vary considerably in different locations, a compass needle that balances perfectly in North America will drag or stick in South America. As a result of these magnetic variances, the compass industry has divided Earth into 5 "zones." Most compass needles are balanced for use in the zone in which they are sold. A ***Global Needle*** will perform perfectly with needle tilts of up to 20 degrees. This allows a single compass to be used effectively in all 5 of Earth's zones.

 

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## *Activity Preparation:*

**Teacher's Note:** We are surrounded by magnetic influences (metal objects in the classroom such as desks, equipment, building materials, etc.) that will affect the compass needle.

1. Select a variety of objects for this activity and place them along one wall of the classroom. Some of the objects should have a magnetic field and some should not have any detectable magnetic field. Objects with a magnetic field include a computer monitor, an electrical outlet, a hot plate, a magnetic screwdriver, etc.
2. Students will use navigational compasses to identify the magnetic fields in the classroom. Use a sticky note to mark the location near each object where students should place their compass to record results. Write a number on each sticky note. Students will use these "Station Numbers" when completing STUDENT WORKSHEET: "Magnetic Mapping." Be sure to place sticky notes close enough to the object for the compass to detect a magnetic field.
3. Choose one object (with a magnetic field) to demonstrate how to complete this activity.

## *Activity Procedure:*

1. During this activity, students will use compasses to find objects around their classroom that have a magnetic field. Explain that magnetic fields created by objects on Earth and in Earth's atmosphere can interfere with the ability to detect Earth's magnetic field using a compass. For example, the electricity generated by the aurora creates a magnetic field.
2. Distribute compasses and demonstrate compass use by asking students to stand in an area free of outside magnetic forces. With the compass held level, ask students to turn in a circle until the needle of the compass is facing directly away from them, toward the geomagnetic North Pole. Write "magnetic north" on a piece of paper. Tape it to the wall in the direction students are facing.
3. Distribute the STUDENT WORKSHEET: "Magnetic Mapping" and demonstrate how to determine if an object has a magnetic field using a compass. Ask students to place the compass on the sticky note near one of the objects set out during Activity Preparation, and then record how many degrees the compass needle moved.
4. Explain that if the compass needle continues to point toward magnetic north, the object has no magnetic field. If the compass needle points away from magnetic north, the object has a magnetic field. Show students how to read their compasses and record data on their worksheets.
5. Determine the direction students will circulate through the classroom. Ask them to spread out and move from item to item, recording each object's magnetic field information on the chart. (*There is no need to adjust the compass for "true" north versus magnetic north during this activity.*)
6. Discuss student results. Which objects had a magnetic field? Which did not? What should students take into consideration when using a compass for navigation?

 

**Name: _____** **Student Worksheet**

# Magnetic Mapping

**Directions:** Electrical energy in the aurora creates a magnetic field that can affect navigational compasses. Many objects on Earth have their own magnetic fields. Use a compass to find objects in the classroom that have magnetic fields. In the chart below, write the name of each object, then draw the direction of the compass needle and record how many degrees the needle moved when standing near the object. Does the object have a magnetic field?

| Station Number | Object | Com-pass Needle | How many degrees did the compass needle move? | Magnetic Field (check one) | |
|---|---|---|---|---|---|
| | | | | Yes | No |
| *Example #1* | *Computer Monitor* |  | *340°* | *X* | |
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1. True or False: The aurora creates a magnetic field.

2. Which of the following can affect the direction a compass needle points?

   A) a geographic field
   B) an aurora
   C) a large body of water
   D) a point on the globe

3. Why might compass readings during a large auroral display be off their mark?

   _____

4. Navigational compasses point toward:

   A) the North Pole
   B) the geographic North Pole
   C) the geomagnetic North Pole
   D) the geographic/geomagnetic North Pole

 