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Introduction to Magnetism and Electronics

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by Becky Blood

Have you ever wondered what it is that makes our modern electronic equipment work? Are you familiar with the way your personal computer reads, stores and provides information to the user? If you are like many adults, you really do not understand all the important electronic equipment that we so heavily rely on in today's society.

Early scientists spent many hours researching magnetic charges and forces. Through manipulation of those magnetic forces, know as the magnetic field, scientists were able to create technology that has enabled us to develop much of our current electronic equipment.

This unit on magnetism and basic electronics is designed for Kindergarten and first grade students. Children will be given opportunities to learn about and apply scientific methods, vocabulary and principles as they perform a variety of trials, tests and experiments.

Objectives

The objectives for this unit were designed to meet New Haven's high educational standards for science, reading, writing, and math on the kindergarten and first grade levels.

The primary objectives are to provide students with an opportunity to learn about magnetism, and basic scientific. Children will learn the scientific method and through practical classroom application, develop their critical thinking skills through use of the scientific method.

Literacy is another very important objective. As we go through all different types of experiments, the children will be working on interactive reading and writing lessons to track document and interpret their work. Students will learn to describe events and the methods they used in their experiments both verbally and in writing. They will then be able to relate this information to others.

Math skills such as: 1:1 correspondence, ordering sets, connecting sets to numerals, fractions and counting are all proficiencies children will use while working on this unit. Children will identify magnets and objects that magnets attract. They will also identify how magnets are used in some electronic equipment and be able to describe the functions of magnets in that equipment. Students will use a variety of materials and tools to enhance and strengthen fine motor movements and control.

Further objectives have been designed relating specifically to understanding and mastery of concepts as they are introduced.

Why Teach Science?

"… Education is more than acquisition of knowledge; it is learning how knowledge can be used-that is learning the function of knowledge." (Forman, p. 25).

Children have an intrinsic motivation to learn about how and why things happen in their environment. As a teacher, it is beneficial to capitalize on this motivation and use student interest to enhance curriculum.

Science can be easily incorporated into all areas of your classroom. Throughout this curriculum unit, children will perform simple experiments and draw logical conclusions based on observations. They must then find a way to document their data in order to interpret it, and eventually share their results to others. Study of the scientific method effectively integrates reading and writing with scientific and mathematical principles.

Setting the Stage

Let your classroom environment set the tone for exciting and dynamic learning experiences. "The vision of community that the classroom provides can color a child's ideas and expectations about equality, cooperation and citizenship for a lifetime." (The Teaching Tolerance Project, 5). This idea will be the core from which your unit will be built. In order to teach science effectively, children must feel secure enough to take risks. As we are all well aware, scientists were only able to make revolutionary discoveries through the process of trial and error, thereby taking risks. Unlike the scientific laboratories, we are providing materials and situations that will promote student's success and learning through discovery. However, when we, as teachers, ask children to really stretch their knowledge and think about formulating hypotheses that will lead them to difficult conclusions, children need an environment where they feel free to explore and formulate unique theories without concern of judgement or ridicule.

The Scientific Method

The scientific method is a four-step process.

1. Formulating the hypothesis

Have the children choose a problem or an idea they would like to explore. Often the problem starts off with a question. A hypothesis is generally in the form of a statement, rather than a question, so once you have your hypothetical question, work with your students to change their question into a statement.

2. Developing the procedure

Have the children describe how they are planning to do the experiments. List all the materials you will need. Then list everything you will do. Number each step. Explain to the children that procedures should be written in such a way that others would be able to repeat your experiment just by reading your procedures.

3. Data Collection

During the procedure, data is collected through experimentation, later the data is analyzed, and conclusions are drawn.

As the children perform the steps described in the procedure, they will be recording their observations. This is their data.

4. Analysis

Have students look carefully at the data and decide what it says about their hypothesis. Does the data show that your hypotheses is accurate or does is prove your original hypotheses to be incorrect? You may decide at this point that you need to revise your hypothesis and think about further experiments or procedures. (http://www.oakview.fcps.edu/~glazewsk/96-97/scientist/index.html)

Vocabulary List

The following is a list of vocabulary that students will be introduced to throughout the unit. This list is far from comprehensive, but it provides an overview.

