**Oct 15th, 2011**

**Accessing magnet**

Objectives

Students will get access to different shapes of magnets. They will understand the concepts of (1) positive & negative poles, (2) magnetic field, (3) magnetic force. They will practice the skill of observation and inference.

Method:

Observation and experiment

Material:

* Bar magnet
* U-shape magnet
* Compasses
* Student balances
* Iron file
* 4”x6” rectangular transparent containers

Background

5-8 graders all have experiences playing with magnet. The phenomena of magnet are interesting to kids. However, they are not aware that the interaction between two magnets, either drawing or repelling, is caused by magnetic force. They have no idea about magnetic field because it is unperceivable directly by five senses. In this class, they will learn another type of force, which could also strengthen their conception of force, pull and push in their words. They can see magnetic field of a magnet visualized by iron files.

Class information:

Grade level: 5-8

Subject area: Physics, classic electromagnetism

Duration: 2 hours.

Procedure:

9:30 – 9:45

Pre-assessment on students’ understanding of the nature of science (NOS) their scientific skills. There will be a class discussion about what science is, why we learn science, and how to do science. Students will be reviewed on important skills for inquiry.

9:45 -10:00

Students will share their experiences with magnets. And each group will be given two bar magnets to observe. Probing questions will be “what do you think make two magnets move toward or away from each other?” “How can you make two repelling magnets ‘like’ each other?” “I accidentally broke a magnet into two parts. Can I put or stick them back together as one?”

10:00 - 10:30

Students will be given two different shapes of magnet, bar magnet and U-shape magnet. They will be asked what are the similarities and differences between the two types of magnet. They will be given a variety of objects to try which one of them can be picked up by a magnet. After that, they will be guided to summarize the key features of a magnet, including that 1. A magnet is a solid that can only pick up iron; 2. A magnet has two poles; 3. A magnet can draw or repel another magnet. Finally, students will be given a compass to identify whether it is a magnet or not.

10:30 - 10:45

Snack time

10:45 -11:40

Students will be asked first what causes the interaction between two magnets. Then the teacher will review the concept force and types of force they have already known. After that the teacher will reveal that the interaction between two magnets is caused by another type of force, magnetic force. Students will feel both strong and weak magnetic forces first. Then they will design an experiment to measure the magnitude of the magnetic force.

Suggested procedures of measuring magnetic force:

1. Put a magnet on the balance to measure its initial weight.
2. Put another magnet 5 cm above the one on the balance. Record the weight.
3. Lift the magnet to 7 cm above the one on the balance. Record the weight again.
4. Think about what changed the weight of the magnet. (magnetic force) How large is it.

After this, students will be able to quantify the magnitude of a magnetic force. And they will figure out that the closer the two magnets are, the larger the magnetic force would be.

11:40 - 12:00

Students will spread out iron file on a 4” X 6” transparent container. Then they will put both a bar magnet and a U-shape magnet beneath the container. The iron file will display certain patterns. Students will draw pictures of the patterns. After that the teacher will reveal that it is because of the magnetic field of each magnet. It exists even though we cannot actually see it. Finally, students will be asked why a compass can point at the direction of south all the time. This question will be answered by a video regarding the global magnetic field. Then students will know the earth is a giant magnet.

Video

<http://www.youtube.com/watch?v=5SXgOWYyn84>

or

http://www.youtube.com/watch?v=CiCBrXKIH\_0&feature=related

Lab-sheet

Compare U-shape magnet, circle magnet and bar magnet. Use your own words to describe what a magnet is.

Do you think a compass is a magnet? Why?

1. Put a magnet on the balance to measure its initial weight.
2. Put another magnet 5 cm above the one on the balance. Record the weight.
3. Lift the magnet to 7 cm above the one on the balance. Record the weight again.

|  |  |  |
| --- | --- | --- |
| Initial weight (g) | Weight with another magnet 3 cm above it (g) | Weight with another magnet 6 cm above it (g) |
|  |  |  |

What can you infer about magnet from this experiment?

Draw the pattern of the iron file above each magnet.

|  |  |  |
| --- | --- | --- |
| Bar magnet | U-shape magnet | Circle magnet |
|  |  |  |

**Nov. 5th**

**Technology of electromagnetism, telegraph**

Objectives

Students will put into practice the knowledge they have learned about electromagnetism. They will have a general idea about the electromagnetic technology in reality, including electrical motor, electric generator, and magnetically levitated train. They will understand the mechanism of a telegraph, and work in pairs to build their own telegraph.

