Correlations to National Standards

The video activities and content address the following National Science Education Standards or The Benchmarks for Science Education *

National Science Education Standards

1. Magnets attract and repel each other and certain kinds of other materials.

The Benchmarks for Science Education

1. Magnets can be used to make some things move without being touched.

2. Without touching them, a magnet pulls on all things made of iron and either pushes or pulls on other magnets.

Glossary

Lodestone - is composed of the mineral magnetite, black iron oxide, Fe3O4, which often occurs with magnesium, zinc, and manganese and is an important ore of iron.

Magnetic field - is a detectable magnetic force at every point in the region around a magnet or electromagnet with two magnetic poles allowing magnetic forces to act over a distance.

Magnetic Force - is the attracting or repelling force exerted between magnetic poles that can act over a distance.

Magnetic Dipole - or magnetic domain is a region in a ferromagnetic material in which the individual atomic or molecular magnetic particles are aligned in the same direction. When a magnetic material is not a permanent magnet, these magnetic domains are aligned in different directions, but when under the influence of a strong magnetic field, they line up to form a magnet.

Magnet - is an object that is surrounded by a magnetic field and that has the property, either natural or induced, of attracting materials containing iron, nickel, or cobalt.

Magnetic Induction - is the magnetism that is produced in another substance, such as iron or steel, by the force of the field radiating from the poles of the inducing magnet.

Magnetic North - is the direction of the earth's magnetic pole that is close to but not coinciding with the geographic North and South poles, where the earth's magnetic field is most intense, to which the north-seeking pole of a magnetic needle points when free from local magnetic influence.

Review and Extension Questions

1. Describe how the poles of two bar magnets must be arranged so that they attract each other and so that they repel each other.

2. Describe evidence that magnets can be used to make some things move without being touched.

3. Is the magnetic field of a bar magnet stronger or weaker than the Earth's magnetic field? Describe evidence that you feel supports your answer.

4. List five kinds of metals that are not attracted to magnets.

5. Describe evidence that supports the idea that magnetism can pass through paper, wood, a notebook, a table, or other similar thicker materials.

6. Describe how you could show that an electromagnet produces a magnetic field similar to a bar magnet.

7. Describe evidence that the pattern of lines surrounding a bar magnet shown by iron filings are a three-dimensional field and not just two-dimensional.

8. The mineral magnetite, also called loadstone, is an important ore of iron. What is magnetite used for?

9. How are the properties of electricity similar to the properties of magnetism and how are they different?

10. Describe several ways that bar magnets, as well as other types of magnets can lose their magnetic strength.

Science Fundamentals

The Earth Is a Giant Magnet

Magnetism

KF521

TEACHER'S GUIDE

Video Purpose

This video is designed to develop students' understanding of the concept of magnetism and its properties by using common examples that motivate students to learn more. This video may be used to introduce new concepts, to support learning activities, or to assist with summarizing concepts.

Video Activities:

1. **Force Field Activity** - demonstrates the characteristics of a magnetic field.
2. **Attracting And Repelling Poles** - demonstrates the characteristics of the fields between attracting and repelling magnetic poles.
3. **Magnetic Materials** - demonstrates the characteristics of magnetic and nonmagnetic materials.
4. **Temporary Magnet** - demonstrates how a magnetic substance can be a temporary magnet.
5. **Needle Compass** - demonstrates how to make a magnet and use it as a compass.
6. **Magnetic Strength** - demonstrates how to the strength of a magnet can be measured.
7. **Lodestone** - demonstrates the magnetic properties of loadstones and its use as a compass.

Student Naïve Conceptions

As students grow up they have many experiences for which they form explanations based on a variety of anchoring experiences, such as, playing with magnets and compasses. While these explanations make sense for the student, they may conflict with the results of science investigations, and they are sometimes called naïve conceptions. Student's naïve conceptions should not be treated as wrong as such but as conceptions based on insufficient analysis of their experiences. The activities in this video are designed to help students recognize their explanations and develop a more analytic view. Students in middle school are usually at different points in their conceptualization of magnetism and its properties. Some students may have difficulty accepting that aluminum, for example, a metal that seems very much like iron, is not attracted to a magnet. It may also be difficult for some students to accept that magnetic fields can penetrate materials such as a stack of paper, wood, plastic, and glass are tangible barriers, unlike air. The notion that magnets can lose their magnetism when placed in a strong magnetic field, dropped, or heated is difficult to comprehend. Some common naïve conceptions about magnetism are that the size of a magnet determines its strength, all metals are attracted to magnets, and while magnetism may be able to pass through paper, it cannot pass through wood, a notebook, a table, or other thicker materials. Diagrams of electric and magnetic fields promote some misconceptions about "lines of force," notably that the force exists only on those lines. Students should helped to recognize that the lines are used only to show the direction of the field. These naïve conceptions about the causes of gravity can persist if they are not appropriately addressed.

Telling or showing students the explanations that science uses may not change their beliefs. There are several strategies that can be used to facilitate a deeper understanding. Students need to become aware of their own preconceptions about a concept and expose these beliefs by sharing their ideas with other students in small groups in an uncritical environment to help them begin a deeper analysis of their experiences. They should be encouraged to make predictions based on their conceptions before activities begin. This will help students to begin to confront and test their beliefs and provide motivation for looking for other plausible conceptions. Students need to have time to work toward resolving conflicts between their ideas and their observations, thereby accommodating new concepts. Students need opportunities to extend new concepts by trying to make connections between the new concept and other situations in their daily lives. Students should also be encouraged to go beyond these initial steps by choosing additional questions or problems related to the concept to expand their understanding. These strategies are used to organize suggested activities into the following groups: exposing beliefs, committing to outcomes, confronting beliefs, accommodating concepts, extending concepts, and expanding inquiry.

Sample Support Activities

Exposing Beliefs

Use an activity like "Think, Pair, and Share" to have students begin thinking about their explanations of topics, such as, magnetic attraction and repulsion and then share their ideas with a partner. Two pairs can then be combined to share their views and each group of four can have a one person share the different explanations. Moving from small to whole group in a secure and uncritical environment gives students an opportunity to see that others are also uncertain and bring a variety of views to their experience.

Committing to Outcomes

Use the different activities in the video as opportunities to have students predict what they think will happen, for example, the "Magnetic Materials" activity. Simply stop the video just before the professor releases the funnels and have students share with a partner or write their predictions of what will happen. It is important that they make a verifiable commitment so that they can begin to address their beliefs.

Confronting Beliefs

Have students test their ideas by recreating one of the activities on the video or related activities that they found interesting. For example, pairs of students could carryout the "Magnetic Strength" or other video activities and describe their observations and explanations. Working in small groups, students could then debate their explanations, conduct interviews, and check written materials before presenting their results. This is an opportunity for students to confront their beliefs.

Accommodating Concepts

Students need to begin to question their observations and their discussions to help them process information and begin to make sense of the explanations behind the observations. During this time, students begin to resolve the conflict that may exist between beliefs and observations. Class presentations of observations of activities and explanations along with carefully posed teacher questions and follow-up small group discussions will assist with the process of accommodating new concepts.

Extending Concepts

Asking students to give examples of where they have seen the concept discussed or demonstrated or giving examples of how they thing the concept is connected to other situations will help students extend their understanding of the concept.

Expanding Inquiry

To encourage students to continue thinking about the concept, opportunities should be provided that invigorates them to investigate additional questions and problems that interest them.