MAGNETISM CURRICULUM

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Summer 2004
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TABLE OF CONTENTS

Florida GLE's – Science/Math/Social Studies/Language Arts	3
Magnetism KWL Chart	4
Magnetic Fields	5
Magnetic Domains	6
The Earth as a Magnet	9
Magnetic Declination	9
Electromagnets	11
Magnetism Word Search	14

The following 6-8 GLE's of the Florida Sunshine State Standards will be covered.

SCIENCE (SC)

- A.2.3.1.6.1 - A.2.3.1.7.1 - A.2.3.2.6.1 - A.2.3.3.6.1
- B.1.3.1.6.1 - B.1.3.1.7.1
- C.2.3.1.7.1 - C.2.3.1.7.2 - C.2.3.1.7.3 - C.2.3.1.7.4 - C.2.3.1.8.1
- H.1.3.1.6.1 - H.1.3.1.6.2 - H.1.3.1.7.1 - H.1.3.1.8.1 - H.1.3.2.7.1 1.3.5.6.1 - H.1.3.6.6.1 - H.3.3.1.6.2 - H.3.3.1.7.2 - H.3.3.1.8.2

MATH (MA)

- A.3.3.3.7.1 – A.3.3.3.8.1
- B.2.3.1.6.1 – B.2.3.1.7.1 – B.2.3.1.8.1 – B.2.3.1.8.2 – B.3.3.1.8.1 – B.4.3.1.6.1 – B.4.3.1.6.2 – B.4.3.1.7.1 – B.4.3.1.7.4 – B.4.3.1.8.1 – B.4.3.2.6.3 – B.4.3.2.7.2 – B.4.3.2.8.2
- E.1.3.1.6.2 - E.1.3.1.7.1 – E.3.3.1.7.2 – E.3.3.1.8.2

SOCIAL STUDIES (SS)

- B.1.3.1.6.2

LANGUAGE ARTS (LA)

- A.1.3.1.6.2 – A.1.3.4.6.4 – A.2.3.5.6.3 – A.1.2.3.6.1 - A.1.2.3.6.2 – A.1.2.3.7.1 – A.1.2.3.7.2 – A.1.2.3.8.1 – A.1.2.3.8.2
- C.3.3.2.6.1 – C.3.3.2.7.1 – C.3.3.2.8.1

NAME_____

MAGNETISM
KWL Chart

K What do you KNOW?	W What do you WANT to know?	L What did you LEARN?
1. List the two poles of a magnet.		
2. What do like poles do to each other?		
3. What do unlike poles do to each other?		
4. List the region in which magnetic forces can act.		
5. What is a magnetic domain?		
6. What is an electromagnet?		

MAGNETIC FIELDS

The region of magnetic force around a magnet is known as its magnet field. Magnetic fields allow magnets to interact without touching. Even though you cannot see magnetic fields, you can see their effect.

→ Do the following activity with your students. (Note: Saran wrap used in this activity keeps the iron filings from attaching to the bar magnet)

Materials:

(Per 2 students)
Bar magnet
Iron filings
Saran wrap – at least 20 cm X 10 cm (note: Saran wrap keeps the iron filings from attaching to the bar magnet)
Small plastic pan (like microwave dinners come in)
½ sheet of plain paper
1 sheet notebook paper

Procedure:

- Give each group: ½ sheet of plain paper, Saran wrap, bar magnet, plastic pan, and small container with iron filings.

- Have students: (1) place the Saran wrap around the bar magnet, (2) place the bar magnet with Saran wrap in the pan, (3) put the ½ sheet of plain paper over the magnet, and (4) pour a small amount of iron filings on the paper.

- Have each group write down what they observed and why they think that this happened.

- Clean up.

- Discuss Observations

Note: This can be done as a demonstration by the teacher. You will need: an overhead projector, bar magnet, 2 sheets of plastic transparency film, tape, and iron filings. Tape the 2 sheets of transparency film together on three sides (make sure there are no spaces between the edges where the iron filings might fall out). Pour some iron filings into this

“sleeve” of plastic. Tape the last two edges together so that the iron filings are now completely sealed in the plastic. Place the sealed plastic/iron filings on the overhead projector. Turn the projector on. Now place the bar magnet in the center of the plastic. Discuss what students observe.

