Decision 1: What will students learn in this unit?

Standards Addressed:

1. Science: 4.P.1 Explain how various forces affect the motion of an object.
   - 4.P.1.1 Explain how magnets interact with all things made of iron and with other magnets to produce motion without touching them.
   - 4.P.1.2 Explain how electrically charged objects push or pull on other electrically charged objects and produce motion.

2. Reading Informational Text: R. I. 4.1, R.I.4.2

What do I want my students to **KNOW**, **UNDERSTAND** and be able to **DO** at the end of this unit?

<table>
<thead>
<tr>
<th>Know</th>
<th>Understand</th>
<th>Do</th>
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</thead>
</table>
| Students know that a magnet pulls on all things made of iron without touching them, and that this pulling can result in motion. Students know that a magnet attracts some metals, but not all of them. Students know that a magnet has a force field and poles that determine how a metal affected by the magnet will behave within its field. | I can determine which objects are attracted to magnets by observing them move. | • I will use a magnet to test for movement in a variety of metal/nonmetal objects.  
• I will sort objects by testing if they have iron in them by using a magnet.  
• I will observe the force field of a magnet.  
• I will diagram the poles on a magnet.  
• I will observe the reaction of the object based on the polarity of the magnet.  
• I will explain that magnets produce motion in objects made of iron. |
| Students know that an object that has been electrically charged pulls or pushes on all other charged objects and that this can result in motion. Students know that electrical charges can result in attraction, repulsion or electrical discharge. | I can observe the attraction of objects resulting from electrical charges. | • I will demonstrate how electric charges will result in the motion of the object through experimentation.  
• I will be able to explain how opposites attract and likes repel  
• I will be able to compare how magnets are related to electrical charges. |
Decision 2: Assessment

Plan for how students will indicate learning and understanding of the concepts in the unit. How will you assess learning?

Possibilities/options:
- Pre-assessment
- Short answer tests or quizzes
- Student logs, journals and informal writing
- Lab activities
- Formal writing assignments
- Informal or formal student Interviews, conferences, observations etc.

Describe the performance, product, or project that will be the culminating activity for the unit.

The student’s assignment for the Culminating Activity includes:
- **Unit** essential question or “I Can” statement for the culminating activity.
- A thorough **description** of the activity including steps or task **analysis** in completing the culminating activity.
- A copy(ies) of the rubric(s) you will use to assess the culminating activity or any other aspects of the unit.
## Decision 2: Assessments – Rubric Reminders:

<table>
<thead>
<tr>
<th>Scale</th>
<th>Criteria</th>
<th>1 (Below Proficient)</th>
<th>2 (Close to Proficient)</th>
<th>3 (Proficient)</th>
<th>4 (Above Proficient)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.P.1.1</td>
<td>Determine 0-1 objects that are attracted to magnets and explain why in 0-1 sentences.</td>
<td>Determine 2-4 objects that are attracted to magnets and explain why in 1-2 sentences.</td>
<td>Determine 5 objects that are attracted to magnets and explain why in 2-3 sentences.</td>
<td>Determine 5 objects that are attracted to magnets and explain why in 2-3 sentences including the influence of gravity and mass of an object.</td>
</tr>
<tr>
<td></td>
<td>4.P.1.2</td>
<td>Cannot explain why the needle floated or why the needle fell.</td>
<td>Can only explain why 1 of the previous (proficient) occurred.</td>
<td>Can explain why the needle floated and fell.</td>
<td>Can explain why the needle fell including balanced and unbalanced forces acting on the needle.</td>
</tr>
</tbody>
</table>
4.P.1.1. Assessment

1. You are sent to the local department store to go on a treasure hunt for materials that are attracted to a magnet. The only “catch” is you are not allowed to take a magnet with you. Choose 5 items to buy that you think will be attracted to your magnet. Make sure you explain why you believe this will be true for each item.

<table>
<thead>
<tr>
<th>Item</th>
<th>Explain Why</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
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<tr>
<td>3.</td>
<td></td>
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<tr>
<td>4.</td>
<td></td>
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<tr>
<td>5.</td>
<td></td>
</tr>
</tbody>
</table>

2. What will happen to the motion of magnet 2 as magnet 1 gets closer?

1. Why will this happen?

3. Explain your thinking.

3. A magnet attracts an object on the table. The object must contain:

A. iron       B. wood       C. rubber       D. glass
4.P.1.2. Assessment

1. Sue rubs a balloon on her hair. The balloon is then able to stick to the wall. This is an example of:

   A. static charge       B. poles       C. magnetism       D. iron

   Explain your answer.