Magnet

Magnetism
Magnetic
Non-magnetic
Magnetic Field
Electro-magnet

Polarity

North Pole of magnet
South Pole of magnet

Attract

Repel

Iron

Steel

Electricity

Static

Charge

Like charges

Shutter

Spring

Magnetic disk

Hub(s)

Paper rings

Magnetic tape

Phillips screwdriver

Flat head screwdriver

Wire cutters

Pliers

Wrench

Magnetic Principles

We will begin our unit by studying properties of magnets. In our study of magnetic principles, students will be given the opportunity to work on a variety of experiments with different types of magnets.

Some of the lessons presented in this unit are best implemented with your whole class as a discussion, presentation or project. However, many of the activities are designed to be implemented with small groups, where children and teachers can work closely, allowing ample opportunity for discussion and analysis so children are able to create and test theories. Before beginning these activities, consider making journals for your students. Throughout the unit, ideas, hypotheses, findings, experiments, etc can recorded and saved for future reference. This provides an insightful and concrete way to reflect with the children on their discoveries.

For a list of useful materials, consult the List of Materials printed at the end of this unit. Now you are ready to begin. Enjoy!

Activity #1: Introduction to Magnets

This activity is just to introduce you class to magnets. Provide children with a variety of magnetic and non-magnetic objects. Allow students to work independently to see what type of experience they already have. Magnetic objects can include, but are not limited to the following: paper clips, screws, nuts, bolts, metal washers, metal tops from frozen juice cans, small magnetic letters, iron shavings and other safe metal objects. Be sure to include enough non-magnetic objects so the children will be able to create some type of comparison. At this point, use only non-magnetic objects that are not made of metal. Later, students will be asked to discriminate between magnetic and non-magnetic metal items.

There are many children's books about magnets; some are listed in the bibliography of this curriculum. Choose one that would be of interest to your class and share the book with them. Then engage them in a discussion about the book and how it relates to what they have been learning.

Activity #2: Magnetic vs. Non-magnetic

Now students can be given some direction. Working closely with students, encourage them to test various objects to see whether magnets will stick to them. Then categorize objects into magnetic and non-magnetic. In a follow up group discussion, work with the class to create a list of magnetic and non-magnetic objects. Prompt the children to think about the materials they have been using and draw upon that information as they compose their list.

Now engage the children in a demonstration and discussion about the types of metals that are magnetic. Present the following information to your class in a way that is developmentally appropriate for their age group. Modern magnets are made of steel and they attract objects that have iron and steel in them. (The Junior Science book of Magnets p.5) Steel is a commonly used hard metal. It is tough and fairly resistant to rust. Iron is the most common metal, it is a white and malleable. In contrast to steel, iron will rust quickly in a moist or salty environment. (Webster's New World Dictionary, p 744 and 1394). Magnets do not attract objects made from brass, copper or aluminum. (Mailbox, p.50). Collect a variety of metal objects, including, but not limited to: pennies, nickels, dimes, quarters, paper clips, thumb tacks, nails and screws, hardware, old computer disk, old cassette tape, old VCR tape, tin foil, metal scissors, tie tack, hair barrette, etc. Test each object to see which are magnetic. If you feel your students are interested, try to figure out what types of metals are in each object.

Activity #3: Magnet Board Game

Here is your first real opportunity for assessment. Show a group of children how to play this game. Once they are able to play independently, you can observe and see how much information students are retaining. This is also an opportunity for the children to practice and internalize the skills that you are learning.

For this game, you will need a couple of magnets, the materials you collected for the last activity, dice, index cards, something to make a game board out of and game pieces.

