

WHAT'S MY LINE?

BENCHMARK and TASK

SC.B.1.2.4 The student knows the many way in which energy can be transformed from one type to another.

- The student investigates the basic principles of magnetism and relates them to the earth's magnetic fields.

KEY QUESTION

Where are the magnetic field lines of a magnet?

BACKGROUND INFORMATION

A **magnetic** field exists in a magnet and in the space around it. The magnetic field is strongest near the poles. The shape of a magnet's magnetic field is shown by the magnetic field lines that spread out from both poles and meet in a series of extended arcs. The magnetic field lines may also be called flux.

The earth acts as if there were a large bar magnet running from north to south through the middle of it. The earth does have magnetic north and south poles and a magnetic field, but the magnetic north pole is not at the earth's geographic north pole; it moves constantly at a rate of about fifteen miles per year.

MATERIALS

Teacher

2 magnets
1 compass (if poles of magnets are not marked)
iron filings
1 small, clear jar with lid
cooking oil

Per pair of students

rod or bar magnet (1 per student)
iron filings (or steel wool)
What's My Line? activity sheet
1 map with a global view of the earth
1 blank transparency
variety of magnets: bar, ring, horseshoe

Per student

science journal
safety goggles (if handling iron filings)

TEACHING TIPS

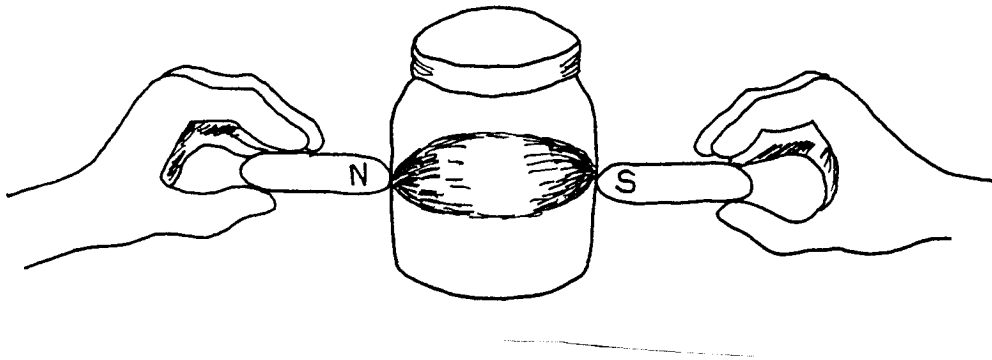
1. Although it may be less effective, you may place a plastic sandwich bag with iron filings on top of the transparency and magnet, instead of sprinkling the iron filings directly on the transparency.
2. If iron filings are not available, rub two pieces of steel wool together above the magnet, and the magnetic lines of force will also be revealed. (Caution: The bits of steel wool can irritate your skin.)
3. Caution students to be careful when working with iron filings. The filings could irritate the eye if students handle the filings and then touch their eyes.

ENGAGE

1. Allow time for students to explore with the magnets and share their findings.
2. Review the terms – attract and repel.
3. Ask: *Does your magnet attract or repel your partner's magnet?*
How many poles do magnets have?
Where are they located?

4. Teacher Demonstration:

If necessary, use a compass to identify the north end of one magnet and the south end of another. Fill a small jar with cooking oil. Add some iron filings to the jar. Cover the jar tightly and shake it to disperse the iron filings. Immediately hold two magnets on either side of the jar with opposite poles touching the jar. The magnetic field around the ends can be easily observed.



EXPLORE

1. Tell students to place the bar magnet on the table and lay the transparency over it.
2. Have students gently sprinkle the iron filings onto the transparency so that the magnetic field lines are revealed. (Note: It is very important for students to sprinkle the iron filings near the poles.)
3. Instruct students to draw the magnet and the magnetic field lines on the *What's My Line?* activity sheet.
4. Have students repeat the investigation using pairs of magnets side-by-side, first with unlike poles together and then with like poles together. Compare the results.

EXPLAIN

How would you describe the pattern formed by the iron filings?

Where were the lines closest together? What do you think this means?

Where were the iron filings the most concentrated?

Where were there fewer iron filings?

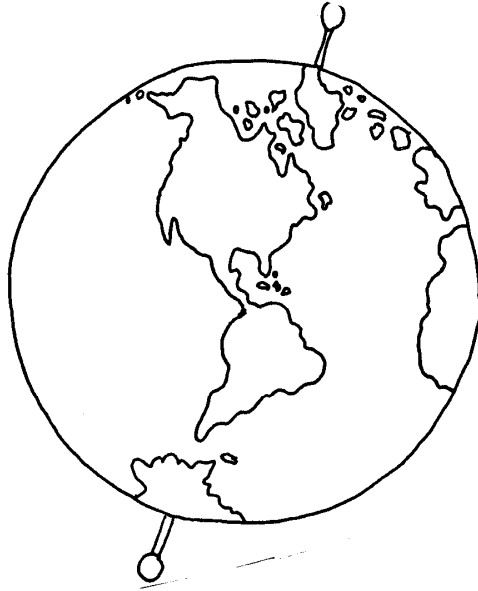
What do magnetic field lines reveal?

Which part of the magnet do you think has the strongest magnetic power?

EXTEND/APPLY

1. Students can illustrate the earth's magnetic field lines using a map, a magnet, a transparency and iron filings. Distribute materials to groups.

- Instruct students to place a bar magnet on the table. Have them place a map showing a global view of the world on top of the magnet and cover the map with a transparency. Students should then sprinkle iron filings on the transparency until the magnetic field lines are visible.



- Repeat the activity several times.
- Ask:
Where on the map were the most iron filings concentrated?
Which part of the earth has the strongest magnetic power?
Do the magnetic field lines fall in the same place each time?

EXTENSIONS

- Instruct students to repeat the investigation using a magnet of a different shape.
- Substitute blueprint paper for the transparency. After the magnetic field lines are formed, place the entire experiment in the sun for 3-5 minutes. Bring the paper inside, shake off the iron filings, and rinse the paper in water. The magnetic field lines will be visible on the paper.

ASSESSMENT

Have students record in their science journals what they have learned about the magnetic field lines of a magnet.

WHAT'S MY LINE?



1. Place a bar magnet on the table and cover it with a transparency. Sprinkle iron filings on top of the transparency. Draw a picture to show the magnetic field lines. Be sure to label the poles of the magnet.
2. Place two bar magnets side-by-side with unlike poles together under a transparency. Sprinkle iron filings on top of the transparency. Draw a picture to show the magnetic field lines. Label the poles of the magnet.
3. Place two bar magnets side-by-side with like poles together under the transparency. Sprinkle iron filings on top of the transparency. Draw a picture to show the magnetic field lines. Label the poles of the magnets.