2. After viewing the demonstration from Acquisition Lesson 2, Push!! Pull!! (What Can Affect the Push or Pull Exhibited by a Magnet?, why did the needle float in the air?

3. After viewing the demonstration a second time from Acquisition Lesson 2, Push!! Pull!! (What Can Affect the Push or Pull Exhibited by a Magnet?, why did the needle fall this time?
# Decision 3: Student Learning Map

## Key Learning Targets:

| 4.P.1.1 | Students know that a magnet pulls on all things made of iron without touching them, and that this pulling can result in motion. Students know that a magnet attracts some metals, but not all of them. Students know that a magnet has a force field and poles that determine how a metal affected by the magnet will behave within its field. |
| 4.P.1.2 | Students know that an object that has been electrically charged pulls or pushes on all other charged objects and that this can result in motion. Students know that electrical charges can result in attraction, repulsion or electrical discharge. |

## Concept:

| I can determine which objects are attracted to magnets by observing them move. |
| I can observe the attraction of objects resulting from electrical charges. |

## Lesson EQ(s):

| I will use a magnet to test for movement in a variety of metal/nonmetal objects. |
| I will sort objects by testing if they have iron in them by using a magnet. |
| I will observe the force field of a magnet. |
| I will diagram the poles on a magnet. |
| I will observe the reaction of the object based on the polarity of the magnet. |
| I will explain that magnets produce motion in objects made of iron. |
| I will demonstrate how electric charges will result in the motion of the object through experimentation. |
| I will be able to explain how opposites attract and likes repel |
| I will be able to compare how magnets are related to electrical charges. |
Decision 4: Launch Activities

Hooks and Links

Develops student interest and links prior knowledge. Provides the Student Learning Map and the key vocabulary to students.

Guiding Questions:
1. How are you going to get students engaged?
2. How are you going to develop student interest and link their prior knowledge?
3. How are you going to start the Student Learning Map of the unit with students?
4. How are you going to preview key vocabulary with students?

Lessons and Common Core Standards:

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Title</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson 1</td>
<td>“Stuck on You” (What Do Magnets Do?)</td>
<td>4.P.1.1</td>
</tr>
<tr>
<td>Lesson 2</td>
<td>Push!! Pull!! (What Can Affect the Push or Pull Exhibited by a Magnet?)</td>
<td>4.P.1.1</td>
</tr>
<tr>
<td>Lesson 3</td>
<td>Get Wired (Design a Complete Circuit)</td>
<td>4.P.1.2 and 4.P.3.1</td>
</tr>
<tr>
<td>Lesson 4</td>
<td>Electromagnets</td>
<td>4.P.1.2</td>
</tr>
</tbody>
</table>
Decision 5: Acquisition Lesson One: Stuck on You (What do Magnets do?)

Language Objective(s), where appropriate:
- I can explain how I know if an object has iron in it by using a magnet.
- I can explain why metal or nonmetal objects move when using a magnet.

Lesson Essential Question(s) or “I Can” Statement(s):
- I will sort objects by testing if they have iron in them by using a magnet.
- I will use a magnet to test for movement in a variety of metal/nonmetal objects.

Activating Strategies: (Learners Mentally Active)
Engage:
*Process Skills: Observe, Classify*
Display many different types of magnets for the students to observe.
Hold up each magnet making sure that it does not touch another magnet or anything else. Help the students notice different observable properties. Some of these properties include shape, size, color, etc. As you hold them up tell students the name of each type of magnet. Magnet types include donut, bar, circle, horseshoe, wand, refrigerator, etc.
Ask the students to name places that they have seen magnets. They will say things such as refrigerators, classroom whiteboards and games.

Acceleration/Previewing: (key vocabulary)
*Vocabulary:*
Attract, iron, magnet, metal, pole, push, pull, repulsion, repel, force field, force

Teaching Strategies: (Explain and Model; Collaborative Pairs; Distributed Guided Practice; Distributed Summarizing; Graphic Organizers)
Explore:
*Process Skills: Observe, Communicate, Predict, Experiment*
Give each student a doughnut magnet and ask the students

- *What are some things that you can do with this magnet?*

Encourage them to touch anything in and around their desk but not to leave their desk. [If computers are easily accessible from the desks explain to the students that the computers are off limits for this exploration.] Circulate as the students explore. If they ask direct questions try to answer with questions that will lead the students toward their own answers.