Draw or trace pictures of your materials on index cards. Then make a game board in which every other space has a picture of a magnet. In the remaining spaces, you can either write a direction for the children to follow, such as go back one space, lose your turn, etc., or you could just leave those spaces blank. Once the game board and cards are prepared, you are ready to begin. Have the children roll the dice and move their game piece the correct number of spaces. If the child lands on a magnet space, they can draw a card and try to predict whether the object on the card is magnetic or not. After they have made their prediction, they are to take a magnet and try to pick up the object depicted on the card to see if their prediction was correct. If the child was correct, they get to hold on to the card they chose, and will roll the dice again on their next turn. If the child was incorrect, they are to put their card at the bottom of the card pile (hopefully to be reused later in the game). On their next turn they will not roll the dice, they just choose another card. First to the finish line "wins." If you would prefer to not have a competitive game, you could make the board a circle, so children can continue going around it as long as they are interested. (Day, 18)

This activity can easily be reintroduced periodically through out the unit as a type of review or assessment.

Activity #3: Strength of Magnets

Ask a child to hold up one magnet. To figure out how strong the magnet is, hang paper clips from that magnet one by one so that it looks like a chain. You could also try hanging more than one chain from a magnet. The magnet that can sustain the most paper clips has the strongest magnetic force. This is a concrete way for children to "see" magnetic force. Note to teachers: Spend some time familiarizing yourself with how this works. Play around with this activity before attempting to share it with your class.

How it works: Some magnets are stronger than others are. As you hang paper clips from a magnet, they take on some of the magnetism, thereby temporarily becoming little magnets. The magnet that can sustain the longest chain or the most chains has the strongest magnetic force. (Mailbox Magazine, Dec./Jan 1993-1994 p. 50)

Another way to assess at the strength of magnets is by looking at the different parts of the magnet. All magnets are strongest on their ends. Focus particularly on bar magnets and horseshoe magnets. First ask the children to test all the objects to make sure they are magnetic, and then challenge the children to try to pick up objects with the middle of the magnet. They will notice that the magnet will only pick up the heavier objects on the ends. (Mailbox Magazine, Dec./Jan 1993-1994 p. 50)

Activity #4: Making a Magnet

This activity is an extension of activity #3. Once the class is confident in their understanding magnetic strength, you can begin working on making a temporary magnet. To do this, you will need horseshoe magnets, some paper clips and steal wool or iron shavings. First straiten out the paper clip. Rub the paper clip against one end of your magnet 20 times. It is very important to always rub in the same direction, do not rub the wire back and forth or your experiment will not work. Once you have made your temporary magnet, it is time to test it. The magnet you have made is not very powerful, so you will need to break up some of your steal wool into tiny bits or if you are using iron shavings, just pour some out onto the table. Now, try to pick up the small bits with your magnetized paper clip. It really works!

(Prove it! P. 56-57). If you find that your students are really interested in this, you could try making an electromagnet with them at this point. The information can be found under the Electronics section of this curriculum; Activity #5.

Activity #5: Polarity of magnets

When you push two magnets together, sometimes, they attract, and sometimes they repel. Every magnet has a north and a south pole. When the two poles facing each other are different, (i.e. north to south) magnets attract. However, when the two poles facing each other are the same, (i.e. north to north), the magnets repel. (The Super Science Book of Forces, p. 14) This concept can be illustrated to children in a few simple ways. If you have a set of BrioR trains accessible to you, they are very useful. Otherwise, bar magnets will work well. Prior to beginning this activity, go through your bar magnets, test and label all the poles. (You could also do this with your BrioR trains). Begin by allowing the children to attach some of the bar magnets or train cars together. Notice how sometimes they initially repel, but when you turn the magnet around, it attracts. If you do not have a large supply of bar magnets or BrioR train cars, you might want to consider implementing this activity as a demonstration with the entire class.

