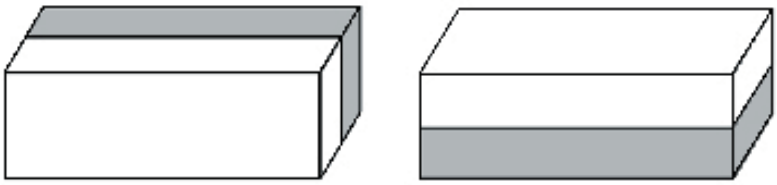
NORTH & SOUTH POLES—NOT JUST POLAR BEARS AND PENGUINS!

PLANNING YOUR EXPEDITION

Mark the set of blocks before you begin this activity (see Appendix B for directions).

Reinforcing the idea that opposite poles attract and like poles repel one another, this activity requires that students use this information to figure out the pole alignment of wand magnets (the poles on these magnets are different than some of the others they have been using). They first use their sets of blocks as models and then attempt to identify the poles on the magnets. This will be particularly useful in Expedition 15, "Build a Simple MagLev Train Model." This activity asks students to rethink their conception of where poles are located on a magnet.



There are three possible ways that the two poles can be positioned within a magnet. These arrangements are modeled by the sets of wood blocks. Students may or may not need to model the position of north and south poles. Some students will move directly to investigating the wand magnets themselves.

1. In response to questions on the Itinerary, students will predict the behavior of magnets and write the predictions in the Alpha Log.
2. After several attempts at predicting the behavior of magnets of different configurations, students will explain the location of the poles in the wand magnet. The poles are not "top and bottom," but are one side and the other.

BACKGROUND INFORMATION

Materials exhibit certain characteristics because of the way in which the atoms that make up the material are aligned. In order for a material to be magnetic there must be moving electrons. Materials with magnetic qualities have domains which are each made up of billions of atoms. The way in which these domains are configured determines the magnetic ability of the material. For instance, if the domains are mostly aligned (the atoms are all pointing in the same direction), the material will exhibit strong magnetic characteristics.

Each magnet has a north and south pole -- the regions on the magnet where the magnetic force is the greatest. Like poles repel and opposites attract. Scientists have attempted to isolate one of the poles but have been unsuccessful. If a magnet is cut in half, two magnets, each with a north and south pole, are created. No matter how small, each piece will still have a north and south pole. The smallest magnet is an atom with its electrons orbiting a nucleus.

Magnet strength depends on several factors:the material from which the magnet is made, how the magnet is made, and how the magnet is treated. Some materials like lodestone (which contains iron) are found naturally in the earth and have magnetic properties because when it formed, all of the tiny magnets lined up (north poles facing in the same direction).

EXCURSIONS

Have students read "The Wind From the Sun" by Arthur C. Clarke, in Science Fiction Stories edited by Edward Blishen, 1988 Kingfisher Books, NY (ISBN 1-85697-889-3). Students will compare and contrast the design problems that Merton had and those that they have experienced in science class and other classes.

SC.B.1.3.1-5, 2.3.1, SC.C.2.3.1-2, SC.E.3.1.4, SC.H.2.3.1, 3.3.5-7

LA.A.1.3.1-4, 2.3.1-8, LA.D.1.3.1-4, 2.3.1-2, LA.E.1.3.1-5

Assign "Reinventing the Wheel" (found in Autoweek, March 3, 1997). After reading the article, have students relate the flywheel technology to the concept of like poles repelling like poles and opposite poles attracting each other. Students will write a short review of the article addressing this issue. Students will make the connection between classroom explorations and real-world applications.