- *What did you find happened when you put 2 magnets together?*
- *What causes magnets to not stick together?*

After several minutes have students share something that was attracted to magnets that surprised them. Next, have them share things that were not attracted to the magnet that surprised them.

Explain:
*Process Skills: Predict, Classify, Communicate, Experiment, Interpret Data*
Collect the magnets. Put students into pairs and give each pair of students a set of test objects. Ask the students to predict which of the objects the magnet will stick to and record their observations on the data sheet *Object Testing* or make data sheets for their science notebooks. Often the predictions will be that the magnet will stick to all of the metal objects. Be sure the students do not change their predictions as they investigate. One way to do this is to have the students write their predictions in ink. As the students investigate have them record their findings on their data chart. Also, have a class/group data chart on the board or on a computer projected onto the board. Have one person from each group record the group data. This way you will be able to quickly evaluate whether the students have an understanding that items stick
to metal, but specifically iron. A discussion of why items did not stick to all metal is important here so students see that aluminum and copper to do not attract magnets. This will lead into a discussion as to what do the metals that do attract items have in common.

When the students have completed their investigation ask them if they found anything that surprised them. The students may bring up that the magnet did not stick to the aluminum foil or that it did stick to the magnetite. Ask students why they think some items were attracted to each other and some were not. Try to lead the students to the understanding that magnetic properties are linked to what the object is made of.

Ask questions such as:

- Did the shape of an object effect whether or not the magnet stuck to it?
- Did the color of an object effect whether or not the magnet stuck to it?

At this point take out a box of Total cereal. Place a cup of the cereal in a plastic bag and crush the cereal. Pour the cereal out onto a paper plate and slowly pass a bar magnet closely over it. The magnet will pick up pieces of the iron in the cereal. Ask the students why this is occurring.

- What is in this cereal that would stick to a magnet?

Give each student a copy of the nutrition facts from Total cereal. The students may conclude immediately that the cereal contains iron. The students should recognize iron as a metal and make the connection between the cereal with iron and its ability to stick to a magnet. The students should be able to explain that the magnets stick to objects that have iron in them.

Discuss the mineral magnetite which contains a lot of iron. Introduce the vocabulary word attract as when something pulls toward another object. The students may have observed that some objects will be attracted to each other when one of them is touching the magnet. Explain to the students that this is one example of a temporary magnet and that the effect wears off when the magnet is removed. If a group did not observe this, give them time to create a temporary magnet. Have students try several different objects to see which ones work the best as temporary magnets.

**Elaborate:**

*Process Skills: Classify, Predict, Communicate*

Assign the students the task of testing their homes for objects that attract magnets. Allow each student to “check out” a small magnet that can be returned the next day. Place each magnet into a separate plastic bag with a slip of paper explaining that magnets should not be used near computers. These are available inexpensively at home improvement stores. It works best to have them in sandwich bags when sending them home with the students. Challenge the students to find at least ten things in their homes that attract a magnet. Have the students use the data collection sheet at the end of the lesson *Magnet Attraction*.

Review with the class the materials that attracted the magnets. Ask them what happens when two magnets are near each other. Many of the students will say that the magnets will attract each other. Hold up several doughnut magnets that are stuck together, and explain to the students that they are correct. Then, carefully place the magnets onto a pencil one by one so that they repel each other. Ask the students to explain what is happening. The students may struggle to find appropriate terminology. Explain that a **force** is any push or pull.

At this point also introduce the vocabulary word **repel** as a force that pushes away. If you have large horseshoe magnets available allow the students to practice using them to test attract and repel. If you do not have horseshoe magnets available have the students use the doughnut magnets for this. Show the students a Magna Doodle™ and ask them to think about how it works. Either explain to the students that there are tiny magnetic particles behind the screen of it, or let the students read about it on the internet at [http://www.howstuffworks.com/magna-doodle.htm](http://www.howstuffworks.com/magna-doodle.htm).

**Distributed Guided Practice/Summarizing Prompts:** (prompts designed to Initiate Periodic Practice or Summarizing)

**Summarizing Strategies: Learners Summarize and Answer Essential Questions**

**Evaluate:**

*Process Skills: Communicate*
After they have completed the extension assignment above have the students explain in their science notebooks why they chose the objects that they tested at home. Have the students also list two other objects that they think would attract a magnet, but they have not yet tested. The students should explain why these objects would attract a magnet.