Now take two bar magnets or magnet wands and put them next to each other. See whether they attract or repel. If they attract turn one of them around so that like poles are together. Then they should repel. Raise the end of one magnet slowly so that it is a little bit above the same pole of the other magnet. The magnetic force should hold the raised magnet in the air. See illustration. (The Super Science Book of Forces, p. 15)

(figure available in print form)

Activity #6: Magnetic force through liquids, paper, cloth, air and plastic

If a magnet is strong enough, it can work through many materials as if they were not even there. You can stick your favorite piece of artwork to the refrigerator with a magnet. How does the magnet work through the paper? If you try to stick a pad of paper to the same refrigerator, it probably will not work. The magnet and the refrigerator are attracted. The magnetic force will go through the paper, but it does weaken the force a little bit. That is why a magnet can hold one piece of paper on your refrigerator, but not the whole pad of paper.

I have found that children are most amazed and intrigued by the concepts and activities below. All the activities are classroom tested, and have been very well received, many labeled "favorites" by the children.

Magnetism through liquids:

> Fill empty 20-ounce soda bottles with a variety of liquids such as: water, milk, light Karo syrup, oil, ginger ale, molasses, etc. Then in each bottle, put a few magnetic objects, such as paper clips or thumb tacks. You could also place some pennies or non-magnetic metal objects in the bottles. Replace the cap tightly, and put some masking tape around the cap so it can not be removed. Use a magnet to move the objects around inside the bottles. Question the children as to why they think this works. Also ask them why the objects in the thicker liquids move more slowly than the objects in the water or the milk.

Magnetism though air:

> Tie a 10-15 inch piece of string to a large paper clip. Tape the free end of the string to a table or the floor. With a magnet wand, pull the paper clip up until the string it taught. Then slowly pull the magnet wand away from the paper clip. Notice the paperclip does not fall down, it floats. When you pull the magnet wand too far away from the paper clip, it falls. Question the children as to why they think the paper clip stays in the air even when the magnet is not touching it. This activity really requires you to use magnet wands because they are strong magnets and they have a handle, which enables you to control your movements.

(figure available in print form)

Magnetism through paper or cloth:

> This is a very simple activity. Provide some magnetic and non-magnetic objects, scrap paper or newspaper and some fabric scraps. Have one child hide an object under a piece of paper or fabric. Another child will try to guess whether the hidden object is magnetic or non-magnetic. After the child guesses, he/she can place a magnet on top of the paper or cloth, and see if the magnet will attract the object. To add interest and variety, include some cardboard as well as fabrics that vary in thickness.

Magnetism through wood:

> Try building a structure similar to the one illustrated below. The small circle in the center should be a magnetic object. Hold a magnet below the thin wooden board and move it around. See if the magnet can swing the pendulum. It should!

(figure availalble in print form)

Magnetism through plastic:

For this you will need either iron shavings, shavings of steel wool or some very small pieces of metal. Then you will need a shallow plastic or cardboard container with a clear top. Put one of the materials listed above inside the container and seal the top. Then begin moving around the materials inside with your magnet wand. Notice you can even pull the items up the side of the container.

Magnetism through other materials:

Try testing other materials such as glass and your finger to see which ones magnets can attract through.

Static Electricity

Now that your students have been exposed to some basic magnetic principles, they are ready to begin working with static electricity. Then with knowledge of static electricity along with understanding magnets, we will begin our investigation of simple electronics.

Activity #1: Balloon experiments

This is a good opening activity to try with your class. Take an inflated balloon and rub it on a wool carpet. Then hold the balloon above your head. Your hair should stand on end. The charged balloon attracts your hair.

Now, take two inflated balloons and tie a string between them. Rub each balloon on a wool carpet or sweater to charge the balloons. Let the balloons hang next to each other, they should repel. (Science for Fun, p117).

How it works: Just as magnets repel when like charges are next to each other. Static electricity works the same way. Since both balloons were rubbed on the same material, they were given the same charge, therefore they repel. (Science for Fun, p117).

Activity #2: Comb experiments

You will need a plastic comb, a wool carpet, coat or sweater and some small ripped up scraps of paper about the size of a ½ dollar. You will first rub the plastic comb on the wool material. Before actually trying to pick up the paper with the charged comb, ask the children if they had any idea what will happen when you put the comb next to the paper. The charged comb should attract the paper.