MAGNETIC DOMAINS

Most scientists believe that within objects there are small clusters of atoms, each containing north and south poles. The clusters, called domains, are normally randomly arranged. When the object is magnetized, the domains tend to line up in a single direction and each acts like a tiny magnet. Some objects line up their domains easier than others. Soft iron, for example, aligns its domains easier than steel. Therefore, soft iron is easier to magnetize, but it is also easier for it to lose its magnetism. While steel is harder to magnetize, it will keep its magnetism better. Aligning their domains cannot magnetize some objects such as wood or plastic. When a magnet is heated or dropped, the domains may get knocked out of line and the object (magnet) will lose its magnetism. Therefore, it is important that magnets or magnetized objects be handled with care.

→ Do the following activity with your students – Magnetic Domains Lab

MAGNETIC DOMAINS LAB

NAME_____DATE_____

BACKGROUND INFORMATION:
Most scientists believe that within objects there are small clusters of atoms, each containing north and south poles. The clusters, called domains, are normally randomly arranged. When the object is magnetized, the domains tend to line up in a single direction and each acts like a tiny magnet. Some objects line up their domains easier than others. Soft iron, for example, aligns its domains easier than steel. Therefore, soft iron is easier to magnetize, but it is also easier for it to lose its magnetism. While steel is harder to magnetize, it will keep its magnetism better. Aligning their domains cannot magnetize some objects such as wood or plastic. When a magnet is heated or dropped, the domains may get knocked out of line and the object (magnet) will lose its magnetism. Therefore, it is important that magnets or magnetized objects be handled with care.

MATERIALS:
- Rectangular jewelry gift box (1 per group of 2-3 students)
- Rubber band
- Red Vis-à-Vis marker
- Small Tootsie Rolls (6-8 per group of 2-3 students)
- Meter stick
- Blank sheet of paper

PROCEDURES:
1. The rectangular jewelry gift box will represent the object, made of iron, steel, or nickel.
2. The Tootsie Rolls will represent the domains.
3. Use the red Vis-à-Vis marker and place a dot on one end of each of the Tootsie Rolls. (This will represent the north pole of the magnet.)
4. On the blank sheet of paper, trace the outline of your box. Do this 3 more times. Number the outlines as boxes 1, 2, 3 and 4.
5. Line up the Tootsie Rolls in the box in rows of 2 (some boxes will only hold 6, others are long enough to hold 8), making sure that all the north poles (red dots) are pointing in the same direction. ANSWER QUESTION #1.
6. On the blank sheet of paper, in box #1, draw the arrangement of the Tootsie Rolls as you accurately see them in the rectangular jewelry gift box. Remember to mark where the red dots are.
7. Now place the lid on the rectangular jewelry gift box and place the rubber band around the center of the box at the narrowest section.
8. Place the zero point of your meter stick on your desk. Using the meter stick place the box 30 centimeters from the top of your desk. Release the box from this distance, allowing it to fall to the top of your desk.
9. Open the box. Draw the arrangement of your Tootsie Rolls as you accurately see them in outline box #2. ANSWER QUESTION #2.
10. Once again, place the lid on the rectangular jewelry gift box and place the rubber band around the center of the box at the narrowest section.

11. Place the zero point of your meter stick on your desk. Using the meter stick place the box 1000 centimeters from the top of your desk. Release the box from this distance, allowing it to fall to the top of your desk.
12. Open the box. Draw the arrangement of your Tootsie Rolls as you accurately see them in outline box #3. ANSWER QUESTION #3.
13. Once again, place the lid on the rectangular jewelry gift box and place the rubber band around the center of the box at the narrowest section.
14. This time, stand, place the box in one hand and lift your hand as high as possible. Release the box, allowing it to fall to the floor.
15. Open the box. Draw the arrangement of your Tootsie Rolls as you accurately see them in outline box #4. ANSWER QUESTION #4.
16. Once you have returned the box, rubber band and meter stick to your teacher, you may eat the Tootsie Rolls.