**Extensions:** Creative Writing. Create a diamante poem using the concepts learned in magnetism.

**Lesson Resources**

*Lesson Introduction:* Magnets are either attracted to or repelled by other magnets and some metals. In the next two lessons the students will learn that magnets are attracted to objects that are made of or contain iron. Students will also learn that magnets can be permanent or temporary. A permanent magnet is always magnetized. A magnet is a permanent magnet.

A temporary magnet is an object that contains iron which will hold a magnetic charge for a short amount of time. For example, when a magnet touches a large paper clip, the large paper clip can temporarily take on magnetic properties. This allows the large paper clip to “pick up” a smaller paper clip. Thus, the large paper clip acts as a magnet without being in contact with the magnet.

Finally the students will learn that the attractive force of a magnet can travel through some objects but is lessened as the magnet gets farther away from the object to which it is attracted.

One thing to be aware of is that computers, credit cards, videotapes, radios, cameras, cell phones, and any other object that stores information can be damaged when it comes in contact with the force of a magnet.

When students are taking notes in science or coming up with predictions have them write the information in ink. This will prevent students from erasing various guesses they have made which will allow their findings to be more valid. Scientists learn from the results of their experiment whether their hypothesis was proven or disproved. Emphasize to the students that they will learn just as all scientists learn.

*Materials for Lessons 1-3:*
- Doughnut magnets (one per student)
- Inexpensive circle magnets (one per student) – These are available at any home improvement store.
- Test objects (one set per two students)

Assemble objects that work for your situation and place them in small resealable bags. **Be sure to include similar amounts of objects that a magnet is attracted to and not attracted to.** Some examples include: paper, paper clips, fabric, nail, craft stick, penny, rock, screw, rubber band, marble, steel washer, Aluminum foil, nickel, magnetite (a mineral rich in iron that attracts magnets - optional). Save these materials for use in Lesson 5, “Ouch, Doc, That Hurt!”

- 10 squares of construction paper (per group of students) Each square should be approximately 2”x2”.
- Science notebook
- One Magna Doodle™
- Variety of different types of magnets (horseshoe, bar, wand, refrigerator)
- Paperclips (10 per two students)
- Thread
- Needle
- Tape
- Magnetic decorative pin
- Total cereal(with iron)
- A copy of the nutrition facts of Total cereal for each child.
- Classroom set of data collection sheet labeled “Object Testing”
- Classroom set of data collection sheet labeled, “Magnet Attraction”
Decision 5: Acquisition Lesson Two: Push!! Pull!! (What Can Affect the Push or Pull Exhibited by a Magnet?)

Language Objective(s), where appropriate:
- I can describe the force field of a magnet.
- I can describe the poles on a magnet.
- I can explain that the magnets with the same poles repel and magnets with opposite poles attract.
- I can describe how magnets make objects made of iron move.

Lesson Essential Question(s) or “I Can” Statement(s):
- I will observe the force field of a magnet.
- I will diagram the poles on a magnet.
- I will observe the reaction of the object based on the polarity of the magnet.
- I will explain that magnets produce motion in objects made of iron.

Activating Strategies: (Learners Mentally Active)

Engage:
Process Skills: Observe, Infer
Ask the class if magnets always have the same amount of pull or push. Since they do not always have the same push or pull have the students come up with reasons why. Attach a needle to an 18 inch piece of thread and tie it off so that the needle will not come off of the thread. Tape the end without the needle to the table. Lift the needle using the magnet to show the attraction between the needle and magnet. With the thread fully extended gently separate the needle from the magnet, but keep the magnet very close to the needle. The students will be astounded to see the needle “floating” in the air. Try not to let the needle drop. When you are done simply catch the needle in your free hand. Offer no explanations.

Acceleration/Previewing: (key vocabulary)
Vocabulary:
Attract, iron, magnet, metal, pole, push, pull, repulsion, repel, force field, force

Teaching Strategies: (Explain and Model; Collaborative Pairs; Distributed Guided Practice; Distributed Summarizing; Graphic Organizers)

Explore:
Process Skill: Formulate a Model, Experiment
Give pairs of students a magnet, paperclips, and many squares of paper. Ask the groups to design an experiment to test the pull of a magnet through paper. The students will begin to realize that the paper can separate the magnet from the paperclips and still work, but as they add more and more paper between the paperclips and the magnet, the strength is reduced.

Explain:
Process Skills: Communicate, Interpret
Have the students record their designs from the explore activity in their science notebooks and share their investigation with the class. Ask each group to draw their design on the board and then have a spokes person from each group explain that group’s design to the class. This will allow you to check for understanding and address any misconceptions. Ask the class how their investigation with the magnet, paper, and paperclips was similar to the needle demonstration at the beginning of class. They should be able to conclude as the distance between an object and a magnet increases the magnetic force between the objects decreases.