Once you have performed this experiment, you can try adding another dimension to it. Save the paper that you just charged with the comb. Recharge the comb on the wool. Then try to attract the same piece of paper. The paper should "run away." Have students try to figure out what caused this to happen.

Now take the same comb and re-charge it on wool. Then turn the water on gently. Ask the children what they think will happen when you put he comb close to the water. The comb should pull the water. Put the comb near the gently stream of water. If you wiggle the comb around the water should dance. (The Super Science Book of Forces, p.15). Teachers note: This is fantastic when it works, but it is often difficult to perform without practice.

Electronics

Now that the children have been exposed to magnetism and some basic properties of energy, they will begin applying this information to common electronic equipment.

Before beginning these activities, you may want to make journals for the children so they can record ideas, hypothesis, findings, etc as you move through the electronics section of the unit.

The first three activities in this section will require two simple tape recorders, one that is working and can be used by students, and another that does not work.

Activity #1: Using a cassette tape

First, you will spend time working with a cassette tape in a functioning tape player. Begin by recording, playing and erasing sounds on a tape. Introduce students to the concept of "memory." Then present the class with a challenge; ask them to figure out some other types of equipment that would use memory. Some ideas may include; computers, printers, computer disks, VCR, videotapes, compact discs, digital watches, etc. Once the children have generated a list, it is time to test their understanding. Challenge them to explain how the memory actually works.

Since the children have learned that cassette tapes contain magnets, it will also be important to spend some time reviewing that, and allow the children time to hypothesize about why they think that magnet is necessary. Record and save their hypotheses so you can refer to it at the end of the unit.

After completion of activity #4 try re-implementing this activity to see if the children's ideas have changed.

Activity #2: Disassembling a tape player

Prior to beginning this activity, make sure students clearly understand that you are not destroying something that works. Explain to them that it is broken and can not be repaired. Test the machine with the children, to prove to them it does not work. Introduce the class to the tools they will be using. Review procedures for safe usage of tools. The tools you will need are: Small screwdrivers (check to see if you will need Phillips or flat head screwdrivers), needle nose pliers, wire cutters and scissors.

This is the section you will probably spend the longest time working on. Children should be allowed ample time and opportunity to disassemble and explore the parts of the tape player. Using simple tools, students can begin disassembling the nonfunctioning tape recorder to find out which parts combine to record, playback and erase the sounds on a cassette.

The teacher will act as a facilitator for this activity, allowing the children to work as independently as possible (of course taking safety into account). However, you will want to create opportunity for students to work on their critical thinking skills, in connection with the scientific method. Encourage children to create and record hypotheses about the tape player. Then work on ways to prove or disprove each hypothesis. The information gathered here can be recorded in the children's journals.

Save all tape player parts for further activities.

Activity #3: Printing with tape player parts

Use the interesting pieces from the inside of the tape player for printing. Provide shallow trays with thinned paint. Allow children to dip chosen objects into paint and create unique prints. Then display the paintings next to the saved objects from the disassembled tape player. Label all parts on display. This interactive display is a test of the children's visual acuity, see if they can then match up the part of the tape player with the print it makes. You can also provide magnifying glasses for the children to examine the parts with.

Activity #4: Dissecting a computer disk and cassette tape

You will need a 3.5-inch computer disk, an old cassette tape and either a flat head screwdriver or a butter knife.

Choose which item you will be dissecting first. Follow the same procedure for both the disk and cassette.

Begin by looking carefully at the item you are working with. Have the children pretend they have never seen the item before. Ask them the following questions: What parts can you find? Does anything move? What happens when you move those parts? Why? Look for places where the item will come apart. (With the disk, if you remove the metal shutter, you will find some slots where you could gently begin prying it apart.) Open the item carefully, the disk has a small spring that was used to hold the shutter closed, it may jump out when you open the casing.

Once you have opened the item notice the two halves. Ask the children the following questions: Are the halves the same? What parts do you see?