SC.H.1.3.1-3, 3.3.5-7

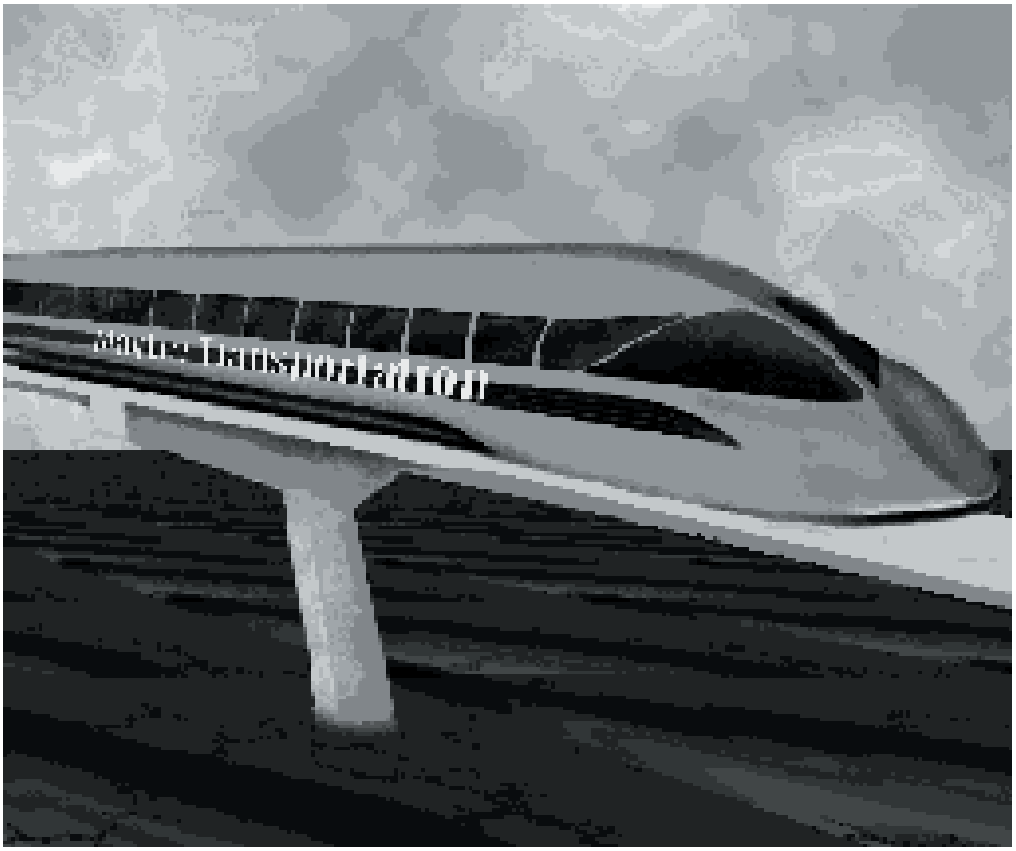
LA.A.1.3.1-4, 2.3.1-8, LA.B.1.3.1-3,

2.3.1-4, LA.D.1.3.1-4, 2.3.1-2

Research current technology (trash separators, MagLev trains) that use the principle of likes repelling and opposites attracting. Students will develop a way to present the results of their research to the class; a poster, written report, oral report, or computer presentation, would be appropriate. Encourage students to make phone calls, explore the Internet, and research current magazines (Popular Science, Autoweek, Discover, etc.) for articles. Students will articulate to their classmates how classroom science is being used in practical applications.

SC.D.2.3.1-2, SC.G.2.3.3-4, SC.H.1.3.1-3, 3.3.5-7

LA.A.1.3.1-4, 2.3.1-8, LA.B.1.3.1-3, 2.3.1-4, LA.D.1.3.1-4, 2.3.1-2



Notes:

FOR YOUR PLANBOOK: North and South Poles - Not Just Polar Bears And Penguins

Suggested Time: 1 hour

Gear: 2 wand magnets per group, 1 set of blocks (colored)

National Science Content Standards: A, B, G

Sunshine State Standards Benchmarks: SC.C.2.3.1, SC.C.2.3.2, SC.C.2.3.3, SC.H.1.3.1, SC.H.1.3.4, SC.H.1.3.5, SC.H.1.3.7

Sunshine State Standards Benchmarks -- Language Arts: LA.B.1.3.1-3, 2.3.1-4, LA.D.2.3.1-2, LA.E.1.3.5

Homework: Have students attempt to answer the following question: How could I turn a Slinky into a magnet?