Method:

Demonstrating experiment, trial and error.

Material:

* Batteries
* Battery holders
* Rolls of electrical wires at different size
* Nails
* Steel stripes
* Masking tape
* Scissors
* Paper clips
* Modeling clay
* Card board

Procedure:

9:30- 9:45

The teacher will review electromagnetic phenomena covered in previous classes. Students will compare electrical magnet and permanent magnet under the guidance of the teacher. Then they draw conclusions about the pros and cons of electrical magnet.

9:45- 10:30

Students first discuss the possible application of electrical magnet in real world. Then the teacher plays the videos of other electromagnetic phenomena, such as Ampere force and Faraday’s effect, as well as their application in real world.

Videos

Electrical motor and electric generator

[http://www.youtube.com/watch?v=d\_aTC0iKO68&feature=related](https://pod51000.outlook.com/owa/redir.aspx?C=YLN5_p8VOEC6iET3oOn6yDy5yfcKb84ISjuS1WQGpAB4xmU4mol2SU-qy9paDUx6B4i_cv_K76I.&URL=http%3a%2f%2fwww.youtube.com%2fwatch%3fv%3dd_aTC0iKO68%26feature%3drelated" \t "_blank)

How to build an electrical motor

[http://www.youtube.com/watch?v=it\_Z7NdKgmY](https://pod51000.outlook.com/owa/redir.aspx?C=YLN5_p8VOEC6iET3oOn6yDy5yfcKb84ISjuS1WQGpAB4xmU4mol2SU-qy9paDUx6B4i_cv_K76I.&URL=http%3a%2f%2fwww.youtube.com%2fwatch%3fv%3dit_Z7NdKgmY" \t "_blank)

Magnetically levitated train

<http://www.youtube.com/watch?v=aIwbrZ4knpg>

Quantum levitation

<http://www.youtube.com/watch?v=UDdqzi1qPhQ>

10:30-10:45

Snack time

10:45-11:10

The teacher will engage students by demonstrate communicating with a telegraph. Then students will discuss in class how a telegraph works. After the discussion the teacher will reveal the answer and play the video of Morse code.

Morse code

<http://www.youtube.com/watch?v=_J8YcQETyTw>

11:10-12:00

Students will work in pairs to build their own telegraph. The teacher will help them with the problems and difficulties they will encounter.

**Nov. 12th**

**Review and Evaluation**

Objectives:

Students will be able to work out a conceptual map and clearly explain what they have learned about electromagnetism. They should be aware of the inquiry process and scientific methods they have applied as well. They will have a general idea about the development of electromagnetism in the history of physics. They should be creative in designing electromagnetism-related equipment.

Method:

Conceptual map, history of science, trial and error

Material:

* Chart paper
* Markers with different colors
* All the materials used in the previous classes (Just in case)

Procedure:

9:30- 10:00

Students will be asked to reflect on the previous classes. They will work in groups to review what they have learned about electromagnetism, as well as the inquiry process. They will draw concept map to indicate the relationship between different concepts. They will also draw flow chart to show the inquiry process and inquiry skills involved.

10:00-10:30

Groups will share their concept map and flowing chart with their peers. One group will be presenting each time and the others will play the role as both audience and evaluators.

10:30-10:45

Snack time

10:45- 11:30

The teacher will summarize all the key concepts and phenomena with respect to electromagnetism, as well as the inquiry skills students have used, including observation & inference, doing experiments, collecting and evaluating data. A slide show will be played regarding the development of electromagnetism in history and the contribution of some world-famous scientists, such as Lorenz, Maxwell.

Slide show

[http://msnucleus.org/membership/slideshows/historyelectricity.html](https://pod51000.outlook.com/owa/redir.aspx?C=JQrf9manjUmafsX-gDb_HtzUxXmKb84IJP_-QX0zvwlAzBZSAqxgKpAQ7dc26zhEMWZIXBSz_HU.&URL=http%3a%2f%2fmsnucleus.org%2fmembership%2fslideshows%2fhistoryelectricity.html" \t "_blank)

11:30- 12:00

Students will be encouraged to brainstorm how they can use the knowledge of electromagnetism. They will work in pairs creatively to design some equipment involving electromagnetism. Then they will share their design with the whole class, which will be evaluated by their peers on its feasibility and practicability. If there is time left, students can try out their design with the materials at hand.