Ask students to draw a picture in their journal of where everything is before going any further. (www.exploratorium.edu_explorer/dissect_disk.html)

Here is a list of the parts inside the computer disk:

Shutter
Spring
Magnetic disk- this is coated with iron oxide which can be magnetized. As Information is saved on the disk, a recording head creates a magnetic pattern on the iron oxide.

Hub- the small metal center of the magnetic disk.

Paper rings

Write-protect tab

Plastic flap

Here is a list of the parts inside the cassette:

Magnetic tape- this is coated with iron oxide and can be magnetized, just as the disk can. The recording heads in the cassette player create a magnetic pattern on the iron oxide of the magnetic tape.

Hubs- the two plastic wheels that the tape winds around.

Write-protect tab

Paper or felt (this cleans the tape while its moving)

Spring

(www.exploratorium.edu_explorer/dissect_disk.html)

Take time to compare and contrast the parts of the computer disk and the cassette tape. Ask students the following questions: What parts are the same/different in both items? Describe the functions of the parts? How does the magnet work? How does the computer/cassette player read the information on the disk/tape? Why is there paper or cloth inside? Add any other questions/comments that are appropriate for your group. With these questions in mind, ask students to work independently in their journals. Make the dissected cassette tape and computer disk available for observation while children are working. Finally, have students share their journal entries with the rest of the class.

You that have now completed work with the tape player and thoroughly examined a cassette tape, go back to the activity #1 and repeat some of the lessons. See how the children ideas have changed.

Activity #5: Making an electromagnet

Electromagnets are devices that use electricity to attract or repel objects. (Zubrowski, 64) Electromagnets are used it many types of large construction equipment.

In order to do this activity you will need: a 1 ½ volt battery (Try using a D battery), covered copper wire (check your local hardware store for this), a large nail, tape and some magnetic and non-magnetic objects.

First you coil the wire around the nail. Connect one end of the wire to one terminal of the battery, and the other end of the wire to the other terminal. You can tape the wires on if necessary. If all went well, the nail should now work like a magnet. Test to see what objects it attracts. Once you have tried your electromagnet, try disconnecting it, and see what happens. (Trencher, 44).

(figure available in print form)

How is works: Electricity traveling through the coiled wire and into the iron nail will create a strong enough magnetic field to attract many metal objects (Brown, 168)

Working with a simple motor and battery

The activities in this section will focus on a motor powered by an everyday battery. In order to implement this section, you will need an erector set with a motor. Review with the children the things they already know about electronics, and see how much information they are able to provide about a motor prior to beginning this section. Many children may be able to tell you something about the motor in their car.

Begin by allowing students to build their own structures with the erector set using the screwdrivers and wrenches provided. This is to ensure that they are adept with the tools before trying to create a functional finished product.

Have the class vote on what they would like to build. (Enclosed with most erector sets are directions on how to build specific types of things). Once you have decided what to make, you are ready to begin construction! Once construction is completed, you should be able to attach the motor, and run your machine. With many of the older erector sets, you need to remove the battery, turn if around and replace it the opposite way in order to reverse the action. For example, if you have built a crane, when you put the battery in one way, the crane will raise an object. In order to lower the crane, you will have to reverse the battery. The necessity to manually reverse the battery will actually work as a teaching tool. The principle of reversibility is such an abstract concept, that having to remove and turn the battery around to reverse action will help you class grasp the concept.

Tell your students they will be working independently in small groups on specific tasks. Divide your students into appropriate groups that will be able to work effectively together. Provide different projects for each group to work on. Once you have chosen the projects, you will be able to decide how many days the groups will have to work. Have the groups share their projects with the class.

Assessments

Children's understanding and mastery of topics covered will primarily be assessed informally. Observational assessments and anecdotal records can be kept where appropriate. Since each new activity and topic introduced will be building on the prior activities and topics, assessments will naturally to be ongoing.

As students move into some of the more independent sections of the unit, you could incorporate some individual literacy based assessments. Review each student's journal individually with them. Ask them to recall and discuss their entries. Check for such skills as: letter recognition, site words, fluency in reading, connecting words to pictures, 1:1 correspondence, number recognition, ordering sets, connecting sets to numerals, fractions and counting. Journals are one way of really keeping running records of student's work in order to assess their skills over the course of the unit.