Elaborate:
Process Skills: Observing, Interpreting
Repeat the needle demonstration. This time allow the needle to “float” for a short time and then slowly pull the magnet
away. The needle will fall. Repeat the process. Remind the class that when we did this before we saw the needle “float” in the air. Have the students discuss in their groups why this occurred. Some questions that can be used include:

- Why did the needle float in the air?
- Why did the needle fall this time?

Distributed Guided Practice/Summarizing Prompts: (prompts designed to Initiate Periodic Practice or Summarizing)

Summarizing Strategies: Learners Summarize and Answer Essential Questions

Evaluate:

Process Skills: Observe, Interpret, Communicate

Show the students a magnetic decorative pin. (These pins are readily available most places that you find costume jewelry. Some permanent name tags now use magnets as opposed to pins.) Explain that this decorative pin is something that you really like to wear, but you have a hard time wearing it with certain clothes. Tell the students that you can wear it with knit shirts or blouses (you may need to show them an example of these), but you can’t wear it with sweaters. Ask the students why this is so and have them record it in their science notebooks.

Make sure that you check the science notebook so that you will know whether the students have gained an understanding about the pull of magnets on all materials made of iron, and how the force can travel through other things— even air. Check, also, that the students understand that the strength of the force dissipates as the object moves away from the magnet. Depending on the strength of the magnet it will attach easily to thin clothes, but may not work with thick ones.

Lesson Resources

Materials for Lessons 1-3:

- Doughnut magnets (one per student)
- Inexpensive circle magnets (one per student). These are available at any home improvement store.
- Test objects (one set per two students)
  - Assemble objects that work for your situation and place them in small resealable bags. Be sure to include similar amounts of objects that a magnet is attracted to and not attracted to.
    - Some examples include: paper, paper clips, fabric, nail, craft stick, penny, rock, screw, rubber band, marble, steel washer, Aluminum foil, nickel, magnetite (a mineral rich in iron that attracts magnets - optional). Save these materials for use in Lesson 10.
- 10 squares of construction paper (per group of students) Each square should be approximately 2” x 2”.
- Science notebook
- One Magna Doodle™
- Variety of different types of magnets (horseshoe, bar, wand, refrigerator)
- Paperclips (10 per two students)
- Thread
- Needle
- Tape
- Magnetic decorative pin
- Total cereal(with iron)
- A copy of the nutrition facts of Total cereal for each child.
- Classroom set of data collection sheet labeled “Object Testing”
- Classroom set of data collection sheet labeled, “Magnet Attraction”
Decision 5: Acquisition Lesson Three: Get Wired (Design a Complete Circuit)
4.P.1.2; 4.P.3.1 (Energy Conservation and Transfer)

Language Objective(s), where appropriate:

Lesson Essential Question(s) or “I Can” Statement(s):
• I can create and explain a closed circuit and how it affects objects.

Activating Strategies: (Learners Mentally Active)

Engage:

Activity #3: Process Skills: Create, Analyze
Give each student pair a piece of PVC pipe (12 inches in length), a piece of wool or flannel cloth (12 in X 12 in) and a plastic grocery bag. Have them rub the pipe with their cloth and place it next to the plastic bag. To show the power of static electricity, have students move quickly around the room with the pipes to see how strong the attachment is to the bag. Have the students come up with ideas about why this occurs. Use this to segue into Activity #2.

Activity #2: Process Skills: Communicate, Classify
Draw the graphic organizer on the overhead or on the board so that all students can see it. (See example below.) Place the word electricity in the center as shown on the example. Have the students write the word electricity in ink in their Science notebooks. Have students place words around the word electricity that they think of when encountering the word electricity.

If students are having difficulty coming up with words here are some to get them started: lightning, lights, radio, etc. Do not give them these words unless they do not have any ideas. This activity is to help students begin to think about electricity.

After giving students several minutes to write down items select students to come up to the board to fill in the chart. Students need to make sure and list items that have not already been listed.

Hold up a flashlight and turn it on for the students. Ask students engaging questions so that they can begin to think about how the flash light works. Some examples include:

- Have you ever wondered how a flashlight works?
- Do you know the parts of a flash light?
- Have you ever turned on a flash light and it didn’t work?
- Why didn’t the flash light work?

Take apart the flashlight. Show students the D-cells, the light bulb and the connecting wires. You do not want to give students the flashlight at this point.

