X...The Earth as a Magnet

Introduction:

What is the Earth's magnetosphere? Scientists call the region surrounding the Earth where its magnetic field is located, the Magnetosphere. When the solar wind sends streams of hot gases (plasma) towards the Earth, the magnetosphere deflects most of this gas. Students will use hands-on experiences to learn about the magnetosphere (the magnetic field surrounding the earth). They will learn how the solar wind (the stream of electrically conducting plasma emitted by the sun) interacts with the magnetosphere. There is a wonderful animated graphic available for this in the Blackout! Video (information available through the IMAGE/POETRY site at http://image.gsfc.nasa.gov/poetry/

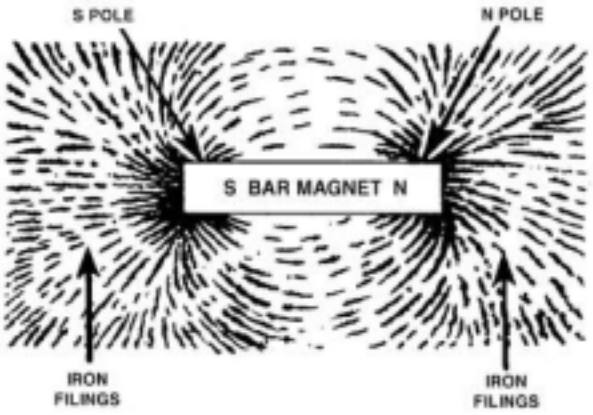
or at the Windows on the Universe site at www.windows.umich.edu/spaceweather/mag_

Objectives:

- The students will use models to learn about the earth's magnetosphere.
- The students will use models to learn how the solar wind interacts with the magnetosphere.

Key Terms:

Magnetosphere – magnetic cavity carved out of the solar wind by virtue of the magnetic field surrounding earth.



Materials:

Magnets– strong polarity bar magnet (enough for groups if possible)

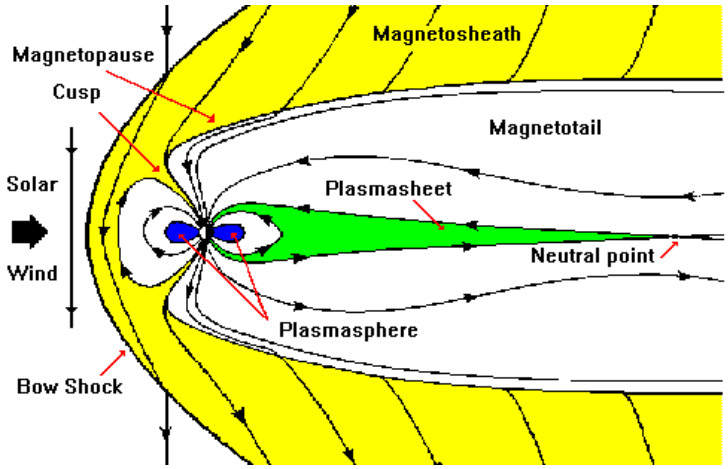
Plastic wrap

Iron filings

Plastic salad tray or aluminum tray

Straws

Safety goggles



Procedure:

What protects the earth?

- The earth has a protective cover called the magnetosphere. It works as skin does on your body to keep out harmful things. Students can observe a model of the magnetosphere using magnets and iron filings. To keep your bar magnet clean, wrap it in plastic wrap with tape around it, or put contact paper around it. Place a bar magnet under a plastic salad tray or aluminum tray. Sprinkle some iron filings onto the tray from a distance of about 10 inches. Observe the pattern made by the iron filings held in place by the forces between the opposite poles of the magnets. The earth's magnetosphere can be modeled by blowing softly through a straw towards the magnetic field lines. A squishing of the field lines on one side of the model shows how the earth's magnetosphere looks. Have the students draw the model of the earth's magnetosphere in their learning logs.

What happens when the solar wind approaches the earth's magnetosphere?

- Students can observe the way water flows around a stone as a pattern of the solar wind as it flows around the earth.

- Place the bar magnet under a plastic tray or aluminum tray. Place a small button directly above the center of the magnet to model the earth. Sprinkle the iron filings along the edge of one side of the tray covering the magnet. Softly blow the filings toward the button through a straw. Caution the students to blow carefully so that no iron filings get into eyes or mouth! Depending on the force used in blowing, the filings will be trapped in the magnetic lines of force. Compare this to the trapping of the solar particles by the Earth's magnetosphere. Have the students draw the model of the effects of the solar wind on the earth's magnetosphere.

Conclusions:

The students will gain an understanding of the earth's protective region, called the magnetosphere. The students will gain an understanding of how the earth's magnetosphere interacts with the charged plasma sent from the sun in solar wind and CMEs.

Culminating Activity :

Grades K-2

The students will work as a class or in groups with an adult to write the story of a charged particle in the plasma of the sun as it makes its way to the earth. The story could be written on chart paper or made into a book with student illustrations. Story events should include, coming from activity on the sun's surface, being organized with other particles in the magnetic fields of the sun, and the type of phenomena that took the particle away from the sun.

Grades 3 - 6

The students will work as a class, individually, or in-groups to write a story or rap song about a charged particle in the plasma of the sun. Story events should include; coming from activity on the sun's surface, being organized with other particles in the magnetic fields of the sun, the type of phenomenon that took the particle away from the sun and what occurred when the plasma approached the earth's magnetosphere.