QUESTIONS:

Circle the correct answer. Note: If most of the domains/poles (red dots) are not in alignment, then the magnet is no longer magnetized.

1. Is it magnetized? YES NO

2. Is it magnetized? YES NO

3. Is it magnetized? YES NO

4. Is it magnetized? YES NO

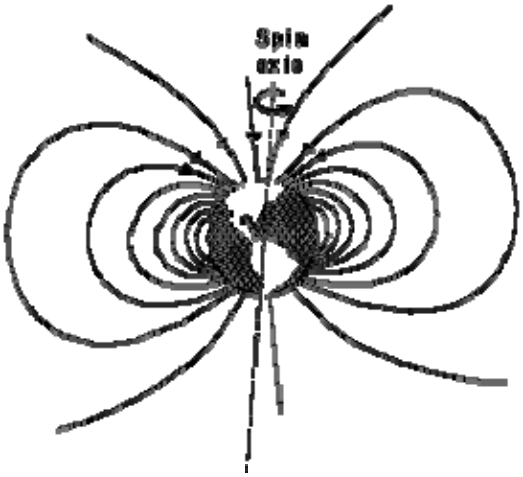
THINK ON THIS:

What would happen to the magnetism of the magnet if you cut the magnet in half?

THE EARTH AS A MAGNET

(http://hyperphysics.phy-astr.gsu.edu/hbase/magnetic/magearth.html)

The earth's magnetic field is similar to that of a bar magnet tilted 11 degrees from the spin axis of the earth. The problem with that picture is that the Curie temperature of iron is about 770 C. The earth's core is hotter than that and therefore not magnetic. So how did the earth get its magnetic field?



Magnetic fields surround electric currents, so we surmise that circulating electric currents in the Earth's molten metallic core are the origin of the magnetic field. A current loop gives a field similar to that of the earth.

The earth's magnetic field is attributed to a dynamo effect of circulating electric current, but it is not constant in direction. Although the details of the dynamo effect are not known in detail, the rotation of the Earth plays a part in generating the currents which are presumed to be the source of the magnetic field. Mariner 2 found that Venus does not have such a magnetic field although its core iron content must be similar to that of the Earth. Venus's rotation period of 243 Earth days is just too slow to produce the dynamo effect.

MAGNETIC DECLINATION

(http://www.geolab.nrcan.gc.ca/geomag/magdec_e.shtml)

Many people are surprised to learn that a magnetic compass does not normally point to true north. In fact, over most of the Earth it points at some angle east or west of true (geographic) north. The direction in which the compass needle points is referred to as magnetic north, and the angle between magnetic north and the true north direction is called **magnetic declination**. You will often hear the terms "variation", "magnetic variation", or "compass variation" used in place of magnetic declination, especially by mariners.

The magnetic declination does not remain constant in time. Complex fluid motion in the outer core of the Earth (the molten metallic region that lies from 2800 to 5000 km below the Earth's surface) causes the magnetic field to change slowly with time. This change is known to as secular variation. Because of secular variation, declination values shown on old topographic, marine and aeronautical charts need to be updated if they are to be used without large errors. Unfortunately, the annual change corrections given on most of these maps cannot be applied reliably if the maps are more than a few years old since the secular variation also changes with time in an unpredictable manner.

The magnetic north pole (in northern Canada) is about 1,250 kilometers from the geographic North Pole. The geographic North Pole is sometimes called true north. The magnetic South Pole is located near the coast of Antarctica.

→Do the following activity with your students:

MATERIALS:

(Per 2 students)
World map (flat - laminated)
Compass
Vis-à-Vis marker

PROCEDURES:

- Mark true north on your map with your Vis-à-vis marker. (If the map has a compass "rose", suggest they use this to find true north.)
- Place the marked end of your map toward true north (for your location).
- Place your compass on the map and mark the position of the needle.
- Answer the following questions.

QUESTIONS:

- Does the compass needle always point to the same place? If yes, where?
- Does the compass needle always point in the same direction? Explain.