Acceleration/Previewing: (key vocabulary)
Vocabulary:
Electrical circuit (closed circuit, open circuit, simple circuit), Electricity, Energy, Magnetic, Insulator, Absorb, D-Cell, electromagnetic

Teaching Strategies: (Explain and Model; Collaborative Pairs; Distributed Guided Practice; Distributed Summarizing; Graphic Organizers)

Explore:

Process Skill: Experiment

Students should work in groups of no more than five people. Give each group of students two wires, a D-cell, and a light bulb. Their task is to make the light bulb come on. Allow students time to explore on their own until they can make their light bulb light by themselves. This can be done in several ways.

One way to make a working circuit is by taking one wire and touching the positive side of the D-cell. Next connect the other end of this wire to the side of the light bulb. The second wire must touch the bottom of the light bulb and connect to the negative side of the D-cell. This is similar to the circuit created with one wire.

The most important thing to remember is that both the positive and negative sides of the battery are connected and both the bottom and side of the light bulb are connected. See the diagram below. Let students know that if the circuit gets hot at anytime they are creating a short circuit which is incorrect.

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If a group cannot make their light bulb work here are some examples of questions to ask which will engage the students.

- What have you tried so far?
- What do you notice about the D-cell? Students should notice the positive and negative sides of the D-cell.
- What do you notice about the light bulb? Students should notice that the bottom and the sides of the base are both metal.
- If students notice that the light bulb has a bottom metal part and the metal sides ask them: Why does the light bulb have both these parts?

Common problems that students will run into while completing a circuit include, not connecting the bottom of the light bulb in the circuit, not using both the positive and negative side of the D-cell, or putting both wires on the same side of the D-cell. Students who have the connection incorrect may tell you their battery or light bulb does not work. In these situations have a completed circuit hidden from the students to check their D-cells and light bulbs just in case they have faulty materials.

Explain:

Process Skill: Communicate

After succeeding at the task listed above, students need to draw a picture in their Science Notebooks and explain how they made the light bulb come on. After students have recorded their information they can try to make another successful circuit different from the one they made the first time. Once each group has finished one student from each group will come up to the board and draw a picture of one of their successful circuit. In cooperative groups students will come up with an explanation how the circuit must be set up in order for the light bulb to work.

Write the following words on the board: energy source, energy conductor, and energy receiver. Have students discuss in their groups which part of the circuit should be labeled with these words.

Some leading questions include:

- What do you think was the source of energy?
- Which item received the energy?
- What could be the energy conductor?
Process Skills: Experiment, Communicate, Interpret

The students will be given a D-cell, D-cell holder, light bulb, light bulb holder, and two wires. Again they need to make the light bulb come on.

In order for students to make this type of circuit work they must first place the light bulb and D-cell in the appropriate holders. These holders have two clips that allow for the electricity to flow through them and connect the appropriate parts of the bulb and D-cell. Have students push the clips down with their pencil erasers so that they do not pinch their fingers in the clips.

Once they have completed this task they will draw a picture of the circuit they created.

Ask students the following question:

- Was the task easier with the use of the holders?
- Why?

After students have accomplished this and drawn their picture, introduce the term Series Circuit and explain to them this is the type of circuit they have been creating. A series circuit is a circuit where all of the objects are connected in one continuous path. Series circuits are like circles.

Add a switch, if a switch is available. In order to do this the students must be given another wire the same size as the ones listed above. Students now have 3 wires, a D-cell, a D-cell holder, a flash light bulb, a bulb holder, and a switch. Do not tell students that the new object is a switch. Have students create a working series circuit with the switch.

Ask the following question:

- What do you think this new object is?
- Does the object do anything? (Students should notice that when the switch is closed the light bulb is on and when the switch is open the light is off.)
- Why does the object cause the lights to go on and off?

Allow the students to discuss this and then introduce the words open and closed circuit. An open circuit is a broken circuit because the switch is open, the lights will be off. A closed circuit is completed, the lights will come on.

Distributed Guided Practice/Summarizing Prompts: (prompts designed to Initiate Periodic Practice or Summarizing)

Summarizing Strategies: Learners Summarize and Answer Essential Questions

Evaluate:

Process Skills: Interpret

Get out the flash light that was taken apart at the beginning of the lesson. Students will need to write a detailed explanation answering the following question:

- How does a flash light work?

Explain, using the terms open and closed circuit. Have the flashlight available for students that may want to take a closer look on how the different parts connect together to make it work. The teacher will evaluate student progress based on the student explanation and the accuracy of it.