Conclusion

Through strategic implementation of a science based unit, children will be developing and practicing skills in all areas of the curriculum. Through the experiments your class will perform, students are learning the scientific method. By providing many opportunities to utilize the principles of the scientific method, children are required to think critically about materials and the ways they are using them. As your students work through the activities in this unit, they will need to call upon a variety of skills. Math skills will be used throughout, children will be learning new mathematical concepts as well as practicing concepts they have already learned. Students must challenge themselves to apply concepts in non-traditional and interesting ways. Throughout the entire unit teachers are presented with many tools to promote literacy. There are numerous opportunities for relevant reading and writing activities. Teachers can really vary the format of these activities from independent to interactive reading and writing. Having children work in small groups and present their finding to the class beautifully extends some experiments, and allows students to utilize communication, problem solving and interaction skills.

This unit provides a unique opportunity for students and teachers to experiment, explore, wonder and learn together. Successful implementation will prove rewarding and educational for all involved.

List of materials

This list provides only an outlines the materials you will need for this unit. Additional materials are detailed in the descriptions of specific activities.

- Magnets
- Horseshoe magnets
- Magnet wands (Available from school supply catalogs)
- Bar magnets
- Other magnets
- Materials to use with Magnet experiments
- Paper clips of different sizes (You will probably use a lot!)
- Steal wool
- A variety of metal objects to use with magnets
- String
- Small plastic soda bottles (20 ounce size works well)
- Shallow plastic or cardboard containers with clear tops
- Coins
- Old computer disk
- Old cassette tape, old VCR tape
- Tin foil
- Metal scissors
- Tie tack
- Hair barrette
- Tag board for Magnet board game
- Materials for experiments on static energy
- Small plastic combs
- Balloons
- Materials for use with Tape player
  - Functional cassette tape
  - Functional tape player
- Broken tape player
  - Small screw drivers
  - Old cassette tape (to take apart)
  - Needle nose pliers
  - Wire cutters
  - Children's scissors

Additional materials

1 ½ volt battery (A size D battery is all you need)
Covered copper wire
Erector set with motor
Old computer disk (to take apart)
Butter knife

Bibliography

Ardley, Neil, and The Science Book of Energy (New York: Harcourt Brace Jovanovich P

Publishers, 1992)

Brown, Robert J., 200 Illustrated Science Experiments for Children (Blue Ridge Summit, PA: Tab Books, 1988)

This book contains more text, less illustrations. Many ideas to really extending the unit or even expand for older children

Day, B. Early Childhood Education: Creative Learning Activities, 2nd Ed. (New York, NY: Macmillan, 1983)

A helpful resource for many areas of the classroom, not specific just to science.

Feravolo, Rocco V., Junior Science Book of Magnets (Champaign, Illinois: Garrard Publishing Company, 1960)

Few illustrations. More for your reference.

Forman, George, E. and Kuschner, David S., The Child's Construction of Knowledge Piaget for Teaching Children (Washington, D.C.: National Association for the Education of Young Children, 1983)

Based on the Piagetian theory, this book gives some basis for implementing his theories into your science curriculum.

Forman, George, E. and Hill, Fleet, Constructive Play (Addison-Wesley Publishing Company, 1984)

This book gives you some theoretical information on children's learning processes. Very helpful to preview before implementing unit.

Gibson, Gary, Science for Fun Experiments (London: Aladdin Books LTD, 1996)

If I could recommend only one resource, this would be the one! Tons of experiments and wonderful ideas for classroom use.

Guralnik, David B. (Editor in Chief), Webster's New World Dictionary of the American Language; Second College Edition (Prentice Hall Press, Somon and Schuster, Inc, 1986) Iannetti, Marie, "Wonders Never Cease Make way for Magnets," Mailbox, (Dec/Jan 1993-1994), 50-51.

This section of the Mailbox magazine is very helpful. It has good ideas that are well explained.