ELECTROMAGNETS

(http://science.howstuffworks.com/electromagnet2.htm)
(http://school.discovery.com/lessonplans/programs/energyefficiency/)

The basic idea behind an electromagnet is extremely simple. By running an electric current through a wire, you can create a magnetic field. An electromagnet starts with a battery (or some other source of power) and a wire.

If you look at a regular D-cell flashlight battery you can see that there are two ends → one marked plus (+) and the other marked minus (-). Electrons collect at the negative end of the battery, and, if you let them, they will gladly flow to the positive end. The way you "let them" flow is with a wire. If you attach a wire directly between the positive and negative terminals of a D-cell, three things will happen:

1. Electrons will flow from the negative side of the battery to the positive side as fast as they can.
2. The battery will drain fairly quickly (in a matter of several minutes). For that reason, it is generally not a good idea to connect the two terminals of a battery to one another directly. Normally, you connect some kind of load in the middle of the wire so the electrons can do useful work. The load might be a motor, a light bulb, a radio or whatever.
3. A small magnetic field is generated in the wire. It is this small magnetic field that is the basis of an electromagnet.

→ Have your students do the following activity – Electromagnets

ELECTROMAGNET

BACKGROUND INFORMATION:
A magnetic field is created when an electric current flows through a wire. A single wire does not produce a strong magnetic field, but a coiled wire around an iron core does. An electric generator uses just such magnetic forces to make electricity.

MATERIALS:

(Per 2 students)

1 – D cell battery
Battery holder
50 cm of wire
Compass
Iron nail
Paper clips
Pencil

PROCEDURE:

1. Place the battery in the battery holder.
2. Attach one end of the wire to one end of the battery holder and the other end of the wire to the other battery holder.
3. Observe the compass and determine the direction of true north.
4. Place the compass near the wire and see if it still points to true north.
5. Record your observations.
6. Put the paper clips into a small pile and pass the wire over them. Did the wire exert any magnetic force on the paper clips?
7. Record your observations
8. Remove one end of wire from the battery holder.
9. Twist the center of the wire several times around the pencil.
10. Remove the pencil (leave the wire twisted) and reattached the end of the wire to the battery holder.
11. Repeat Procedures 4 – 7.
12. Repeat Procedures 8-10 varying the number of twist in the wire.
13. Remove one end of wire from the battery holder.
14. Straighten the wire (remove the twist).
15. Take the iron nail and twist the wire around the nail several times.

16. Reattach the end of the wire to the battery holder (leave the nail on the twisted wire).
17. Repeat procedures 4-7. Is there a difference in the iron nail being attached to the wire?
18. Record Observations
19. Clean up.
20. Complete the Conclusion.

Number of turns	Effect on Compass	Plain Twist	Iron Nail Twist
0			----------

CONCLUSION:

Explain your findings in writing and then state how you think such electromagnets might be used on a larger scale.

MAGNETISM

C R H M F U O R A N F A P Z Q Z I E D A
R O P L N J N G E R W F N O Y W N J Q R
R T M A G N E T I S M C E K G U S D E S
K C V S Q L U C A M I R V Y R V U K K Q
T U T Y I B T G O O U S M X E D L J N O
I D T V K I M I B T Z D T N N Q A H J P
C N C X O M J R A X G T R I E H T Q H O
O O S N M S B R Q W K P M L V R O U U V
X C E L U C E L O M M W M O A E R C N I
E R S Q J P D T B A T E Z P C M L H C I
V E U S M I J Q D O I B T L H V Q G Q I
M P D E S M T N G W Q W E C I J J K A X
C U T G E G Q C Q K B P J L A F Y E Z Q
G S K W W I J X M M E Z Y S A R Z L H M
G T D X K O F G X R P N H C K M T P V M
N T X W V X L L N N P F Z L M C G T B I
N E Y C B D N C F R D U Q X H H N H A E
P E Z K I A V C S P E D U B O N Y W Y L
J L W G O C N Y R O I I C O R E J F F M
P N O W N A Q F Z C A H H C N H W S B C

ATTRACT
CORE
ENERGY
FRICTION
INSULATOR
MAGNETISM
MOLECULE
REPEL
RESISTIVE
SUPERCONDUCTOR
TEMPERATURE