Class Reflection Questions for Closure:

- How a series circuit works?
- Tell the difference between a closed circuit and an open circuit.
- Name the energy source, energy conductor, and energy receiver, used in the series circuit made.

Lesson Resources

Teacher Notes:

In this lesson students will be creating a complete circuit. Students need to be given an energy source, an energy conductor, and an energy receiver. An energy source is an object that provides energy. Some examples include batteries,
electrical outlets, generators, etc. In this case the energy source is the D-cell. A cell is another word for a battery. The letter comes from the size of the battery. The batteries that are used for this lesson are size D.

The energy receiver is an object that must receive the energy in order for it to work. In this lesson the energy receiver is the flash light bulb. There are many different objects that are energy receivers. Some examples of energy receivers include computers, over head projectors, classroom lights, etc.

An energy conductor is an object that allows electricity to flow through it. The wires in this lesson are energy conductors. There are many objects that can act as energy conductors. Students will learn more about conductors and nonconductors when completing lesson 5.

To begin the lesson students will be making a circuit with one wire, a D-cell and a light bulb. The students need to see how a light bulb and D-cell are connected in order for them to work. Students will not be using holders at first because using them will prevent a complete understanding of how a circuit works. A circuit is a pathway in which electricity flows.

One way for this particular circuit to work is for students to use the wire to touch the negative side of the battery and connect it to the bottom of the light bulb. Simultaneously they must hold the side of the light bulb to the positive side of the D-cell.

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After students have gained an understanding of how a circuit works they will observe how the holders work. They should be able to explain the metal of the holders is connected to all the necessary parts of both the flash light bulb and the D-cell.

This lesson begins with a working flash light. This has all the same parts as the circuit students are going to make. It is important to take the batteries and light bulb out of the flash light so students can see that they are using the same parts that a flash light already has.

Materials:
- Working Flashlight
- Graphic Organizer
- Materials needed for each group
  - 1 D-cell
  - 2 wires about 10 cm long with both ends stripped of plastic coating about two centimeters on each side
  - one light bulb
  - Science Notebook
- Optional Items
  - one light bulb holder
  - 1 D-cell holder
  - Light bulb holder D-cell holder

Resources:
- Light bulb Image: www.4physics.com/.../lightbulbs-1.html

FOSS Kit – Electricity & Magnetism
Decision 5: Acquisition Lesson Four: Electromagnets

Language Objective(s), where appropriate:

Lesson Essential Question(s) or “I Can” Statement(s):
- I will demonstrate how electric charges will result in the motion of the object through experimentation.
- I will be able to explain how opposites attract and likes repel
- I will be able to compare how magnets are related to electrical charges.

Activating Strategies: (Learners Mentally Active)

Engage:
Process Skill: Experiment
Give students a magnet, a small nail, and some paperclips. Tell them to try to pick up the paperclips with the small nail. After they have struggled for a few minutes, have the students pick up the magnet and show them how to rub the small nail in one direction. After they have rubbed the small nail several times, let them try to pick up the paper clips again. They should be able to see that the small nail is beginning to pick up the paper clips. Ask them what they think will happen if they rub the nail for a longer period? Give them time to work in their groups. They should discover that the more they rub the small nail the stronger it becomes. Tell them that they have just turned the nail into a temporary magnet.

Acceleration/Previewing: (key vocabulary)

Teaching Strategies: (Explain and Model; Collaborative Pairs; Distributed Guided Practice; Distributed Summarizing; Graphic Organizers)

Engage:
Process Skill: Experiment
Give students a magnet, a small nail and some paperclips. Tell them to try to pick up the paperclips with the small nail. After they have struggled for a few minutes, have the students pick up the magnet and show them how to rub the small nail in one direction. After they have rubbed the small nail several times, let them try to pick up the paper clips again. They should be able to see that the small nail is beginning to pick up the paper clips. Ask them what they think will happen if they rub the nail for a longer period? Give them time to work in their groups. They should discover that the more they rub the small nail the stronger it becomes. Tell them that they have just turned the nail into a temporary magnet.

Explore:
Process Skills: Experiment, Infer, Use Numbers
Give each group of students an iron nail, a 22 gauge wire, D-cell, D-cell holder, 10 cm long wire, and switch. Tell the students you would like them to make a circuit with the supplies you gave them. (Do not tell them how to connect the wires, D-cell and holder or nail.) It will take students a few minutes to realize how to connect the longer wire. Ask students how a circuit is normally connected. They should recall from previous lessons that the circuit should be connected in a circular fashion. Next ask students why they think that one of their wires is so long. At this point they should begin to wonder about the long wire and nail.

