Magnets, for elementary sites [Fall 2011]

The Idea

Give the mentees some basic take-home ideas about magnets and something they can actually take home .

Teaching Goals

- Students will build and personalize a “floating angel” display
- Students will explore the effect of distance on magnetic force magnitude.
- Students will observe magnetic poles
- Students will magnetize paper clips and use them to attract other paper clips and observe poles in these ”new” magnets

Materials

Consumables:

- Notecards (20 per site or greater than the number of students)
- Scotch or masking tape (2 rolls per site)
- Plastic cups (20 per site or greater than the number of students)
- Paper clips (unpainted if possible, 20-30 per site or greater than the number of students)
- Popsicle sticks (20 per site or greater than the number of students)
- String (one roll per site)
- Magnets (20 per site or greater than the number of students)
- Construction paper (20-30 sheets per site or greater than the number of students)

Nonconsumables:

- scissors (at site hopefully)
- markers (at site hopefully)

Agenda/Lesson Plan

Setup (5 min, before session begins)

- One person begin cutting lengths of string
- Another person begin splitting materials up based on an educated guess of how big each small group is going to be

Introduction (10 min)

- Have one person (maybe the site leader?) explain what magnets are and examples of where they are used (compasses, door locks). Using the background section of this document and what we discussed in the decal, go into as much detail as you feel is appropriate. Show off your completed “floating angel” display

Break into small groups (5 min)

- Break the students up into as many groups as there are mentors.

Module 1 (5 min)

- Each small group will have a mentor who will be in charge of that group. For this first module, hand out a magnet to each student and have him or her pair up with the person next to them. 3 people together is ok if it is necessary.
- Explain and show how magnets have poles and that opposite poles are attractive and like poles repel. Have the students observe this by pairing up and experimenting with facing different sides of the magnets towards each other.

Module 2 (5 min)
- Now hand each student a paper clip. Have them place the paper clip on the table and retrieve it using their magnet. Tell them to leave the paper clip on the magnet and then place it on the table. Working in pairs, have them experiment with two magnetized paper clips and draw conclusions. Did the paper clip also become a magnet? Does it attract a new paper clip (if you have enough to play around)? Does it also have poles?

Module 3 (35 min)
- Now they can begin building their floating angel displays. Make sure to begin by creating the parts involving the magnet or they will be distracted by it and not listen to a word that you say.

Step 1: Tape the magnet to one end of a popsicle stick

Step 2: Turn the cup upside down on the table and tape the other end of the stick to the bottom of the cup, making sure the magnet is facing down.

Step 3: Flip the cup over and tape the note card to the mouth of the cup in two places. Line up one of the short edges of the card with the lip of the cup so that you can securely tape at least one side of the cup to the card.

Step 4: Tie the string to the paper clip. You will probably have to help all of them with this.

Step 5: Tape the other end of the string to the note card right beneath the magnet. Have them experiment to determine how far the paper clip can be from the magnet before it falls.

Step 6: have them decorate their display however they would like using the tape, construction paper and markers.

Departing (5 min)
- Make sure each student takes their display home and return any materials from the site to their proper place.

Background

Magnets are pretty complex. Magnetic force is one of the fundamental forces according to physics. In the case of solid materials without any electrical current flowing through them, magnetic properties are the result of electron spin. Electrons occupy orbitals or “shells” around the nucleus of an atom. Each electron has a spin, and when there are even numbers of electrons in a shell, the spin direction of every other electron is different, canceling any potential effect. Some materials have several orbitals with only one electron whose spin is unmatched. The spin of these electrons creates a small magnetic moment. When these atomic-level magnetic moments are aligned by some outside phenomenon (i.e. cooling in the presence of earth’s magnetic field), they add together to create a strong enough field that we then call that material a magnet. For some metals (like the metal in a paper clip) the magnetic moments of the atoms can be aligned by proximity to another magnet, creating another magnet. This effect only lasts a short time because the atoms’ magnetic fields eventually fall out of alignment.