Morrison, Kathy and Reader, Alice, Beginning Science, the Essential Elements, Science Activities for the Young Child (Minneapolis, Minnesota: T. S. Denison and Co., Inc. 1986).

Most of the activities in here are very basic, but could be useful for less advanced students.

Pine, Tillie S. and Levine, Joseph, Magnets, and how to use them (Scholastic Magazine, 1963).

Presents an overview of basic information on magnets. Great for sharing at home with the family. Also has some interesting experiments. I have included this book in the reading list for children as well.

Sooten, Harry, Experiments with Static Electricity (New York: Grosset, Dunlap and Hestle Books, 1969)

Although published thirty years ago, it will provide you with additional activities to illustrate the concept of static electricity to your class.

Trencher, B. R. Child's Play: An Activities and Material Handbook. (Atlanta, GA: Humanics, 1976)
As the title states, it has many activities for classroom use. Wellington, Jerry, The Super Science Book of Energy (New York: Thomson Learning, 1994)

This book will help you gain some background information. You may be able to draw some helpful ideas from this. Vivid illustrations. This would be a great book to keep in your classroom library though out your unit. I have included this book in the reading list for children as well.

Wellington, Jerry, The Super Science Book of Forces (New York: Thomson Learning, 1994)

This book only provides a short section on magnetic force, but has a variety of information on other forces in nature. A great way to extend your unit. Vivid illustrations. This would be a great book to keep in your classroom library though out your unit. I have included this book in the reading list for children as well.

Wyler, Rose and Ames, Gerald, Prove it! (Scholastic Book Services, 1963) 53-63.

The section on magnets is especially interesting and helpful. I have included this book in the reading list for children as well.

Zubrowski, Bernie, Blinders and Buzzers Building Experiments with Electricity and Magnetism (New York, NY: Morrow Junior Books, 1991

This book has some interesting information for teachers as well as experiments for older or more advanced children. If you find your class particularly interested in electronics this will be a great reference.

Internet Resources

http://www.exploratorium.edu

This site is a fantastic reference. It has ideas that have been submitted by classroom teachers. Children could access and peruse this site with adult assistance.

http://www.go2dsc.org/funstuff.htm

This site has a number of wonderful science activities on it. Not too much directly related to electronics and magnetism, but could be a super resource. Children could access and peruse this site with adult assistance.

http://www.oakview.fcps.edu/~glazewsk/96-97/scientist/index.html

This site was designed by a group of elementary school students at the Oakview School in Virginia. It has some great ideas! It is also a site that children could access and peruse with adult assistance.

http://teacher.nsrl.rochester.edu/phy_labs/AppendixE/AppendixE.html

This site has some more advanced information on use and application of the scientific method

Student Reading List

Branley, Franklyn M. and Vaughan, Eleanor K., Mickey's Magnet (New York, NY: Harper and Row, Publishers, Inc., 1956)

This is a wonderfully imaginative story for young children.

James, Albert, Batteries and Bulbs (Great Britain, Macdonald &Co., 1973)

Published in Great Britain, This book presents children with some simple interesting experiments they can perform at home. I also used this book as a resource for writing this unit.

Pine, Tillie S. and Levine, Joseph, Magnets, and how to use them (Scholastic Magazine, 1963).

Presents an overview of basic information on magnets. Great experiments for sharing at home with the family. I also used this book as a resource for writing this unit.

Wellington, Jerry, The Super Science Book of Forces (New York: Thomson Learning, 1994)

This book only provides a short section on magnetic force, but has a variety of other information on forces in nature. A great way to learn more. Great illustrations. I also used this book as a resource for writing this unit.

Wilkes, Angela, My First Book of Science (Alfred A. Knopf, Inc, 1990)

A wonderfully illustrated book of experiments and ideas. Very appealing to children. I also used this book as a resource for writing this unit.

Wyler, Rose and Ames, Gerald, Prove it! (Scholastic Book Services, 1963) 53-63.

A thought provoking book for children on a variety of scientific topics. Section on magnets is especially interesting. I also used this book as a resource for writing this unit.