In order to make this circuit work students must wrap the long wire around the nail and then connect one of the two ends of the wire to one side of the D-cell holder, and the other side of the long wire to the switch. The smaller wire must be connected from the other side of the D-cell holder to the switch. (If students are not using the optional items they will wrap the long wire around the nail and connect one end of the wire to the positive side of the D-cell and the other side of the wire to the negative side of the D-cell)

After students have created their electromagnet, give each group 20 to 30 small paper clips. Have students try to pick
up as many paper clips as possible. Have students determine the best way to wrap the wire so that they can pick up the most paper clips. (Students should find that the more wire that is tightly and neatly wrapped around the nail, the stronger the electromagnet will be.)

Have students create a graph using the number of winds of the wire and how many paper clips were picked up by that number of winds.

**Explain:**

*Process Skills: Communicate*

Have the students draw a picture of the electromagnet they made. Below the picture have the students write a summary of how they turned the nail into an electromagnet.

**Elaborate:**

*Process Skills: Communicate, Classify*

Have the students research five places where electromagnets are used. They can use the internet and other sources that are available to you. In a whole group activity make a combined list of places electromagnets are used. Students may also like to bring in pictures of the examples of where electromagnets are used. This can be made into a poster or even used as a bulletin board. Students may be very surprised at what they discover.

**Summarizing Strategies: Learners Summarize and Answer Essential Questions**

**Evaluate:**

*Process Skills: Communicate*

Have the students work with a partner to share their drawings and summaries from Explain and Elaborate. Working together they can evaluate what they wrote and make corrections or additions as needed. When they have finished evaluating their work, they can turn this in to the teacher.

**Lesson Resources**

*Lesson Introduction:*

In this lesson students will be creating an electromagnet. Electromagnets are useful because they are magnets which can be switched off and on. One of the most common uses for an electromagnet is at the junk yard. Junk yards use electromagnets to move large pieces of metal such as cars or trucks. The junk yards can turn on the magnet to pick up the large items and then turn it off to drop the items where they would like to place them.

(*Do not explain this to students. They need to try and figure out how to make the electromagnet work on their own.*)

This is one way to make an electromagnet. Students must have an iron nail about 6 in. long and 10 ft. of 22 gauge insulated, stranded copper wire, and one or more D-cell batteries. Both ends of the wire need to be stripped of their wire about ¼ inches. The ends of the wire will touch both sides of the D-cell. The wire must be wrapped around the nail in order to make the electromagnet work. After wrapping the wire around the nail, students can use the nail to pick up metal objects. The nail has become electrically charged. It can be switched on and off by disconnecting the D-cell.

*Materials:*

- Iron nails (15 cm. long)
- 22 gauge copper wire (2 m. long)
- D-cell batteries
- Small penny nails
- Magnets
- 20 to 30 small paper clips
Optional Items

- Switch
- D-cell holder
- One wire (10 cm. long)

Additional Resources: (double click on an icon to open the resource)

- ch5 magnetism.ppt
- intro_to_magnets.ppt
- Magnet Magic.ppt
- Web Sites about magnets and magnetism
- Force.ppt
- Lesson Plan for Magnetism.pdf
- Magnetism.ppt
**Decision 6: Extending Thinking Activities**

Include extending activities for several lessons in the essential units.

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<tr>
<th>Cause/Effect</th>
<th>Compare/Contrast</th>
<th>Deduction</th>
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<td>Justification</td>
<td>Induction</td>
<td>Analyzing Perspective</td>
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<tr>
<td>Error Analysis</td>
<td>Abstracting</td>
<td>Evaluation</td>
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<tr>
<td>Classifying</td>
<td>Constructing Support</td>
<td>Writing Prompt</td>
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Decision 7: Differentiating the Unit

What accommodations will you make in order to meet the varied interests, learning styles, and ability levels of all students?

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<tr>
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<td>visual, auditory, kinesthetic activities</td>
<td>scaffolding</td>
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<td>real world meaning</td>
<td>interests</td>
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Decision 8: Unit Calendar

Determine the most viable sequence for the experiences, activities, and lesson and create a timeline.
Decision 9: Resources

Provide graphic organizers, links, book titles, websites, etc. that provide support for teaching this unit.
Unit Designers:

Date: 1/22/13

<table>
<thead>
<tr>
<th>Name</th>
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</thead>
<tbody>
<tr>
<td>Shawn McMurray</td>
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