Homework Assessment: Student responses should have some mention of electric current being passed through the coils of the slinky. This answer will reiterate the fact that moving electrons produce a magnetic field. If students also add that a permanent magnet placed in the coils would produce a stronger magnetic field, that indicates a deeper level of knowledge. Additionally, if students deal with insulated versus noninsulated wire or mention superconducting wire as having little resistance to the flow of electricity, then students have demonstrated mastery of the concept.

Assessment: Student Alpha Logs reflect their knowledge that "likes repel; opposites attract." Drawing the poles of wand magnets demonstrate that students have recognized that poles can be located in positions other than "top and bottom." The Log work allows those students who were still unsure of this concept to revisit it with yet another model.

Have students write a science fiction story that uses the concept either of poles being in different configurations on magnets (not always top and bottom) or of opposites attracting and like poles repelling. If they need a "story starter," you could use the Excursion from "What Is A Magnet?": Write a fiction story about a sports team that is affected by an invention that magnetizes some aspect of their game (for instance, a magnetized basketball hoop and basketball). Or, an alien visits Earth and is examining a magnet; how would you explain it to someone with absolutely no knowledge of magnets?

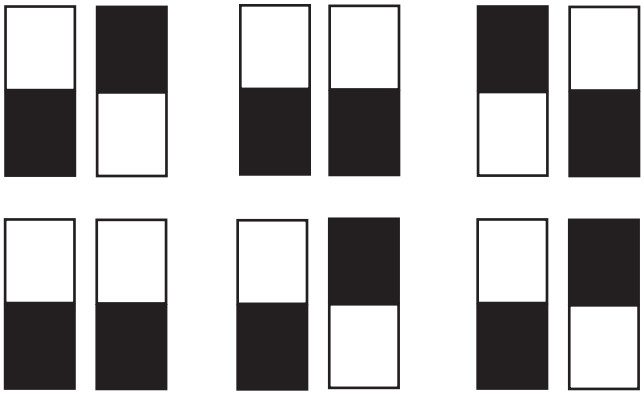
Have students design a piece of jewelry that uses magnetism in its construction. The results could be displayed by diagram or in writing and should include materials used in making a prototype. Products will reflect student understanding of forces acting at a distance and through certain materials; design will take into consideration magnet strength, etc.

NORTH AND SOUTH POLES -
NOT JUST POLAR BEARS AND PENGUINS!

Itinerary

In this activity, your group will be looking at the arrangement of a wand magnet to determine how the poles are aligned. Each magnet has a north and south pole, the regions on the magnet where the force is the greatest. Like poles repel and opposites attract. Scientists have attempted to isolate one of the poles but have been unsuccessful. If a magnet is cut in half, two magnets each with a north and south pole are created. No matter how small, each piece will still have a north and south pole. The smallest magnet is an atom with its electrons orbiting a nucleus.

There are three possible ways that the two poles can be positioned within a magnet. These arrangements are modeled by the three sets of wood blocks that you have. Examine each magnet. Where are the poles? You probably cannot tell just by looking at it. The magnets you have are not divided into colored regions indicating their poles. So, how can you figure out how the poles are arranged in your magnets? Answer these two questions in your Alpha Log in the form of a prediction.



1. The diagram shows your magnet models in certain arrangements. Draw arrows to show the direction each magnet would move if placed next to another magnet as indicated.

2. Choose one set of wood models. Begin by placing the two blocks together with the colored surfaces facing each other. What do you think would happen if these were actual magnets? Record your prediction in your Log.
3. With the same set of blocks, place the colored surface of one block next to the uncolored surface of the other block. What do you think would happen if these were actual magnets? Record your prediction in your Log.
4. Repeat steps #2 and #3 with the other two sets of wood blocks. Be sure to record your predictions in your Log.
6. How are the polar regions arranged in your magnet? Draw a picture of a wand magnet in your Log, indicate the poles and draw the magnetic field lines.